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Scope and Validity

This catalogue only covers ITABAR flow sensors. Information about other products manufactured by Intra-Automation, such as level, ultra sound, flow computers, purge instruments, signal converters, etc can be requested by fax or e-mail via our home page.

Categorizing ITABAR Differential Pressure sensors according to Pressure Instruments Guidelines („Druckgeräterichtlinie“) 97/23EG (PED)

According to article 1 Abs. (2), Nr 2.1.4 of „Druckgeräterichtlinie 97/23/EG (PED)“ the ITABAR sensors are pressure containing devices. Pressure is generated in both measuring chambers and no medium is flowing. For this reason they are classified as „containments“ . The containment volume is smaller than 1 liter.

In consideration of diagram 1 from Anh.II of the „Druckgeräterichtlinie“ all differential pressure sensors with a max. pressure of 200 bar (2940 psig) fall into the category „Gute Ingenieur Praxis“ (SEP) (good engineering practice) and may not be marked with a CE symbol (see Artikel 3 Abs. 3.). Installation components such as flanges, weld-o-lets do not meet the definition of pressure instruments and thus are not labelled with the CE symbol.

Miscellaneous

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PITOT TUBE FLOW SENSORS ITABAR[®]

for Liquids, Gases and Steam



This picture shows a sensor for direct steam mass flow measurement. A RTD is integrated into the sensor. The digital signal converter 2010TC is a microprocessor based field instrument with communication capabilities in multi-variable sensing technology. It is of modular design and consists of differential pressure sensing mechanism with integrated calibration electronics, a pre-amplifier with program module, as well as an input for the RTD resistance thermometer. The 2010TC senses the differential pressure, the temperature and the absolute pressure. The on-board computer constantly compensates for the density of the fluid measured.

Flow Measurement with ITABAR

Non Wet-Tap Assembly

Gases and Liquids

Page

IBR/IBF 15/20/21/25/26/35/36/65/66

45-71

IBF-100 Flue Gases in large pipes

72-74

Low- and Medium Pressure Steam

Page

IBRD/IBFD 20/21/25/26/35/36

112-134

High Pressure Steam

Page

IBFD 26/36 HT / HTG

135-155

Wet-Tap Installation

Gases and Liquids

Page

FTN/FTM/FTH 20/21/25/26/35/36/65/66

79-111

Low- and Medium Pressure Steam

Page

FTMD/FTHD 20/21/25/26/35/36

156-174

Structural and constructional steels

Page

International comparison of standards

113/1

1. Introduction to Pitot Tube Flow Measurement

Pressure sensors are classified as Differential Pressure sensors for flow measurement.

The measuring principle of the pitot tube utilizes the differences between the pressure ridge on the upstream side of a bluff body and the static pressure on its down stream side.

ITABAR-pitot tube sensors, see sample Fig 1.1, are mainly used to measure the volumetric flow of liquids, gases and steam in closed pipes ranging from ½" to 480" (DN 20 to DN 12000).

Examples of their applications are precise volumetric flow measurement in batch processes, continuous measurement of liquid ingredients in the process industry, fuel, air, steam and gases as primary energy source as well as in control functions requiring a high degree of stability and repeatability.

Exemplary in comparison to almost all other flow measuring instruments is the ITABAR-sensor's ease of installation. The installation consists of these steps: drilling of the pipe, weld-o-let is welded on to the pipe, ITABAR is inserted. Models Flo-Tap FT , see Fig 1.2, allows installation and removal without shutting the process down.

ITABAR-pitot tube sensors were developed with the goal of high reliability even under difficult conditions. ITABAR-pitot tube sensors are optimized in several ways with respect to fluid stream conditions. Advantages of the engineered sensor profile are their low permanent pressure loss as well as the consistent measurement accuracy over a wide range of Reynolds numbers.

For over two decades ITABAR-pitot tube sensors have been applied in the industrial world. Their exemplary reliability and excellent long-term use record resulted in broad acceptance by customers. Many measurements by independent institutes are testimony to the ITABA-sensor's high measuring accuracy.



Fig 1.1



Fig.: 1.2: Flo-Tap pitot tube sensor ITABAR FTM 20 for installation and removal under pressure

2. Measurement Principle of Pitot Tube Sensors

According to the continuity law derived by Bernoulli and the energy equation, the sum of the pressure energy and the potential and kinetic energy of a flowing fluid inside a pipe and in conditions of stationary and frictionless flow is the same at any time and in any part of the pipe.

$$p_{stat} + p_{dyn} = const \quad (Gl. 2.1)$$

The factor p_{stat} is the static pressure equally distributed in all directions. The other term in the equation represents the dynamic pressure, effective in the flow direction, p_{dyn} .

For flowing fluids in horizontal pipes, with a small velocity compared to the Mach-number ($Ma \ll 1$), the dynamic pressure p_{dyn} of a fluid with a flowing velocity v , a density ρ and a resistance factor ζ is calculated as:

$$p_{dyn} = \zeta \frac{\rho}{2} v^2 \quad (Gl. 2.2)$$

Inserting a fixed body into a flowing fluid causes the flow to dam up immediately upstream of the body and to be completely zero at S_2 , see Fig 2.1. At this point the total pressure p_{S2} is

$$p_{S2} = p_{stat} + p_{dyn} \quad (Gl. 2.3)$$

The apertures of the sensor's downstream side are only affected by the direction-independent static pressure p_{stat} . The difference in both pressures, the differential pressure Δp , is a measure of the velocity with which the inserted body is impacted, see Fig. 2.2.

$$\Delta p = p_{S2} - p_{S1} \quad (Gl. 2.4)$$

Substituting Gl. 2 and 3 into 4 results in

$$\Delta p = \zeta \frac{\rho}{2} v^2. \quad (Gl. 2.5)$$

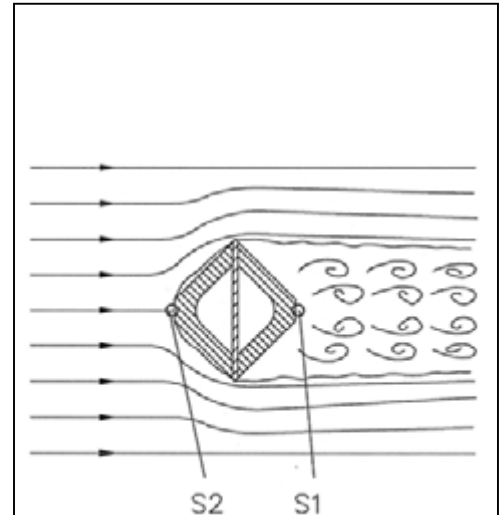


Fig. 2.1: Schematic representation of fluid flow pattern at location of ITABAR profile

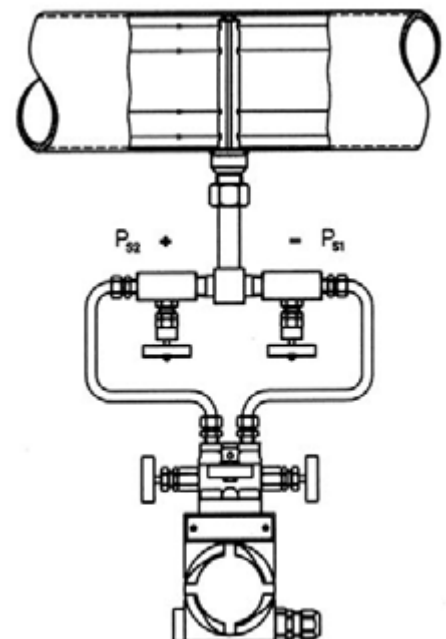


Fig. 2.2: Schematic representation of generating a differential pressure Δp

The volumetric flow can be calculated using the continuity law with a pipe area A and an average flow velocity. The following formulas can be derived

Measured value	Formula for SI Units	Equation
Volumetric flow for gases under standard conditions	$Q_{vn} = k(...) A \varepsilon \sqrt{\frac{2 \Delta p P_b Z_n T_n}{\rho_n T_b Z_b P_n}}$	2.7
Volumetric flow for gases under operating conditions	$Q_v = k(...) A \varepsilon \sqrt{\frac{2 \Delta p}{\rho_b}}$	2.8
Mass flow for gases and steam	$Q_m = k(...) A \varepsilon \sqrt{2 \Delta p \rho_b}$	2.9
Mass flow for liquids	$Q_m = k(...) A \sqrt{2 \Delta p \rho_b}$	2.10
Volumetric flow for liquids	$Q_v = k(...) A \sqrt{\frac{2 \Delta p}{\rho_b}}$	2.11

The following definitions apply :

	Größe	Units in equations				
		2.7	2.8	2.9	2.10	2.11
Δp	Differential pressure at sensor profile	Pa	Pa	Pa	Pa	Pa
ρ_n	Medium density at standard conditions	kg/Nm ³	---	---	---	---
ρ_b	Medium density at operating conditions	kg/m ³	kg/m ³	kg/m ³	kg/m ³	kg/m ³
ε	Expansion factor	1	1	1	---	---
A	Cross sectional area of the pipe	m ²	m ²	m ²	m ²	m ²
D _i	Pipe inside diameter	---	---	---	---	---
k	k-factor	1	1	1	1	1
P _b	Operating pressure	Pa	---	---	---	---
P _n	Absolute pressure of gas at standard conditions	Pa	---	---	---	---
Q _m	Mass flow	---	---	kg/s	kg/s	---
Q _v	Volumetric flow	---	m ³ /s	---	---	m ³ /s
Q _{vn}	Volumetric flow at standard conditions	Nm ³ /s	---	---	---	---
T _b	Temperature of gases at operating conditions	K	---	---	---	---
T _n	Temperature of gases at standard conditions	K	---	---	---	---
Z _b	Real gas factor at operating conditions	1	---	---	---	---
Z _n	Real gas factor in standard conditions	1	---	---	---	---

The expansion factor needed to calculate the flow of gases and steam is computed as follows :

$$\varepsilon = 1 - \frac{\Delta p}{k(\dots) P_b} \left\{ \left(1 - \frac{2 b}{\sqrt{\pi F}} \right)^2 0,31424 - 0,009484 \right\} \quad (\text{Gl. 2.11})$$

Symbol	Variable	Units
ε	Expansion factor	1
Δp	Differential pressure at sensor profile	Pa
P_b	Operating pressure	Pa
k	Isotropic exponent of gases (also: ratio of specific temperatures of ideal gases)	1
b	Width of sensor profile perpendicular to flow direction	m
F	Cross sectional area of pipe	m ²

For example: for one-atom (two-, three-atom) gases the isotropic exponent k of the gas has a value of $k = 1.66$ (1.4 und 1.3). The width of the sensor profile perpendicular to the flow direction depends on the sensor type (see page 13)

3. Required Fluid Conditions

Pitot tube sensors, such as orifice plates, flow nozzle or venturi tubes are classified as flow measuring devices which utilize differential pressure to measure volumetric flow. The technical descriptions in (German) DIN 1952 „Durchflussmessung mit Blenden, Düsen und Venturirohren in voll durchströmten Röhren mit Kreisquerschnitt“ are analogous to pitot tubes:

- The fluid has to completely fill the pipe so that the measured differential pressure is representative of the volumetric flow. Fluids in partially filled pipes can only be measured if a full pipe can be arranged (e.g. by means of a siphon)
- The fluid must be single-phase. Two-phase fluids (e.g. water-air mixtures) cannot be measured.

The average flow velocity v_m and the kinematic viscosity ν of the fluid to be measured in a given pipe size with an inside diameter d must reach a Reynold's number value $Re > 3150$ according to the formula

$$Re = \frac{v_m d_i}{\nu} \quad (\text{Gl. 3.1})$$

meaning: the flow has to be sufficiently turbulent. Fluids of laminar nature cannot be measured with pitot tubes. Fluids may contain small particles or bubbles. The pressure generated in front of the sensor apertures causes a deflection of the particles or bubbles. Fluids which tend to cristalize will quickly plug the pressure tubes of the sensor and therefore cannot be measured with pitot tubes. Gases and gas mixtures containing dust can coat the sensor to an undesirable degree. To clean such dust desposits the air urge unit LSP (Fig 3.1) can be applied. This instrument will automatically flush out the sensor with air pressure in programmable intervals and durations . For flue gas mixtures a sensor version is recommended, which allows mechanical cleaning from both ends without having to take the sensor out of the pipe (see Fig 3.2)

In steam measurement applications condensate pots are used, inside of which a constant transition from steam to condensate and vice versa occurs. The pressure transfer is achieved via water columns.



Fig. 3.1: Air purge unit LSP for automatic cleaning of pitot tubes used in gas and gas mixtures containing dust or bubbles

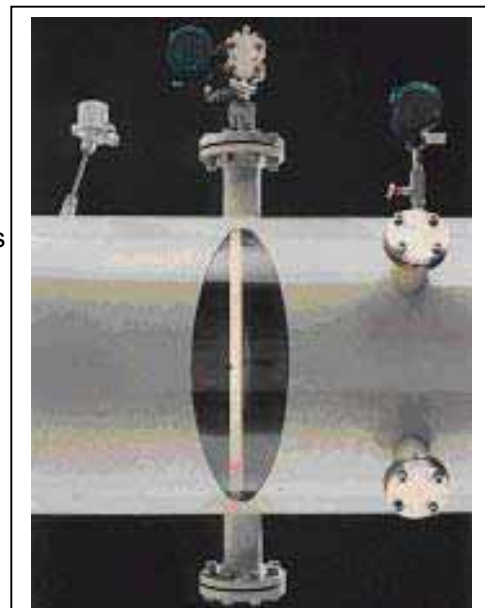


Fig. 3.2: Foto of sensor version IBF-100, developed specifically for flue gas measurement, installed in a (for demo purposes) transparent pipe. The sensor is accessible from both ends and allows mechanical cleaning without having to be taken out of the line.

4. Advantages of ITABAR-Pitot Tube Sensors

4.1 Advantages in Comparison to Orifice Plates

4.1.1 Lower Installation Costs

Compared to an orifice plate the ITABAR-sensor reduces material- and labor costs for the installation as well as operating expenses.

Part of the installation material costs of an ITABAR-sensor are the expenses for a weld boss and – depending on the sensor type – for a counter support fitting. The material costs for an orifice installation consist of two flanges and the necessary screws and hardware. The advantage in the ITABAR-sensors material costs are especially high for: large diameter pipes, pipe materials of exotic materials because of chemical compatibility issues, pipes for high pressure applications.

Labor costs for an ITABAR-sensor or orifice plate installation must include the wages for the welders. The installation of a weld boss requires – depending on the sensor type – a weld seam of approx. 10 cm (4"). The installation of a DN100 /4" (DN500/20") requires a weld seam of approx. 36 cm /14" (approx. 628"). The time needed to install an orifice plate is approx. 12 hours, as compared to approx. 1.5 hours for an ITABAR-sensor. The ITABAR-sensor in this case saves 10.5 labor hours.

The total savings in material- and labor costs which can be realized by using an ITABAR-sensor are at least 25% in a 4" pipe installation and at least 70% in a 20" pipe installation.

4.1.2 Bi-Directional Flow Measurement

The profile of all ITABAR-pitot tube sensors is designed to be symmetrical to the plane between the pressure channels. This arrangement results in the same resistance values and thus the same k-factor with respect to the fluid properties during forward as well as reverse flow. The differential pressures generated by a given flow velocity are the same for flow in either direction. They only differ in the +/- sign

This constitutes an advantage over to the orifice plate, see Fig 4.1), which - because of its angled downstream corner – has different resistance values for forward and reverse flows. It would indicate widely different differential pressures for the same flow velocity in opposite directions.

The differential pressure measurement and processing can be accomplished with either one or two signal converters. The use of two signal converters is justified in cases requiring a high resolution or if separate signals are needed for forward and reverse flow.

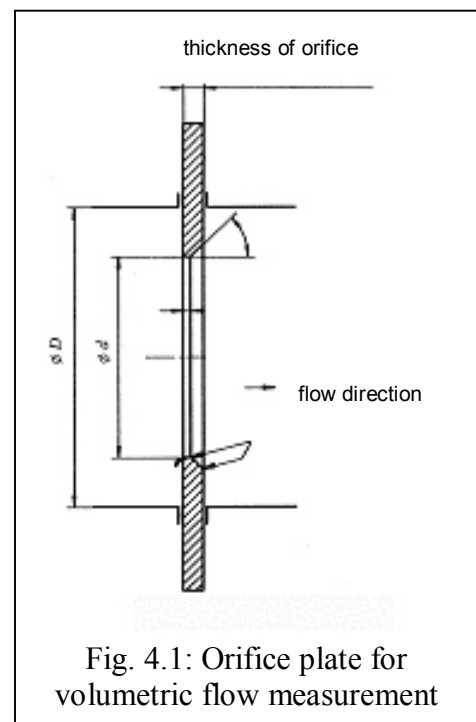


Fig. 4.1: Orifice plate for volumetric flow measurement

4.1.3 Shorter Up/Down Straight Pipe Run Requirements

In order to increase the ITABAR-sensor's measurement accuracy the dynamic and static pressures are measured at four points along the sensor profile and averaged. A non-symmetrical flow profile thus has a smaller influence on the measured result. This leads furthermore to shorter up/down stream straight pipe run requirements. For example: The ITABAR-sensor requires 7 straight pipe diameters downstream of a 90°-bend. An orifice plate requires 10 to 46 times as much depending on the β ratio.

4.1.4 Lower Permanent Pressure Loss

The sensor profile of the ITABAR-sensor is optimized with respect to the conditions of a flowing fluid and causes – in comparison to an orifice plate – a considerably smaller permanent pressure loss. The following application example is to illustrate this point: pipe size 10 inches (DN 250 PN 16); fluid: water; fluid temperature $T = 70\text{ }^{\circ}\text{F}$ ($20\text{ }^{\circ}\text{C}$); operating pressure $p = 29.4\text{ psia}$ (2 bar abs); volumetric flow $Q_v = 770\text{ GPM}$ ($175\text{ m}^3/\text{h}$) and average flow velocity = 3.2 FPS ($0,99\text{ m/s}$).

Type	Ratio of diameters β	D/ mm	d/ mm	Diff. Pressure/ mbar	Pressure loss/ mbar	Ratio of perm. pressure loss vs differ. pressure / %	Required up stream straight pipe run after 90°-bend	Required downstream straight pipe run before 90°-bend
ITABAR IBR-25	---	250,4	---	12,48	1,36	10,9	7 x DN	3 x DN
Orifice plate	0,25	250,4	62,6	2874	2730	95,0	10 x DN	4 x DN
Orifice plate	0,3	250,4	75,1	1386	1247	90,0	10 x DN	5 x DN
Orifice plate	0,35	250,4	87,6	748	636	85,0	12 x DN	5 x DN
Orifice plate	0,4	250,4	100,2	439	351	80,0	14 x DN	6 x DN
Orifice plate	0,45	250,4	112,7	274	205	74,8	14 x DN	6 x DN
Orifice plate	0,5	250,4	125,2	180	126	70,0	14 x DN	6 x DN
Orifice plate	0,55	250,4	137,7	123	80	65,0	16 x DN	6 x DN
Orifice plate	0,6	250,4	150,2	87	52	59,8	18 x DN	7 x DN
Orifice plate	0,65	250,4	162,8	63	35	55,6	22 x DN	7 x DN
Orifice plate	0,7	250,4	175,3	47	23,4	49,8	28 x DN	7 x DN
Orifice plate	0,75	250,4	187,8	35,5	16	45,1	36 x DN	8 x DN

As this example illustrates it is possible to reduce the permanent pressure loss of an orifice plate by selecting the proper diameter-ratio $\beta = d/D$. The price to be paid for this is a considerable increase in longer straight pipe run requirements. The comparatively higher permanent pressure loss of orifice plates can be explained by their increased influence on the flow profile and related generation of eddy currents.

In summary: Compared to orifice plates pitot tubes have the advantage of causing considerably lower permanent pressure losses while generating useful differential pressures. A further advantage is the need for shorter up/down stream straight pipe requirements.

The ITABAR-sensor's lower permanent pressure loss reduces the the energy- and thus operating costs of a measurement point considerably. In many applications the replacement costs of an ITABAR-sensor for an orifice plate are amortized within a very short time period

4.2 The ITABAR-Sensor Profile

4.2.1 Design Advantages For Flow Measurement

Unique Sensor Profile

The design of the ITABAR-sensor profile, see Fig. 4.2, is optimized with respect to fluid flow properties, and meets the technical challenges of accurate measurement as well as static and sensor-oscillating problems. It represents a forward step in technical development.

Excellent Linearity

A significant improvement in the sensor design with respect to the fluid properties is the shape of the sensor profile. The fluid separation takes place at the same spot on the sensor over a wide range of Reynolds numbers, which results in minimal Reynold number dependency. This specially designed ITABAR-sensor profile achieves excellent linearity over a wide measuring range.

Exemplary Reproducibility

The form design of the sensor profile not only improves the linearity but also the reproducibility of the measurement in cases of averaging within certain time intervals. The result is especially positive with shorter time intervals

Superior Averaging

In order to reduce the influences of in most cases less than ideal flow profiles, the differential pressures representing the local flow velocities are measured at four points, averaged and processed. Each of these four measuring points has pressure sensing apertures located opposite from each other. The positioning of these pressure apertures is designed for fluid flow profiles as they are encountered in real applications. .



Fig.4.2: Sensor profile of pitot tube model 35/36 in a cut-away view to illustrate the two pressure channels near the pressure apertures.

Large Pressure Apertures and Pressure Channels

Large diameter pressure sensing apertures and pressure channels allow the long term uninterrupted use even in contaminated fluids. Condensate in form of drops can more easily flow off through the larger areas. A mechanical blockage of the pressure channels through condensate drops is thus eliminated. The table below lists the characteristic dimensions depending on the type of sensor.

	Sensor Type				
	15	20/21	25/26	35/36	65/66/100
Width of profile perpendicular to flow	11 mm	12 mm	25,4 mm	42 mm	56 mm
Height of profile in flow direction	10,5 mm	11 mm	23 mm	36 mm	50 mm
Diameter of pressure sensing apertures	4 mm	4 mm	8,5 mm	10 mm	16 mm
Area of pressure channel	28 mm ²	14 mm ²	62 mm ²	78 mm ²	113 mm ²

Very Good Mechanical Stability

The mechanical stability in situations of static and dynamic stress to the sensor profile is one of the most important criteria in the constructive design of the sensors.

The dislodging of a one-side mounted sensor profile through static stress caused by the flowing medium is inversely proportional to the 2nd degree axial area-momentum of the sensor.. For this reason the ITABAR-pitot tube sensor is designed with a very high 2nd degree axial area-momentum. Similar arguments are valid for a sensor's resonance-frequency oscillations, which are determinant for dynamic stresses.

Commercially available pitot tubes made of only 1 mm thick stainless steel sheet metal have a low 2nd degree axial area-momentum. The mechanical stability of such thin-sheet sensors under static and dynamic stresses is lower compared to the ITABAR-sensor (e.g. as shown in Fig 4.2).

ITABAR-Sensors Are Better Than Any Cylindrical Sensor

Pitot tube sensors with a cylindrical sensor profile do not belong to the same class as ITABAR pitot tube sensors. The differences lie in the form and design of cylindrical sensors.

A typical cylinder-shaped sensor consists of a thin walled pipe with four sensing ports to measure the total pressure and one sensing port to measure the static pressure. The static pressure is lead to the outside via a thin pice of pipe located inside the sensor profile.

The main disadvantages are measurement inaccuracies and poor reproducibility. The reasons for this are a weakly defined technical relationship to fluid flow properties and thus a Reynolds number dependence. Contrary to a sharp-edged sensor profile design the fluid separation point is not fixed on the sensor (see Fig 4.3). As a result the resistance value c_w is very much Reynolds number dependent, see Fig. 4.4. A sensor's k-factor is derived from its resistance value as follows:

$$k = \sqrt{\frac{1}{c_w}}$$

For example a 10% change in the k-factor causes a change in the measured volumetric flow value of also 10%. For this reason a k-factor dependence on Reynolds numbers is not desirable.

Further disadvantages of cylindrical sensors are their lack of mechanical stability and their inaccurate performance in bi-directional flow measurement.

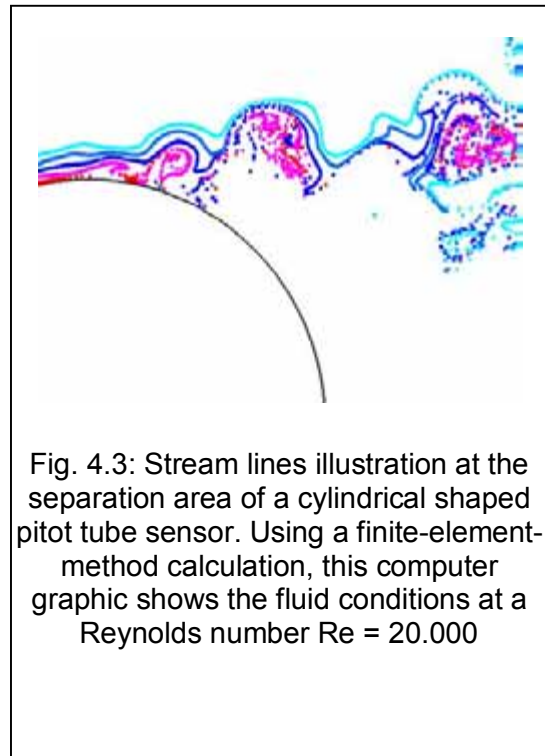


Fig. 4.3: Stream lines illustration at the separation area of a cylindrical shaped pitot tube sensor. Using a finite-element-method calculation, this computer graphic shows the fluid conditions at a Reynolds number $Re = 20.000$

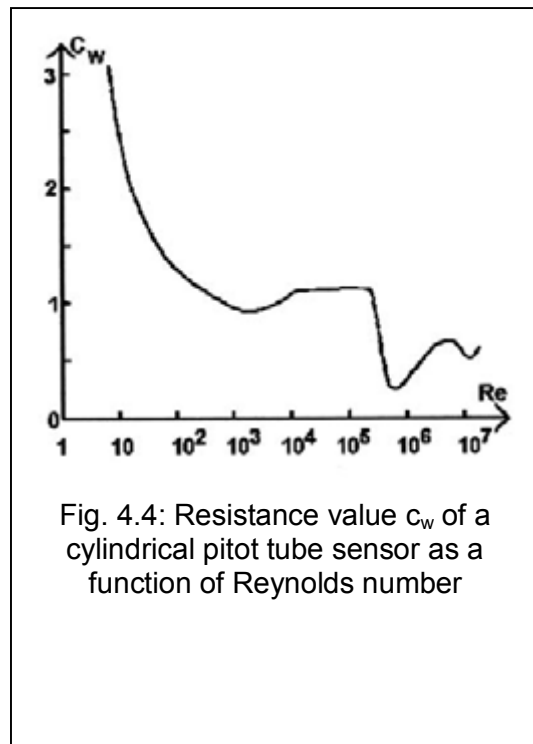


Fig. 4.4: Resistance value c_w of a cylindrical pitot tube sensor as a function of Reynolds number

4.2.2 Sensor Profile with Integrated RTD resistance thermocouple

In order to measure the fluid temperature all ITABAR-pitot tube sensors – with exceptions: IBFD-HT, IBFD-HTG and types –20/21 – can optionally be equipped with a RTD resistance thermocouple, see Fig 4.5. The advantages of the selected thermometer are as follows:

- The resistance thermometer is rod shaped, of robust design for long term use.
- A st steel (material 316 SS) tube provides a reliable protective cover for the the resistance thermometer.
- This version is designed with long term reliable components for industrial applications with increased challenges of oscillations.
- The temperature sensor is of 3-wire design in order to reduce the effective resistance.
- The resistance thermometer is usable in a temperature range from – 200 to + 500°C.

The constructive solution of inserting the resistance thermometer is unique and convinces with the following advantages:

- The resistance thermometer is inserted into the sensor profile, see Fig 4.6 for a cross-sectional view of the sensor profile for a resistance thermometer assembly. With this method it is not a fluid wetted part, nor is it exposed to operating pressures.
- This design together with the rod-shaped version of the resistance thermometer allows for easy and quick installation and removal under pressure.

The temperature sensor is positioned along the sensor axis in between the two pressure channels. After all thermic adjustments in the vicinity of the temperature sensor it measures the fluid temperature along the pipe axis.



Fig 4.5: Pitot tube sensor type IBR with integrated resistance thermometer. Right side: opened junction box

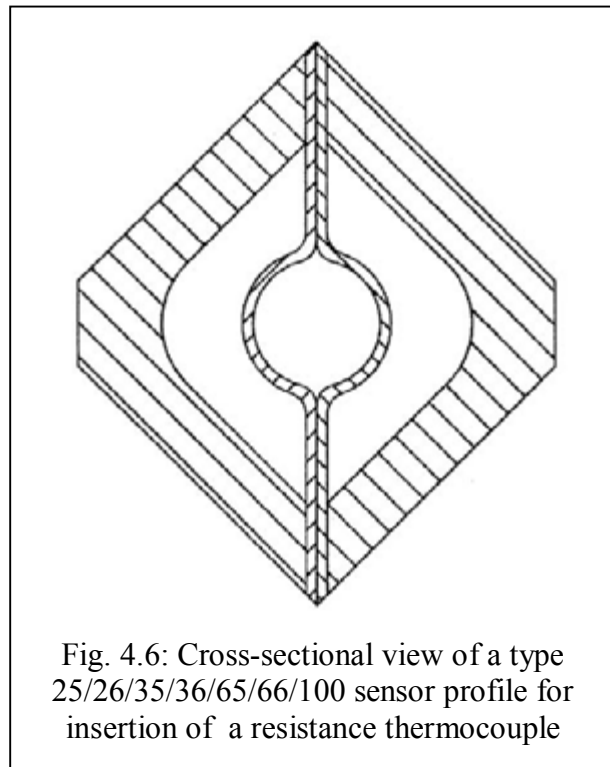


Fig. 4.6: Cross-sectional view of a type 25/26/35/36/65/66/100 sensor profile for insertion of a resistance thermocouple

4.3 Patented ITABAR-Sensor Series Flo-Tap

4.3.1 Retroactive Installation In Under-Pressure Conditions

The current level of technical development allows only a few flow measurement devices to be installed retroactively, when a process interruption is expensive and to be avoided. Some criteria to be considered as part of the flow meter selection process are: the type of fluid to be measured, the desired measurement accuracy as well as purchase and installation costs. The following table compares several competing flow metering technologies, which can be installed under pressure, with respect to these criteria:

Flow Measurement Instrument	Applicable fluids	Method applied to read average flow velocity	Accuracy	Purchase costs	Installation costs
Pitot tube sensor ITABAR, series Flo-Tap	Liquids, gases, steam	Averaging of four flow representative locations	$\pm 1\%$ of rate	low	medium
Non intrusive ultra sound sensors (transit time)	Liquids with air- or gas content of < 3 Vol. %	Averaging along the ultrasonic beam between ultrasonic sensors	$\pm 1-3\%$ of rate	high	low
Non intrusive ultra sound flow sensor (Doppler)	Liquids with evenly distributed air-, gas- or particles	Averaging along narrow ultrasonic beam	$\pm 1\%$ of rate	medium	low
Electro-magnetic sensors (insertion type)	Liquids with conductivity $> 5 \mu\text{S}$	Localized measurement in vicinity of sensor electrodes	$\pm 2-3\%$ of rate	low	medium

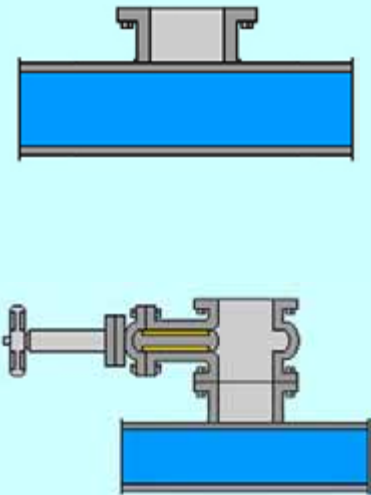
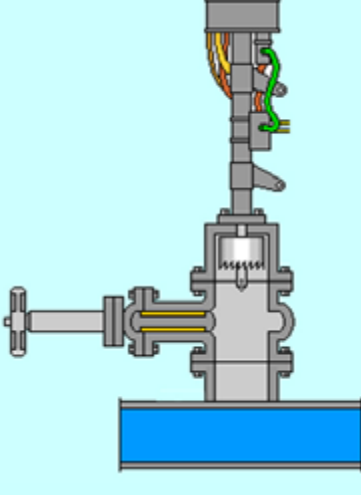
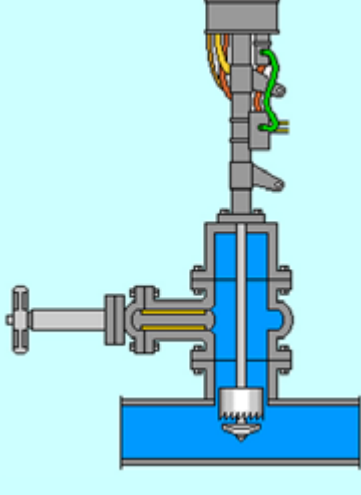
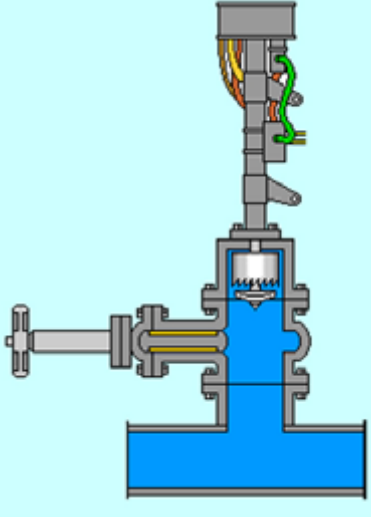
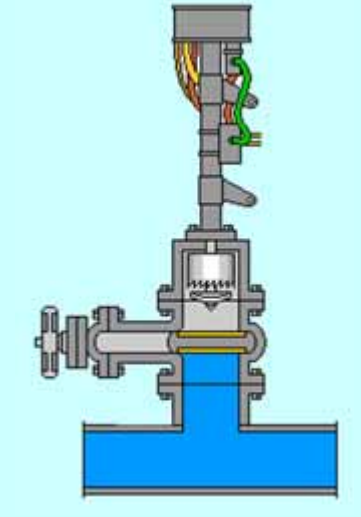
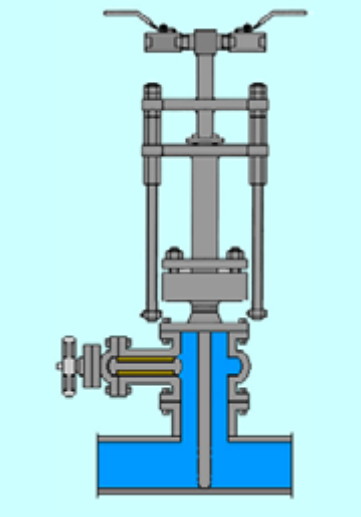
For many applications, which require an under-pressure installation, the ITABAR pitot tube series Flo-Tap is the first choice. A retroactive Flo-Tap-sensor installation under pressure is done in the following steps:

1. Welding of the assembly stud with assembly flange to the pipe, see Fig. 4.7a.
2. Assembly of isolation valve to the assembly stud, see Fig. 4.4a lower picture.
3. Installation of the tapping tool, see Fig. 4.7b.
4. Drilling of the pipe, see Fig. 4.7 c.
5. Withdrawl of the tapping tool, see Fig. 4.7d.
6. Closing of isolation valve and removal of tapping tool, see Fig. 4.7e.
7. Assembly of Flo-Tap pitot tube sensor, opening of isolation vane and insertion of flow sensor profile, see Fig. 4.7f.

4.3.2 Removal without Process Shut-Down (Flo-Tap)

All Flo-Tap versions of the ITABAR-sensor allow the removal under pressure. These features are valuable in applications requiring

- a periodic check of the flow sensor's measurement accuracy
- an exchange after extended service in abrasive fluids or
- cleaning during normal maintenance operations

		
<p>Fig. 4.7a: Welding of assembly weld boss with assembly flange to the pipe (above) and assembly of the isolation valve to the weld boss (below)</p>	<p>Fig. 4.7b: Installation of the tapping tool</p>	<p>Fig. 4.7c: Drilling the pipe</p>
		
<p>Fig. 4.7d: Pull back of tapping tool</p>	<p>Fig. 4.7e: Closing of valve and removal of tapping tool</p>	<p>Fig. 4.7f: Assembly of Flo-Tap-pitot tube sensor, opening of the isolation valve and insertion of pitot tube sensor</p>

4.3.3 Safe Operation with Second Packing Gland

The current level in technical design of Flo-Tap pitot tube sensors is marked by one packing gland on the far end of the process isolation valve (see Fig 4.9). This type of construction can lead to accidents in practical installations.

Pitot tubes are often subjected to mechanical stresses with static and dynamic components under varying operating conditions. The forces impacting on the sensor profile can cause irregular or resonant oscillations. Depending on the amplitude and the frequency of this stress the material can weaken and the sensor can break.

For this reason a pitot tube sensor profile with only one single packing gland and because of its unsupported length is in danger of being damaged

In order to avoid such accidents all ITABAR® Flo-Tap-sensors are equipped with two packing glands (see Fig 4.10). This measure increases a sensor's resonant frequency by such a magnitude that the material cannot easily weaken even in severe operating conditions.

Intra Automation GmbH has this design patented and is the only manufacturer of pitot tube which are equipped with a second packing gland.

ITABAR® models FTM, FTH, FTMD and FTMD are all equipped as standard with a pair of threaded rods (mat 316 SS) (see Fig. 4.8). A wrench is required to remove and install the sensor. The removal/installation is made faster and easier with a threaded wheel. The housing is made of aluminum, the wheel of carbon steel.

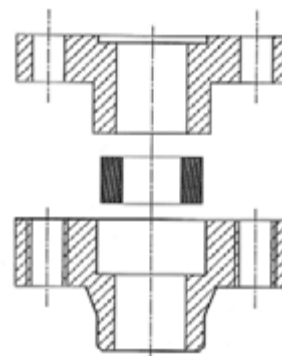


Fig. 4.8: ITABAR® Flo-Tap-sensor with second packing gland

Construction of Wet-Tap Pitot Tubes

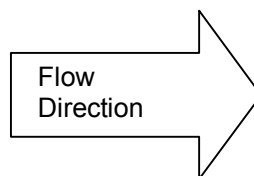
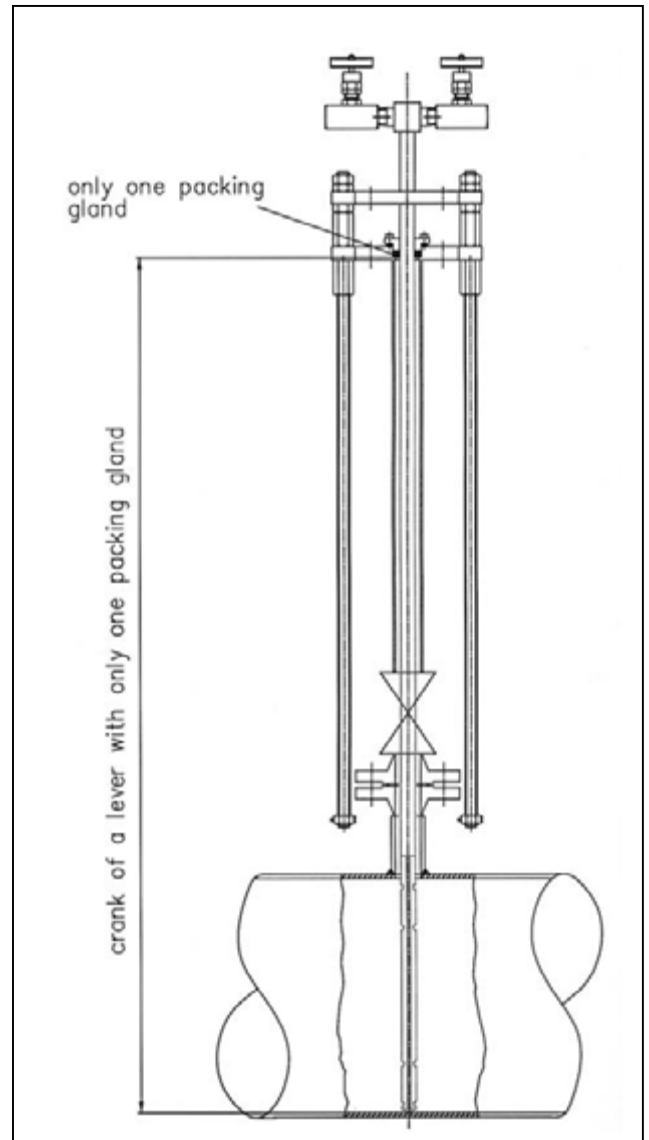
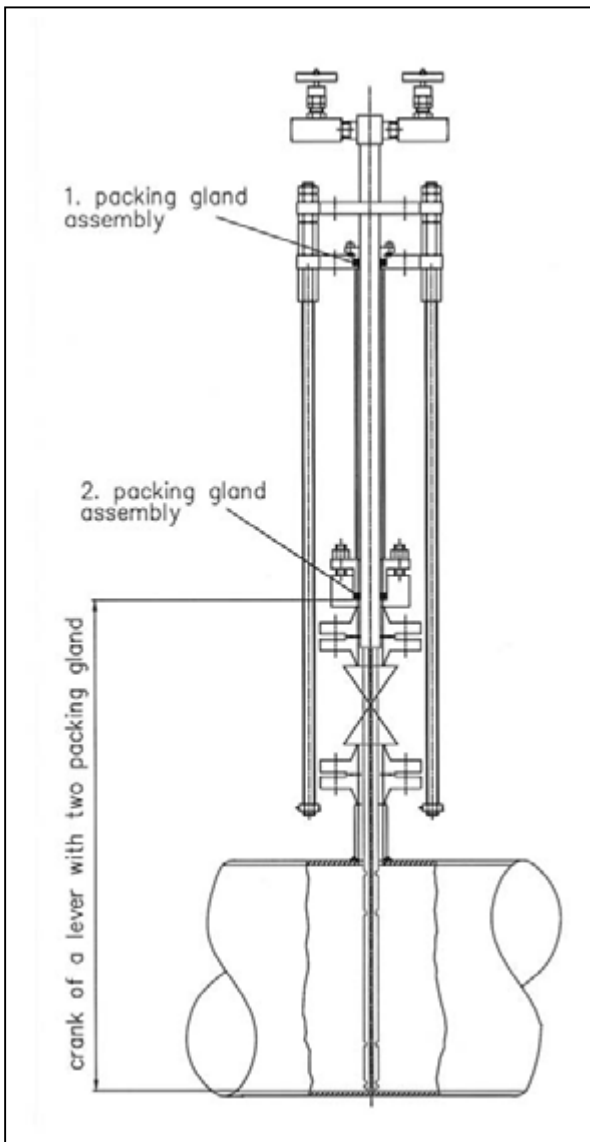


Fig. 4.9: ITABAR pitot tube with two packing glands. The short leverage practically eliminates the danger of the sensor breaking.

Fig. 4.10: Conventional pitot tube without prevention of material weakening. The long leverage increases the likelihood that the sensor might break

5. Specifications for ITABAR- Flow Sensors

The selection of the proper pitot tube sensor can be made quickly and reliably by this manufacturer if the operational data about the existing pipe line, the fluid and the desired version are made available according to the table below.

General Information:

Customer:

Reference-Nr.:

Installation-Nr.:

Pipeline:

Material: Nominal pressure: psig

Pipe inside diameter: inches Pipe wall thickness: inches

Thickness of pipe insulation: inches

Fluid:

Name: liquid steam gas

Isotropic exponent:

Compressibility factor:

Flow direction: horizontal vertical

Physical values :	Minimum:	Operating Condition:	Maximum:	Unit
Flow				
Temperature				
Pressure abs. <input type="checkbox"/> rel. <input type="checkbox"/>				
Std density				
Operating density				
Dynamic viscosity				

Desired version:

Special pipe assembly with threaded weld-o-let :

Special pipe assembly with flanged version: DIN-Flanges: ANSI-Flanges

Wet-tap version of ITABAR-sensor required:

Compact version (if technically possible):

6. Specification of Pitot Tube Sensors

Specifying a pitot tube sensor starts with the selection of a fitting version for a specific application

For a better understanding the meaning of the sensor-version nomenclature will be explained in the following. Pitot tube sensors which start with the letter „IB..“ are designed for fixed (installation not under pressure) installations. The letter „R“ („F“, „G“) indicates a threaded (flanged, welded) process connection between the pipe and the sensor's assembly components. All sensors, which are used to measure steam have the letter „D“ at the end of the model name. The additions „HT“ or „HTG“ stand for „High Temperature“. Pitot tube sensor series „Flo-Tap“ is indicated by the letter „FT“ at the beginning of the model name. They can be installed and removed under pressure conditions (wet-tap design). The letters „N“ („M“, and „H“) signify their possible use in low („N“) and medium and high operating pressure applications, with „D“ for steam use. Model series 21,26,36 and 66 differ from series 20,25,35 and 65 in that they come with a counter-end support, which serves to avoid mechanical stress caused by high flow velocities and high impact pressures or sensor-resonance oscillations.

Sections 7.1 and 8.1 cover in detail the selection criteria for the various ITABAR- sensor model series, depending on the specific operating pressure, operating temperature and the desired assembly and installation design.

The WINFLOW sizing and model selection program serves to calculate and configure a pitot tube sensor. The WINFLOW program (program window see Fig 6.1) calculates the following as a function of the parameters for a specific measurement point:

- the differential pressures generated under varying operating conditions,
 - the permanent pressure loss caused by the sensor,
 - the sensor resonance and – if need be – it recommends a sensor with counter support,
 - the sensor oscillating frequency at operating conditions,
- the maximum allowable differential pressure,
- the maximum allowable flow for the selected sensor,
- the average flow velocity and
- the viscosity and density of commonly measured fluids under operating conditions.

The WINFLOW program can be ordered at no charge by any customer and in the desired format. The selection process can also be done by this manufacturer if the customer has furnished all required information mentioned in chapter 5 „Specifications for ITABAR flow Sensors.

The order specifications are selected via a simple to use order specification key, which has the same format for all sensors and which shows the variety of the in modules constructed versions. It enables a sensor specific selection for almost any application.

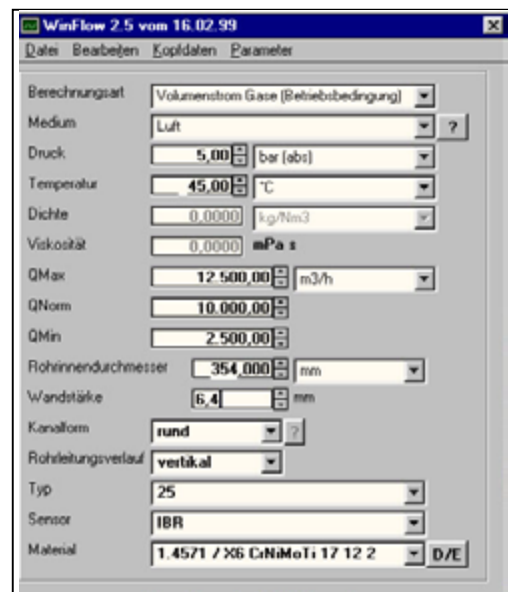


Fig. 6.1: The program window of WINFLOW

6.1 Compact or Separate Version?

The compact or the separate versions describe the assembly of the sensor components. In the compact version the pitot tube sensor, a separate 3- or 5-way manifold and a transmitter are assembled together into one compact unit (see Fig 6.1). In the separate version the transmitter and the sensor are separated from each other and are connected via conduit-pipes, (see Fig. 6.2.)



Fig. 6.1: Example of a compact version with flange plate, 3-way manifold and DP transmitter



Fig. 6.2: Example of a separate version with 3-way manifold and DP transmitter




The compact version (see Fig 6.1) offers obvious cost advantages compared to the separate version (see Fig 6.2). Assembly- as well as material expenses are eliminated for:




- two ball valves
- two conduit fittings
- one mounting bracket for the DP transmitter
- the fixed conduit and
- two conduit fittings on the DP transmitter
- Assembly time

7. Pitot Tubes for Liquids and Gases

7.1 Selection Criteria

The following table allows the selection of a model series depending on the given measurement task, the operating pressure, the operating temperature as well as the desired installation and assembly design.

	IBR	IBF	IBF-100
Installation / Removal with Process Shut Down			
Measurement task:			
Measurement of liquids, gases and gas mixtures	X	X	---
Measurement of flue gases	X	X	X
Possible operating pressures:			
6 bar, 16 bar (88, 235 psig)	X	X	X
40 bar, 63 bar (588 , 926 psig)	X	X	---
100, 160, 250, 320 ,400 bar (1470,2352,4704,5880 psig)		X	---
Max. operating temperature			
200° Celsius / 25 bar (680 °F / 3675 psig)	X		
1175° Celsius (3995°F), material dependent	---	X	X
Materials of installation parts:			
Carbon steel, 316 SS	X	X	X
1.4462 Duplex, 1.4539, Hastelloy C4, Incoloy 800, Inconel, Monel, PVDF	---	X	X
Sensor materials			
316 SS - Standard	X	X	X
1.4462 (Duplex), Inconel, Monel,	---	X	---
1.4539, Hastelloy C4, Incoloy 800, PVDF	---	X	X
Construction design features:			
Threaded connection with weld boss and locking nut for installation of sensor to pipe	X	---	---
Flanged connection to install sensor on pipe	---	X	X
Counter support with threaded removable blind flange for ease of sensor cleaning	---	---	X

	FTN	FTM	FTH
Installation / Removal Under Pressure (Wet-Tap)			
Measurement task:			
Measurement of liquids, gases and gas mixtures	x	x	x
Measurement of flue gas	x	x	x
Possible operating pressures			
6 bar / 235 psig	x	x	x
16 bar, 40 bar (235, 588 psig)	---	x	x
63 and 100 bar (926 and 1470 psig)	---	---	x
Max. operating temperature:			
200° Celsius (680°F)	x		
300° Celsius (1020°F)	---	x	X
400° Celsius (1360°F)	---	---	X
Materials of assembly parts			
Carbon steel, 316 SS	x	x	x
1.4462 Duplex, 1.4539, Hastelloy C4, Incoloy 800, Inconel, Monel	---	---	x
Sensor material:			
Carbon steel, 316 SS (Standard)	x	x	x
1.4462 Duplex, 1.4539, Hastelloy C4, Monel	---	---	x
Design features :			
Threaded connection with weld-o-let and locking nut for installation of sensor to pipe	x	---	---
Threaded connection with weld-o-let and lock ring for installation of sensor to pipe	---	x	---
Flanged connection to mount sensor to pipe	---	---	x
Protective safety chain during removal	x	---	---
Threaded rods for easy removal (safety chain required)	---	x	x
Option: threaded with hand wheel	---	x	x

7.2 Illustration of Sensor Heads and Assembly Parts



Fig. 7.1: Sensor head with 1/2 " NPT, only for gases and liquids



Fig. 7.2: Sensor head with flange plate to direct-mount a 3-way manifold. Limited use w/out pipe insulation, gas to pressure_{max} = 63 bar (926 psig) and temp_{max} = 200 °C (680°F) liquids to pressure_{max} = 63 bar (926 psig) and temp_{max} = 150°C (510°F)



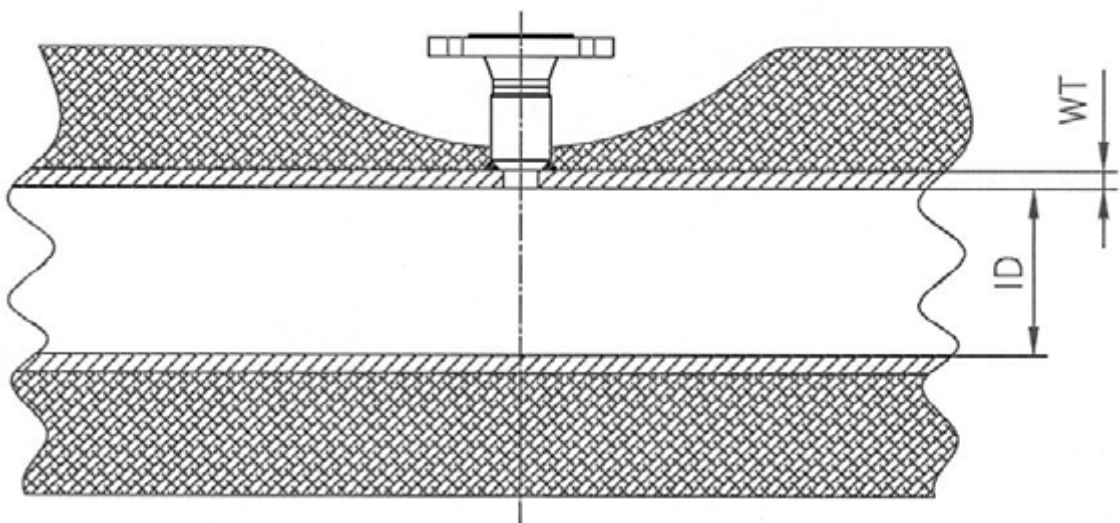
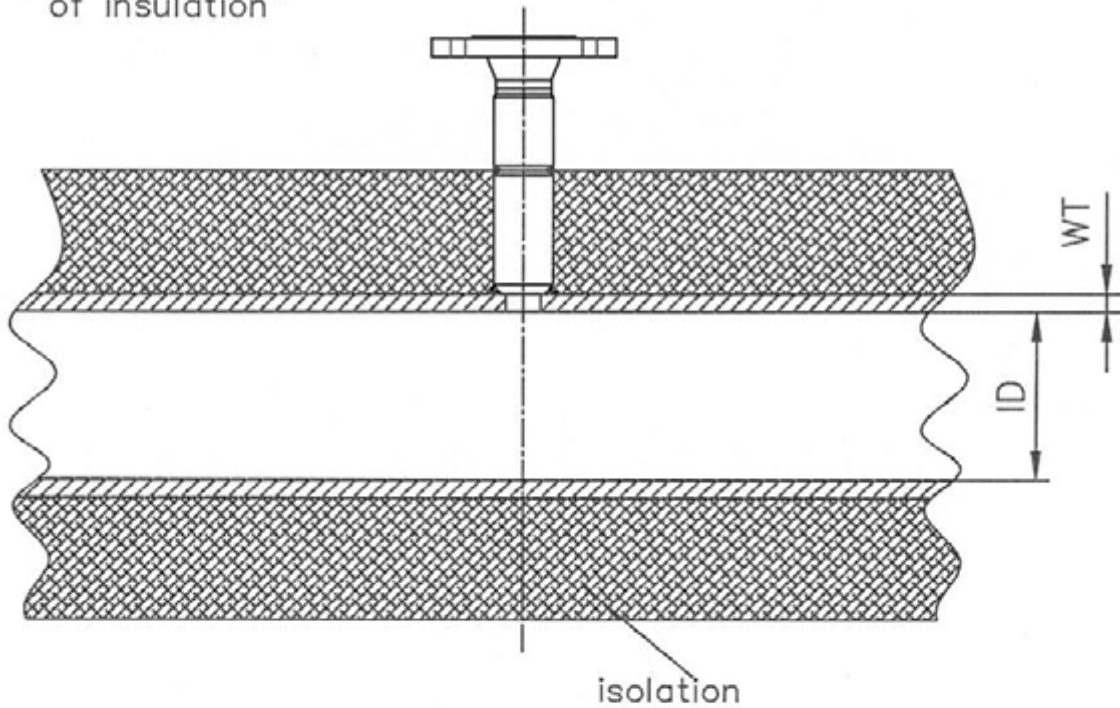
Fig. 7.3: Threaded weld boss for IBR-25/26 mat. Carbon steel, 316 SS



Fig. 7.4: Installation stud in weld-o-let version

7.9 Considerations of Heat Insulation in Order Codes

"Installation stud extension – so that fitting is outside of insulation"

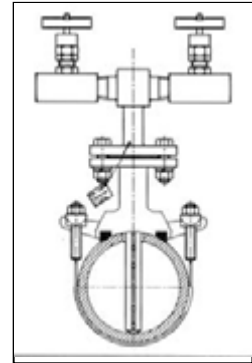


"If an extension is not included, the isolation must be reduced – increased insulation effort"

7.10 Saddle Flange Version for Cast / Pig Iron, Steel and AZ Pipes (Asbestos – Cement Pipe)

The saddle flange version is a special assembly version for pitot tubes in cast iron, steel and asbestos-cement pipes. Common pipe diameters are between 2 1/4" to 20" (DN 65 to DN 500). Larger pipes can be realized upon customer request.

The picture to the right shows an example for a pitot tube sensor model IBF-25 in saddle flange version. This version consists of a drill-clamp with flange PN 4 / 58.8 psig (gas) / PN 16 / 235.2 psig (water) and at least one saddle clamp.



This assembly version is not available for pitot tube sensors with counter support.

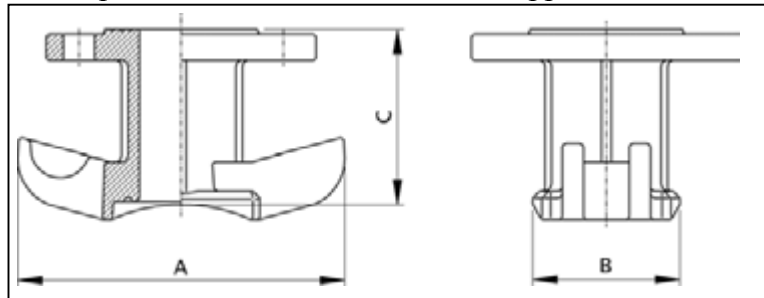


Fig 7.6: Universal drill-clamp with flange pipe size 2" DN 40/50 PN 4 / 58.8 psig (gas) / PN 16 / 235.2 psig (water)

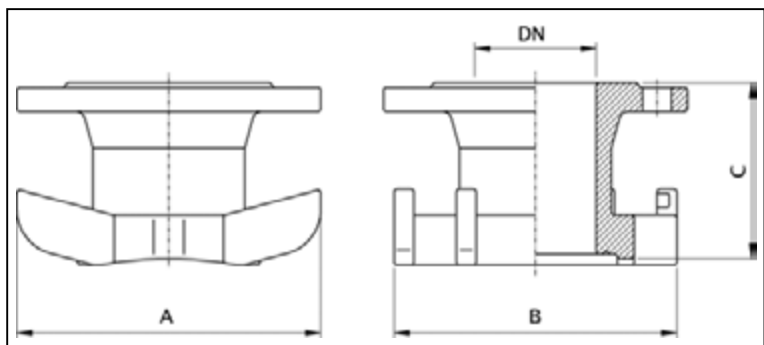


Fig 7.7: Double saddle clamp- drill-clamp with flange pipe size 3" DN 80 PN 4 / 58.8 psig (gas) / PN 16 / 235.2 psig (water)



Fig 7.8: saddle clamp, fully vulcanized



Fig 7.9: saddle clamp, stainless, acid-resistant steel (304 SS)

	Saddle clamp, fully vulcanized	Saddle clamp st steel (304 SS)	Saddle clamp for AZ pipe
Figure:	7.5	7.6	n/a
Use for pipe types:			
- Welded pipe according DIN 2060	x	x	---
- Welded pipe with PE-cover to DIN 30670	x	x	---
- Cast pipe to DIN 28610 bituminized	x	x	---
- Cast pipe to DIN 28610 with PE-cover to DIN 30674 T 1	x	x	---
- Cast pipe to DIN 28610 with ZM-cover	x	x	---
- Asbestos-cement pipe 10 bar (147 psig)	---	---	x
- Asbestos-cement pipe 12.5 bar (183.7 psig)	---	---	x
- Asbestos-cement pipe 16 bar (235.2 psig)	---	---	x
Pipe outside diameter	87 – 470 mm (3.4 – 18.5")	75 – 582 mm (2.9 – 22.9")	97 – 494 mm (3.8 – 19.4")
Width of saddle:	70 mm (2.7")	65 mm (2.6")	90 mm (3.5")
Material of saddle :	St steel, fully vulcanized	1.4301	1.4301
Saddle seal:	NBR	NBR	NBR
Order code (x= pipe outside diameter in mm):	HB1-x	HB2-x	HB3-x

Materials Overview

Material Nr.	Temperaturerange	Use	Use
316 SS (Standard)	550°C 1870°F	Extraction facilities, dryers, mixing- and batching facilities, evaporators, distilleries, and other	The Cr-Ni-Mo alloyed material is very resistant against reducing organic and inorganic acids, as well as against halogen-containing media. This steel is furthermore less susceptible to selective corrosion. The titanium stabilized material exhibits slightly better heat properties with somewhat less resistance to acids.
1.4462 (st steel)	Duplex	Sea water desalination plants, petrochem industry, off-shore technology, evaporators, extraction facilities, distilleries, dryers	Good mechanical properties combined with high resistance against general corrosion, tear- and oscillation corrosion.
1.4539 (st steel)	450-800°C 1530-2720°F	Flue gas sulfur elimination (scrubbers), below dew point	The material is a highly acid resistant specialty steel with particularly good resistance to sulfuric and phosphoric acid at concentrations of up to 70% and operating temperatures of up to 80°C. Furthermore this material is resistant against concentrated organic acids, even at high temperatures, as well as against salt- and soda solutions. The steel is especially insensitive to selective corrosion and tear corrosion.
2.4610 NiMo16Cr16Ti Hastelloy C4	650-1040°C 2210-3536°F	Flue gas sulfur elimination (scrubbers), chlorine gas	Excellent stability in the chemical process industry against strong oxidizing media, hot contaminated mineral acids, solvents, chlorine- and chlorine contaminated media (organic and inorganic), anhydrous bleach acid, formic acid, distilled vinegar, Essighydrid-, seawater, and The alloy exhibits great ductile strength and resistance to corrosion even in temperatures of 650 – 1040°C. Resistant to build-up of Korngrenzkriben and is therefore in most cases usable without heat treatment after welding.
1.4876 X10NiCrAlTi3320 Incoloy 800	900°C 3060°F	Hydrogen facilities	This alloy is resistant against corrosion from hydrogen and hydrogen sulfides as well as against tension corrosion.
2.4816 NiCr15Fe Inconel 600	1175°C 3995°F	air heaters	Excellent oxidation resistance up to 1175°C with superb general resistance to corrosion. Maintains high stability up to approx. 650°C. Good mechanical properties even in low temperatures. Because of its resistance to chloride-corrosion this alloy is also used in nuclear reactor components. Can be welded w/out heat treatment.

Materials Overview

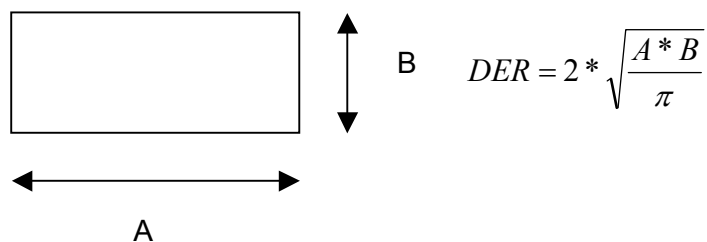
Material Nr.	Temperature range	Use	Use
2.4360 NiCu2Ofe Monel	425-550°C 1445-1970°F	Extraction facilities, dryers, mixing – and batching plants, evaporators distilleries, sea water desalination plants	The Cr-Ni-Mo alloyed material is very resistant against reducing organic and inorganic acids, as well as against halogen-containing media. This steel is furthermore less susceptible to selective corrosion. The titanium stabilized material exhibits slightly better heat properties with somewhat less resistance to acids.
PVDF	-40 bis +120°C -136°F to +408°F	Chemical plants, flue gas cleaning (scrubbers), filter technology	Well suited for many aggressive acids, many solvents and cleaning agents, hot water resistant
1.5415 15 Mo 3	530°	High pressure steam applications	
1.7335	550°C 1802°F	High pressure steam applications	
1.7380 10 CrMo 4 4	570°C 1938°F	High pressure steam applications	
1.4903 10 CrMoVNB 91	650°C 2210°F	High pressure steam applications	High pressure steam, energy and environmental technologies, chemicals/ petro-chem, oil- and gas industries, cryogenics, food and beverage industry, plastics

Technical Specifications

Sensor materials		Comercial designation	AISI	UNS
	1.4571	316Ti (standard)		S31635
	1.4462	Duplex	316 Ti	S31803
	1.4539			N08904
	2.4610	Hastelloy C4		N06455
	1.4876	Incoloy 800		N08811
	2.4816	Inconel 600		N06600
	2.4360	Monel		N04400
	PVDF			-
	1.5415	15 Mo 3		K12020
	1.7335	13 CrMo 44		K11562
	1.7380	10 CrMo 910		-
	1.4903	X 10 CrMoNVb		-

Pipe inside diameter	1 ½" – 480" (DN 20 - DN 12000)
Max. operating pressure	PN 400 / 5880 psig (depending on sensor type)
Max. operating temperature	1200°C (4080°F) (depending on sensor material)
Accuracy	± 0,3 % of full scale

- Lower permanent pressure loss (energy savings)
- Use from Re=3150
- Direct mass flow measurement (integrated temperature and flow measurement)
- Direct-mount of electr. DP transmitter
- Little danger of contamination due to large pressure sensing apertures
- ITABAR-flow-sensors with certified accuracy, tested at water calibration facility ABB Göttingen/Gerrmany. All sensor types from DN400 (16") through DN1600 64") were calibrated and tested – see test protocols.
- Material certificates available in 3.1B und 3.1A
- Flo-Tap-versions allow installation and removal under pressure (wet-tap)
- Flow measurement in rectangular or square vessels is possible

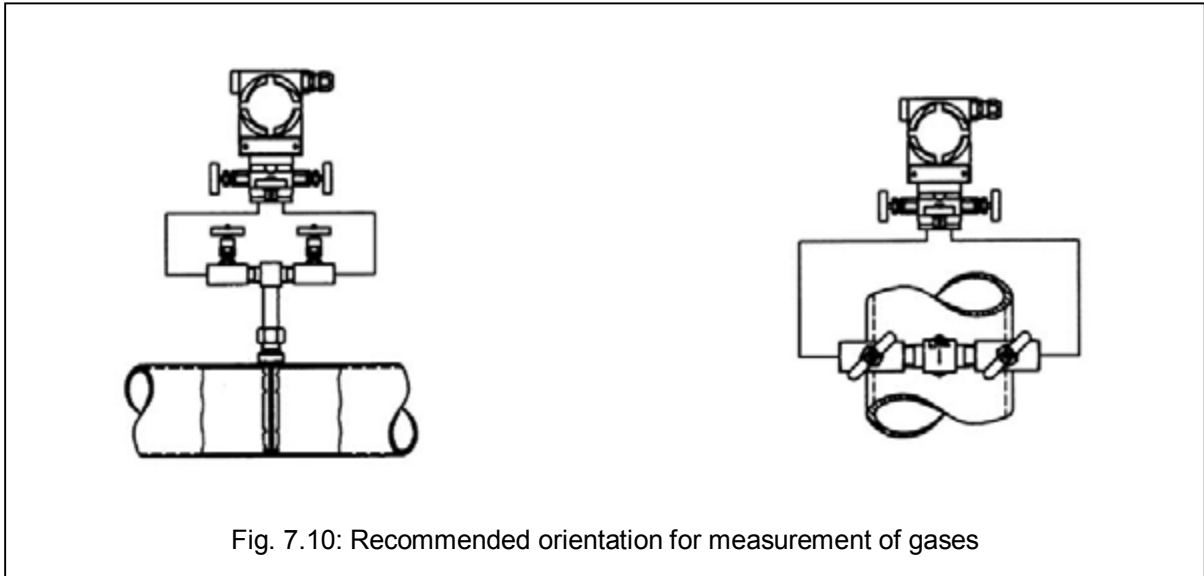


The sensor is always made for the longer side to better cover the flow profile.

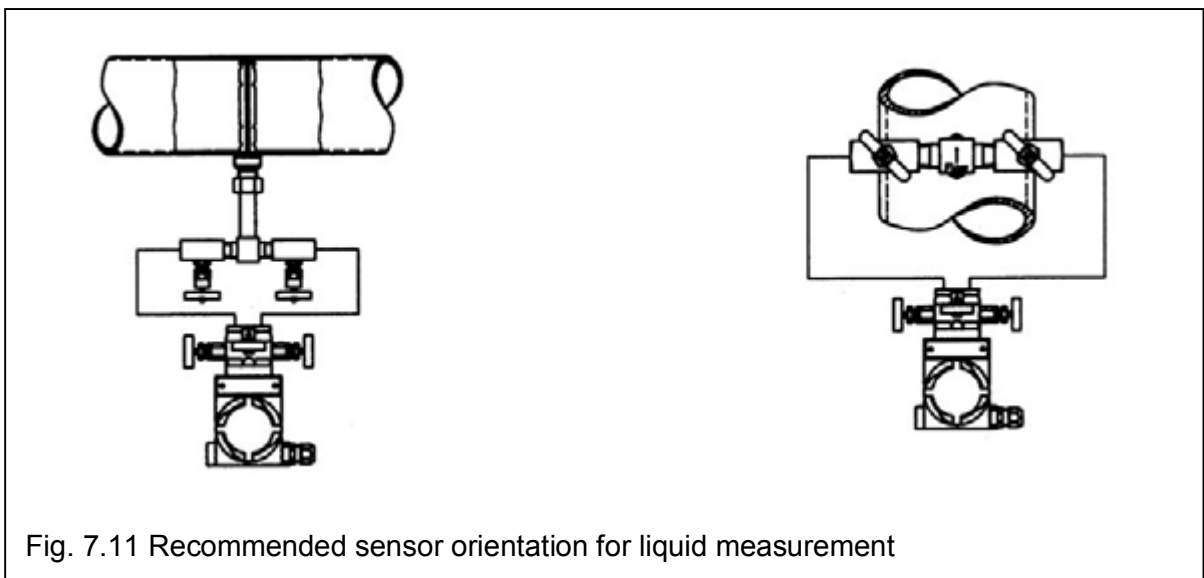
- Shorter straight pipe run requirements as compared to orifice plates and nozzle.

Selection of Sensor Orientation

1. Gases, if possible the sensor should be inserted into the pipe from the top or from the side. In case the gas contains moisture, liquid drops can migrate back into the measurement chambers. If the sensor is installed into the bottom of a pipe an increase in the liquid column can cause measurement errors.



2. Liquids, sensor installation from side or from below into pipe, never from above (as opposed to gases). Air bubbles rise and cause measurement errors, transmitter always below the pressure connections.



3. Steam, the sensor is always to be inserted from the side into a pipe, the transition between the aggregate conditions steam and water must be allowed to take place freely, the transmitter is to be installed below the pressure process connections. The water columns of the condensate pots must be located above the transmitter at exactly the same hydrostatic level.

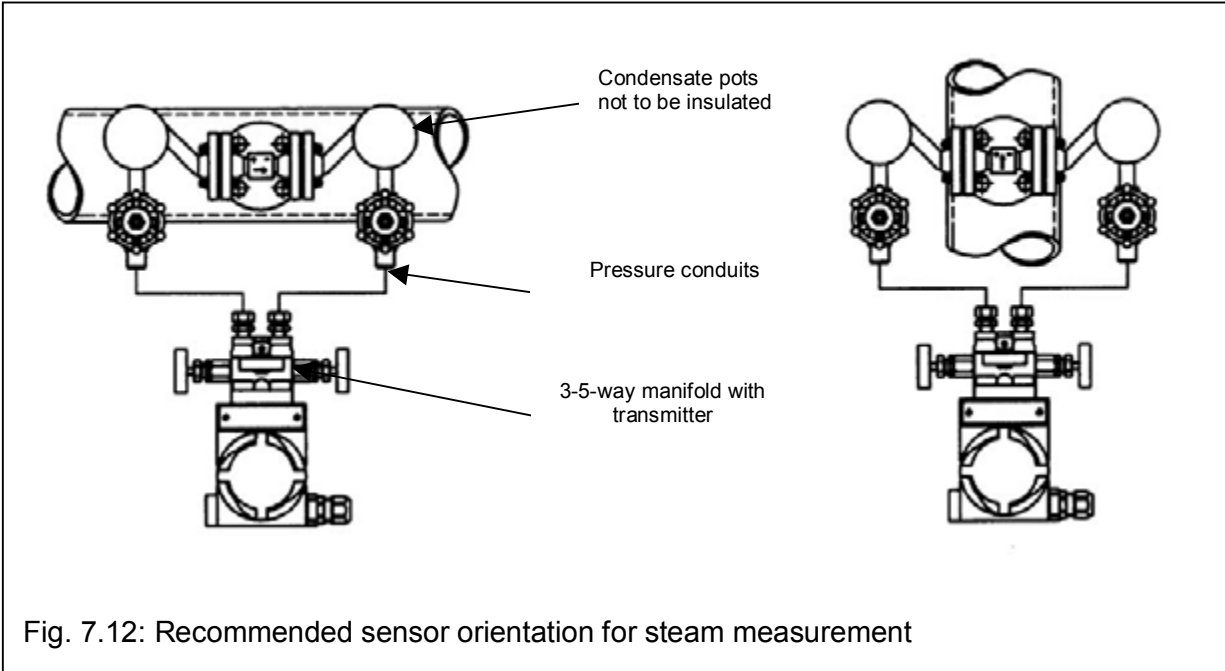


Fig. 7.12: Recommended sensor orientation for steam measurement

Important: When measuring steam never insert the sensor from the top into a pipe !

Calibration of ITABAR-Flow-Sensors

In order to achieve the highest accuracy for the ITABAR-flow-sensors, they were tested on a PTB tested and approved calibration facility. The objective was to determine the absolute measurement error at minimum as well as maximum flow.

The measuring turn-down was 1:5, the Reynolds number influence was to be determined and to be integrated into the Winflow Program, so that the user can demand the highest performance from the product.

Tested pipe diameters inches (mm)	Sensor type
ID 12.047 (306 mm)	IBF-26/36/66
ID 15.748 (400 mm)	IBF-26/36/66
ID 19.685 (500 mm)	IBF-26/36/66
ID 23.543 (598 mm)	IBF-26/36/66
ID 39.291 (998 mm)	IBF-26/36/66
ID 63.307 (1608 mm)	IBF-26/36/66

Intra-Automation manufactured several different pieces of pipe for these tests, which could be inserted into the hydraulic test stand. The pipe-layout was measured with a tolerance of ± 1 mm.

The conversion from the differential pressure into a mA signal was done with a DP transmitter manufactured by Endress + Hauser, which was calibrated $\pm 0,1$ % of full scale.

The water temperature and the pressure were read at the calibration stand. The output signal of the electrical DP transmitter was transmitted in the form of pulses to the ABB computer and were compared directly with the calibration standard values.

Six measurements were automatically taken at every flow range in intervals of 100 seconds. The measurement errors at each interval were averaged.

With the help of these calibrations it was possible to reach an accuracy of $\pm 0,3$ % for all ITABAR-sensors. In the ongoing manufacturing process the width of all sensors is manufactured with and checked for a tolerance as listed in the following table

Sensor types	Manufacturing tolerance
IBR/IBF-15	$\pm 0,05$ mm
IBR/IBF-20/21	$\pm 0,05$ mm
IBR/IBF-25/26	$\pm 0,05$ mm
IBR/IBF-35/36	+ 0 mm - 0,1 mm
IBR/IBF-65/66/100	+ 0 mm - 0,1 mm

Against this background Intra-Automation guarantees an accuracy of $\pm 0,3$ % for ITABAR-flow-sensors.

MEN

Mess- und Eichwesen Niedersachsen

- Landesbetrieb -

Office of Legal Metrology of the state of Niedersachsen (Germany)



DIE BEI DEN MESSUNGEN VERWENDETEN NORMALE SIND AUF DIE NATIONALEN NORMALE BEI DER PHYSIKALISCH-TECHNISCHEN BUNDESANSTALT RÜCKGEFÜHRT.

THE STANDARDS USED FOR THE MEASUREMENTS ARE TRACEABLE TO THE NATIONAL STANDARDS AT THE PHYSIKALISCH-TECHNISCHE BUNDESANSTALT.

Prüfschein

Inspection certificate



Nummer

Number

20011647

Gegenstand

Object

Magnetisch – induktiver Durchflussmesser

Identifikation

Identification

Durchflussaufnehmer

mit Seriennummer 8901N1738/A3

Messumformer MAG - XH

mit Seriennummer 8901N1738/B3

Hersteller

Manufacturer

Fischer & Porter GmbH

Antragsteller

Applicant

ABB Automation Products GmbH

Dransfelder Straße 2

37079 Göttingen

Anzahl der Seiten der Anlage

Number of pages of the addendum

eine

Ort und Datum der Prüfung

Place and date of inspection

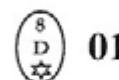
Göttingen, 20. September 2001

Gültigkeit der Prüfung bis 31. Dezember 2002

This inspection is valid until

Stempelzeichen

Marking



Prüfscheine ohne Unterschrift und Dienstsiegel haben keine Gültigkeit. Dieser Prüfschein darf nur unverändert weiterverbreitet werden.

Inspection certificates without signature and official stamp are not valid. This inspection certificate may only be reproduced in unchanged form.

Ort und Datum

Place and date



Im Auftrag

By order

Hannover, 24. September 2001

Wohlthat



Zusätzliche Angaben zum Gegenstand

Additional comments concerning the object

Nennweite DN 500

Prüfverfahren

Test procedure

Die Messnormale wurden entsprechend der „Richtlinie für die Eichung von Volumenmessgeräten für strömendes Wasser und Anforderungen für die Normale“ vom 13. Juni 1996 geprüft.

Umgebungsbedingungen

Environmental conditions

Bei der Prüfung darf die Wassertemperatur 30 °C nicht überschreiten.

Ergebnis

Result

Durchfluss	Abweichung
m ³ /h	%
3000	-0,04
2250	-0,05
1500	-0,05
600	-0,35
1500	-0,09
1125	-0,21
800	0,32
300	-0,82

Der Zähler entspricht den „Anforderungen für Normale“ und kann als Referenzzähler verwendet werden.

Messunsicherheit

Uncertainty of measurement

Die Messunsicherheit wurde nicht bestimmt.

Hinweis

Notes

Die Prüfung verliert ihre Gültigkeit vorzeitig, wenn am Gegenstand Beschädigungen oder Veränderungen aufgetreten sind, die Einfluss auf dessen messtechnische Eigenschaften haben können oder wenn das aufgebrachte Stempelzeichen beschädigt oder entfernt wird.

Ende der Anlage

End of the addendum

Calibration facility / Fa. ABB Göttingen (Germany)



Test Protocol

Calibration Facility: ABB Göttingen, PTB-tested / Test Stand PS 0014
 Pipe ID : 306 mm / Medium : Water

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-26	20°C	100	1000	27,632	27,594	0,1388
IBF-26	20°C	100	1000	27,616	27,615	0,0035
IBF-26	20°C	100	1000	27,662	27,652	0,0345
IBF-26	20°C	100	1000	27,563	27,555	0,0284
IBF-26	20°C	100	1000	27,598	27,608	0,0395
IBF-26	20°C	100	1000	27,599	27,547	0,1882
Average		100		27,612	27,595	0,0721

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-36	20°C	100	1000	27,613	27,564	0,1807
IBF-36	20°C	100	1000	27,520	27,489	0,1125
IBF-36	20°C	100	1000	27,614	27,576	0,1400
IBF-36	20°C	100	1000	27,644	27,546	0,3531
IBF-36	20°C	100	1000	27,580	27,577	0,0130
IBF-36	20°C	100	1000	27,697	27,505	0,6983
Average		100		27,611	27,543	0,2496

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-66	20°C	100	1000	27,499	27,432	0,2464
IBF-66	20°C	100	1000	27,451	27,425	0,0933
IBF-66	20°C	100	1000	27,436	27,457	-0,0774
IBF-66	20°C	100	1000	27,503	27,495	0,0274
IBF-66	20°C	100	1000	27,448	27,453	-0,0164
IBF-66	20°C	100	1000	27,618	27,569	0,1793
Average		100		27,493	27,472	0,0754

Test Protocol

Calibration Facility: ABB Göttingen, PTB-tested / Test Stand PS 0014
Pipe ID : 400 mm / Medium : Water

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-26	9°C	100	2000	55,840	55,908	-0,1209
IBF-26	9°C	100	2000	55,635	55,788	-0,2743
IBF-26	9°C	100	2000	55,975	56,016	-0,0724
IBF-26	9°C	100	2000	55,909	56,001	-0,1648
IBF-26	9°C	100	2000	55,775	55,815	-0,0726
IBF-26	9°C	100	2000	55,673	55,779	-0,1914
Average		100		55,801	55,884	-0,1493

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-36	3°C	100	2000	56,205	56,141	0,1135
IBF-36	3°C	100	2000	56,034	56,068	-0,0618
IBF-36	3°C	100	2000	56,050	56,028	0,0391
IBF-36	3°C	100	2000	56,197	56,260	-0,1111
IBF-36	3°C	100	2000	56,256	56,254	0,0039
IBF-36	3°C	100	2000	56,202	56,209	-0,0127
Average		100		56,157	56,160	-0,0048

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-66	3°C	100	2000	55,622	55,641	-0,0337
IBF-66	3°C	100	2000	55,657	55,659	-0,0022
IBF-66	3°C	100	2000	55,713	55,644	0,1240
IBF-66	3°C	100	2000	55,505	55,583	-0,1405
IBF-66	3°C	100	2000	55,625	55,485	0,2523
IBF-66	3°C	100	2000	55,373	55,499	-0,2272
Average		100		55,583	55,585	-0,0045

Test Protocol

Calibration Facility: ABB Göttingen, PTB-tested / Test Stand PS 0014
Pipe ID : 499 mm / Medium : Water

Type Test	Operating temperatur	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-26	8,2°C	100	3000	83,285	83,387	-0,1220
IBF-26	8,2°C	100	3000	83,443	83,831	-0,4628
IBF-26	8,2°C	100	3000	83,196	83,369	-0,2071
IBF-26	8,2°C	100	3000	83,323	83,543	-0,2684
IBF-26	8,2°C	100	3000	83,138	83,358	-0,2684
IBF-26	8,2°C	100	3000	83,012	83,358	-0,4155
Average		100		83,233	83,475	-0,2899

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-36	8,2°C	100	3000	83,297	83,333	-0,0422
IBF-36	8,2°C	100	3000	83,170	83,130	0,0484
IBF-36	8,2°C	100	3000	83,723	83,097	-0,4502
IBF-36	8,2°C	100	3000	83,116	83,109	0,0079
IBF-36	8,2°C	100	3000	83,253	83,221	0,0375
IBF-36	8,2°C	100	3000	83,074	83,164	-0,1080
Average		100		83,105	83,176	-0,0844

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-66	7,0°C	100	3000	83,512	83,602	-0,7078
IBF-66	7,0°C	100	3000	83,482	83,629	-0,1754
IBF-66	7,0°C	100	3000	83,802	83,830	-0,0330
IBF-66	7,0°C	100	3000	83,696	83,636	0,0715
IBF-66	7,0°C	100	3000	83,596	83,760	-0,1957
IBF-66	7,0°C	100	3000	83,683	83,701	-0,0219
Average		100		83,629	83,693	-0,0770

Test Protocol

Calibration Facility: ABB Göttingen, PTB-tested / Test Stand PS 0014
Pipe ID : 599 mm / Medium : Water

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-26	6,0°C	100	4000	110,96	111,03	-0,0597
IBF-26	6,0°C	100	4000	110,93	111,10	-0,1550
IBF-26	6,0°C	100	4000	111,13	111,18	-0,0431
IBF-26	6,0°C	100	4000	110,86	111,08	-0,1973
IBF-26	6,0°C	100	4000	110,98	111,07	-0,0833
IBF-26	6,0°C	100	4000	111,09	111,12	-0,0208
Average		100		110,99	111,10	-0,0932

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-36	2,4°C	100	4000	110,45	110,33	0,1116
IBF-36	2,4°C	100	4000	110,44	110,26	0,1615
IBF-36	2,4°C	100	4000	110,44	110,32	0,1081
IBF-36	2,4°C	100	4000	110,50	110,32	0,1640
IBF-36	2,4°C	100	4000	110,41	110,28	0,1215
IBF-36	2,4°C	100	4000	110,40	110,47	-0,0623
Average		100		110,44	110,33	0,1007

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-66	5,0°C	100	4000	110,97	111,05	-0,0760
IBF-66	5,0°C	100	4000	110,68	110,90	-0,2060
IBF-66	5,0°C	100	4000	110,87	111,01	-0,1260
IBF-66	5,0°C	100	4000	110,65	111,05	-0,3622
IBF-66	5,0°C	100	4000	110,86	111,07	-0,1870
IBF-66	5,0°C	100	4000	111,13	111,09	0,0414
Average		100		110,86	111,03	-0,1526

Test Protocol

Calibration Facility: ABB Göttingen, PTB-tested / Test Stand PS 0014
Pipe ID : 999 mm / Medium : Water

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Niorm m ³	Error %
IBF-26	12,5°C	100	5000	139,99	140,14	-0,1067
IBF-26	12,5°C	100	5000	139,96	140,12	-0,1144
IBF-26	12,5°C	100	5000	139,82	139,92	-0,0685
IBF-26	12,5°C	100	5000	139,79	139,99	-0,1409
IBF-26	12,5°C	100	5000	139,51	139,78	-0,1954
IBF-26	12,5°C	100	5000	139,77	139,86	-0,0617
Average		100		139,81	139,97	-0,1146

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-36	16,5°C	100	5000	138,02	137,75	0,1985
IBF-36	16,5°C	100	5000	138,36	138,51	-0,1087
IBF-36	16,5°C	100	5000	138,72	139,09	-0,2662
IBF-36	16,5°C	100	5000	139,54	139,37	0,1195
IBF-36	16,5°C	100	5000	138,92	139,56	-0,4613
IBF-36	16,5°C	100	5000	139,66	139,68	-0,0181
Average		100		138,87	138,99	-0,0899

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-66	13,5°C	100	5000	138,32	138,70	-0,2685
IBF-66	13,5°C	100	5000	138,41	138,65	-0,1771
IBF-66	13,5°C	100	5000	139,11	138,69	0,3033
IBF-66	13,5°C	100	5000	138,86	138,63	0,1674
IBF-66	13,5°C	100	5000	139,10	138,60	0,3640
IBF-66	13,5°C	100	5000	138,50	138,78	-0,2013
Average		100		138,72	138,68	0,0313

Test Protocol

Calibration Facility: ABB Göttingen, PTB-tested / Test Stand PS 0014
Pipe ID : 1608 mm / Medium : Water

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-26	12,5°C	100	5500	153,47	153,21	0,1698
IBF-26	12,5°C	100	5500	153,99	153,14	0,5586
IBF-26	12,5°C	100	5500	153,60	153,20	0,2594
IBF-26	12,5°C	100	5500	153,63	153,25	0,2465
IBF-26	12,5°C	100	5500	153,88	153,30	0,3813
IBF-26	12,5°C	100	5500	153,32	153,18	0,0879
Average		100		153,65	153,21	0,2839

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-36	11,5°C	100	5500	154,61	154,45	0,1015
IBF-36	11,5°C	100	5500	153,68	154,28	-0,3892
IBF-36	11,5°C	100	5500	154,23	154,22	0,0042
IBF-36	11,5°C	100	5500	154,28	154,26	0,0130
IBF-36	11,5°C	100	5500	153,49	154,33	-0,5445
IBF-36	11,5°C	100	5500	154,16	154,69	-0,3376
Average		100		154,08	154,37	-0,1922

Type Test	Operating temperature	Time sec	m ³ /h	Test m ³	Test Norm m ³	Error %
IBF-66	11,5°C	100	5500	152,45	152,02	0,2856
IBF-66	11,5°C	100	5500	151,83	151,84	-0,0073
IBF-66	11,5°C	100	5500	152,35	151,95	0,2642
IBF-66	11,5°C	100	5500	152,13	151,94	0,1247
IBF-66	11,5°C	100	5500	152,36	152,03	0,2180
IBF-66	11,5°C	100	5500	152,49	151,86	0,4153
Average		100		152,27	151,94	0,2168

Approvals and Test Certificates

The following tables shows the currently valid approvals and test certificates :

Sensor Type	Test Method	Result	Approval/Test Agency	Location	Date of Test
IBF-100	Sample design test to TA Luft 1986, 13. BImSchV und 17. BImSchV	Test passed	TÜV Rheinland Sicherheit und Umweltschutz GmbH	D-Köln	12.5.1999
IBF-20	Measurement accuracy	±0,5% of rate for all measured values	NMI Nederlands Meetinstituut	NL-Dordrecht	24.3.2000
IBF-25	Measurement accuracy	±0,68% of rate for all measured values	PIGSAR Ruhrgas AG (Staatl. anerkannt)	D-Dorsten	24.11.1999
IBF-25/26	Sample design test to TA Luft 1986, 13. BImSchV und 17. BImSchV	Test passed	TÜV Rheinland Sicherheit und Umweltschutz GmbH	D-Köln	12.5.1999
IBF-35/36	Sample design test to TA Luft 1986, 13. BImSchV und 17. BImSchV	Test passed	TÜV Rheinland Sicherheit und Umweltschutz GmbH	D-Köln	12.5.1999
IBFD-26-HTG	Test according to TRD 110 and TRD 110 Anlage 1	Test passed	VdTÜV	D-Essen	7.12.1995
IBR-25/26	Sample design test to TA Luft 1986, 13. BImSchV und 17. BImSchV	Test passed	TÜV Rheinland Sicherheit und Umweltschutz GmbH	D-Köln	12.5.1999
IBR-35/36	Sample design test to TA Luft 1986, 13. BImSchV und 17. BImSchV	Test passed	TÜV Rheinland Sicherheit und Umweltschutz GmbH	D-Köln	12.5.1999

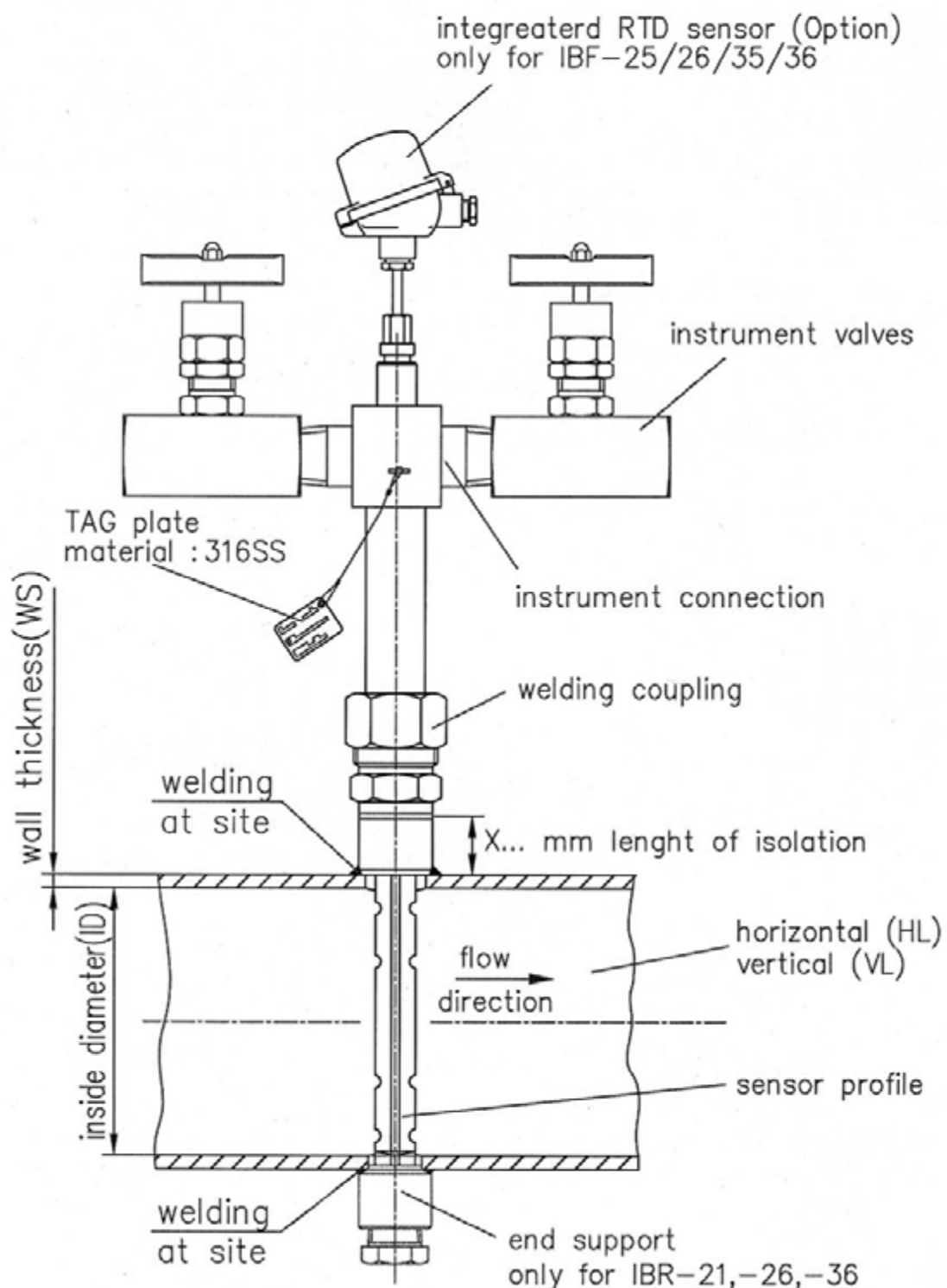
8.0 Series IBR 20/21/25/26 to 588 PSI, IBR 35/36 to 235 PSI

Description

The ITABAR-sensor series IBR is used to measure volumetric flow of liquids and gases. It is designed to be installed through threaded weld-o-let pipe mounting parts. It offers a good price/performance ratio in applications with no high temperature or pressure requirements. Standard sensor material is 316 SS. The design is such that the DP transmitter can be integrally mounted onto the sensor via an optional 3-way-manifold. An optional RTD temperature sensor is available for mass flow measurement

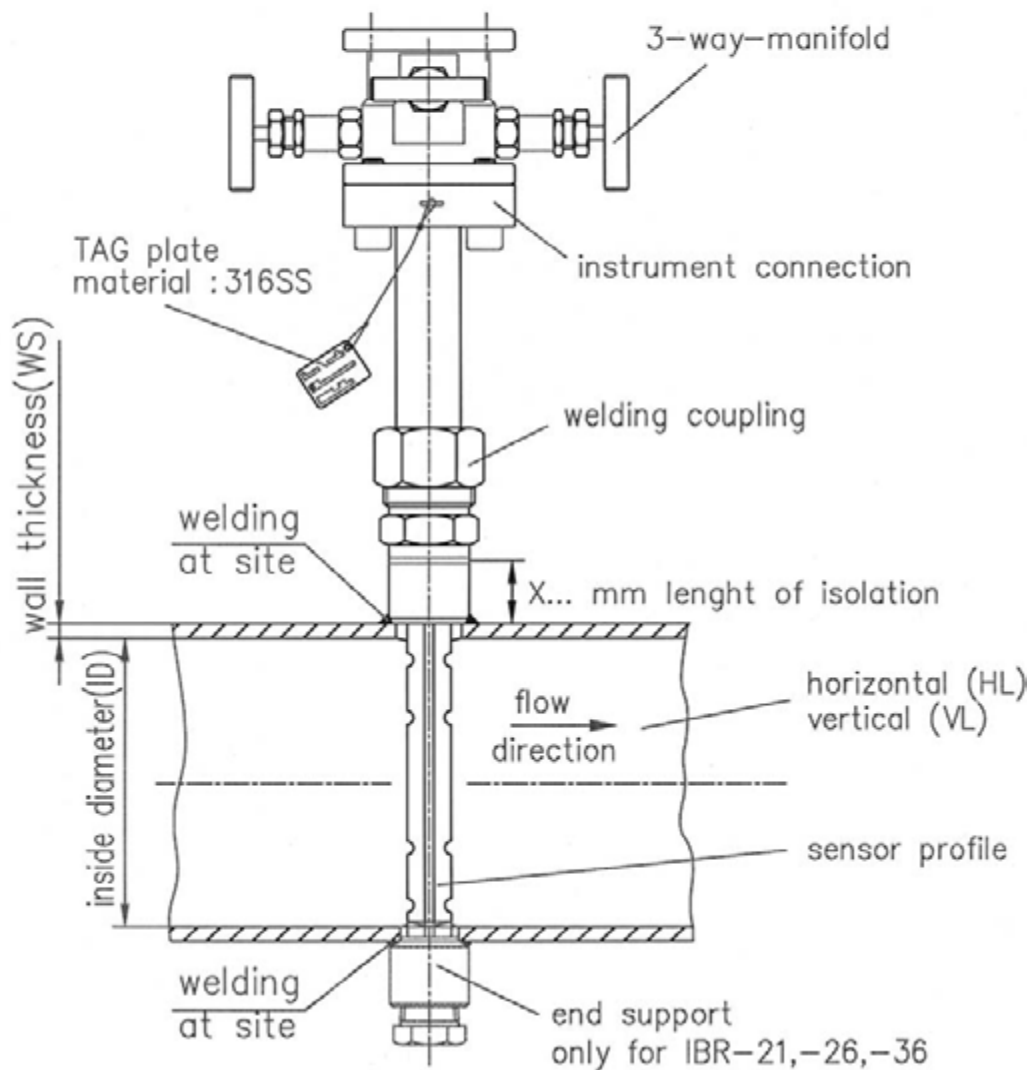


seperate installation of sensor and transmitter



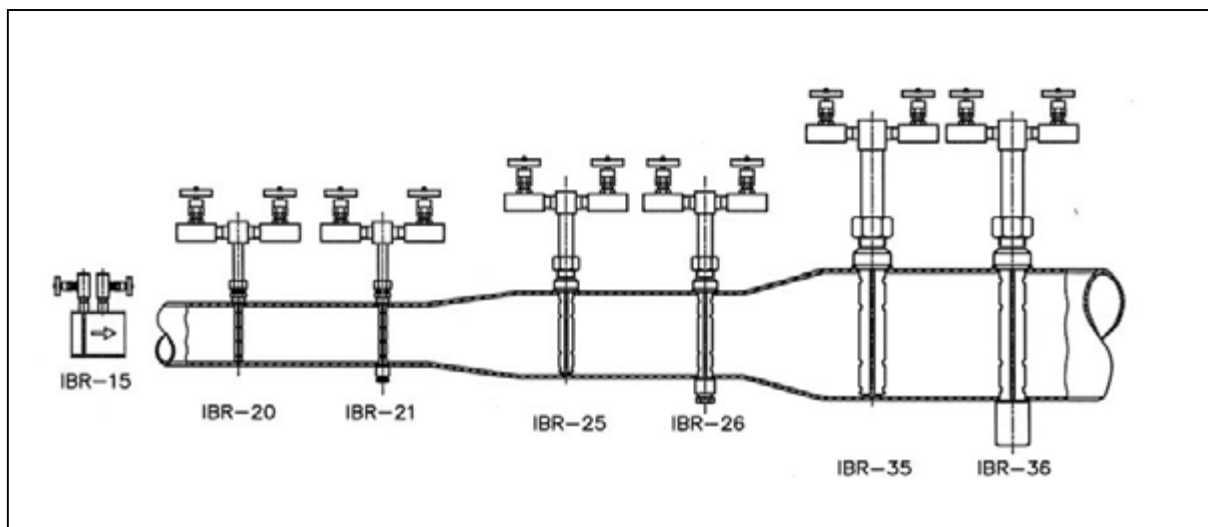
Drawings for ITABAR series IBR

compactversion electr. d.p.transmitter mounted on to the flow sensor (only with A06)



Order Data for ITABAR Series IBR- 15/20/21/25/26/35/36

1. Sensor Type



Pipe Size inches	Max. volumetric flow GPM						
	IBR-15	IBR-20	IBR-21	IBR-25	IBR-26	IBR-35	IBR-36
1	159	---	---	---	---	---	---
1 ¼	225	---	---	---	---	---	---
1 ½	---	228	541	---	---	---	---
2	---	329	770	---	---	---	---
2 ¼	---	501	1161	---	---	---	---
2 ½	---	686	1566	---	---	---	---
4	---	924	2099	1126	2618	---	---
5	---	1201	2996	1504	3454	---	---
6	---	---	---	1878	4285	---	---
8	---	---	---	2622	5926	---	---
10	---	---	---	3418	7695	---	---
12	---	---	---	4272	9596	8830	19826
14	---	---	---	5090	11418	10608	23786
16	---	---	---	5882	13173	12390	27755
20	---	---	---	7519	16830	15787	35323
24	---	---	---	9116	20394	19245	43040
28	---	---	---	10753	24059	22818	51013
32	---	---	---	12491	27913	26470	59171
36	---	---	---	14185	31922	30179	67465
40	---	---	---	28028	36044	33932	75851
48	---	---	---	19795	44228	41412	92628
56	---	---	---	23328	52288	48936	109353
64	---	---	---	26844	59941	56416	126042
72	---	---	---	---	---	63602	142067
80	---	---	---	---	---	70778	158056

These values are for water of 0.999 SGU and at a temperature T = 67 °F. To calculate volumetric or mass flow of fluids with other densities see chapter 6 „Specifications of DP Sensors with WINFLOW“.

1. Order specification ITABAR-FLOW-Sensor, series IBR-15

1. type of sensor

15 without end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S 316 SS

5. piping run

HL horizontal

VL vertikal

6. process connection s. page 75

7. instrument valves, s. page 75

IBR- 15 / S

1. Order specification ITABAR-FLOW-Sensor, series IBR-20/21

1. type of sensor

20 without end support

21 with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S 316 SS

4. welding coupling

00 without

07 material C.S.

08 material 316 SS

5. material end support (IBR-21)

Y without end support

C end support, material: C.S.

S end support, material: 316 SS

6. isolation

KI without

X.. isolation in inches (or mm), please specify

7. piping run

HL horizontal

VL vertikal

8. process connection s. page 75

9. instrument valves s. page 75

IBR- / S

1. Order specification ITABAR-FLOW-Sensor, series IBR-25/26

1. type of Sensor

25	without end support
26	with end support

2. inside diameter and wall thickness.

ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
-----------------	--

3. sensor material

S	316 SS
---	--------

4. welding coupling

0	without
1	material: C.S.
2	material: 316 SS

5. material end support (IBR-26)

Y	without end support
C	end support C.S. material
S	end support 316 SS material

6. isolation

KI	without
X..	isolation in inches (or mm), please specify

7. piping run

HL	horizontal
VL	vertikal

8. integrated RTD resistance thermocouple

T0	without
TA	3-wire
TB	3-wire, with ex-proofness

9. process connection s. page 75

10. instrument valves, s. page 75

IBR- / S

1. Order specification ITABAR-FLOW-Sensor, series IBR-35/36

1. type of Sensor

35	without end support
36	with end support

2. inside diameter and wall thickness.

ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
-----------------	--

3. sensor material

S	316 SS
---	--------

4. welding coupling

0	without
1	material: C.S.
2	material: 316 SS

5. material end support (IBR-36)

Y	without end support
C	end support C.S. material
S	end support 316 SS material

6. isolation

KI	without
X..	isolation in inches (or mm), please specify

7. piping run

HL	horizontal
VL	vertikal

8. integrated RTD resistance thermocouple

T0	without
TA	3-wire
TB	3-wire, with ex-proofness

9. process connection s. page 75

10. instrument valves, s. page 75

IBR- / S

8.1 Series IBF to 5880 PSI

Description

The ITABAR-sensor series IBF is designed to measure the volumetric flow of liquids and gases. The sensor flange is threaded to a pipe mount welding boss, which makes the use in max 5880 psi applications possible. The maximum pressure is a function of the flange rating.

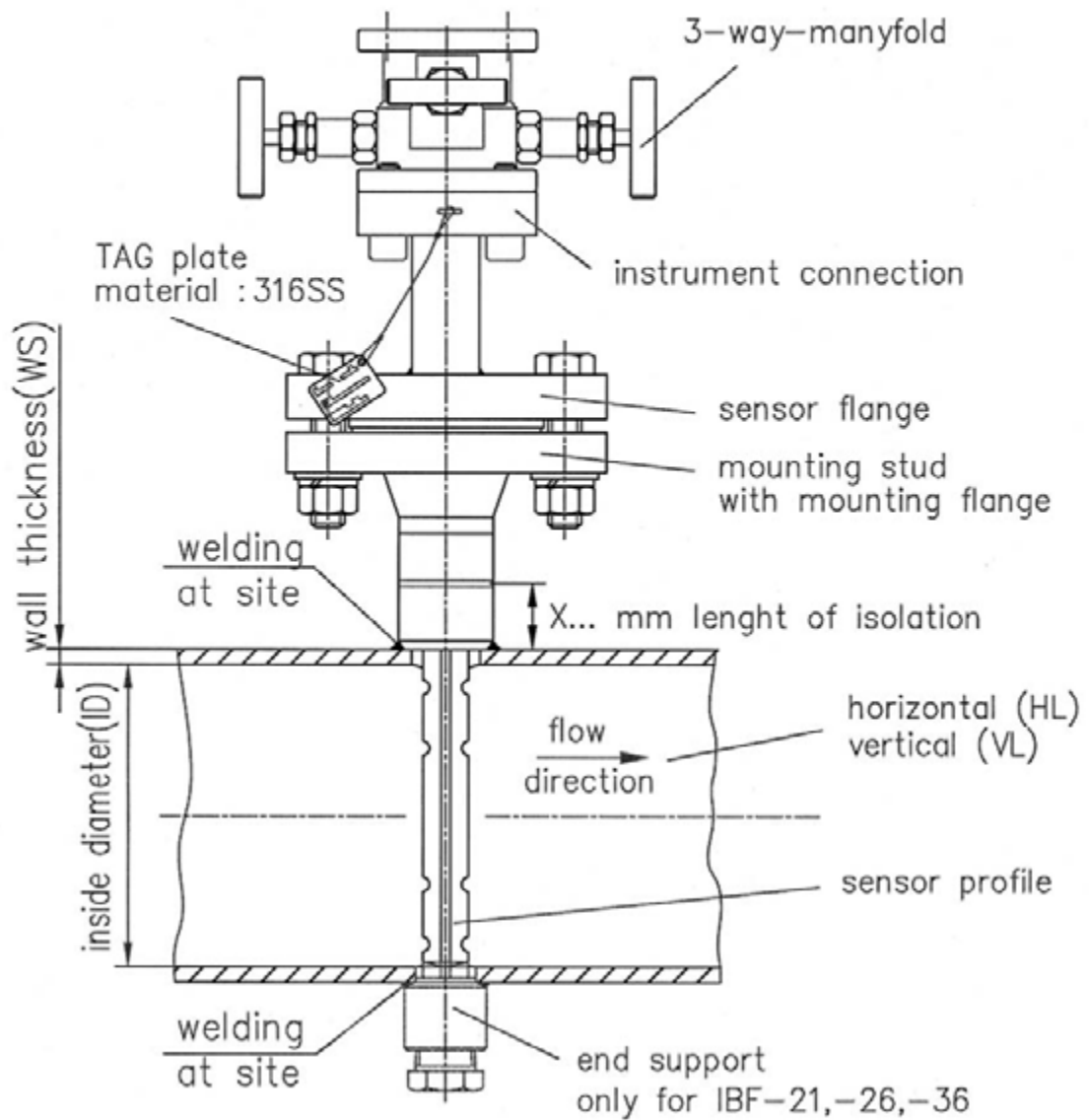
The standard sensor material is 316 SS; the following materials are optional alternatives: 1.4462 (Duplex), 1.4539, Hastelloy C4, Incoloy 800, Inconel, Monel.



Fig.: 7.2: DP sensor IBF-25 for a pipe with ID 146,3 mm. The DP transmitter is remotely mounted and is connected to the sensor through Ermeto- pipe

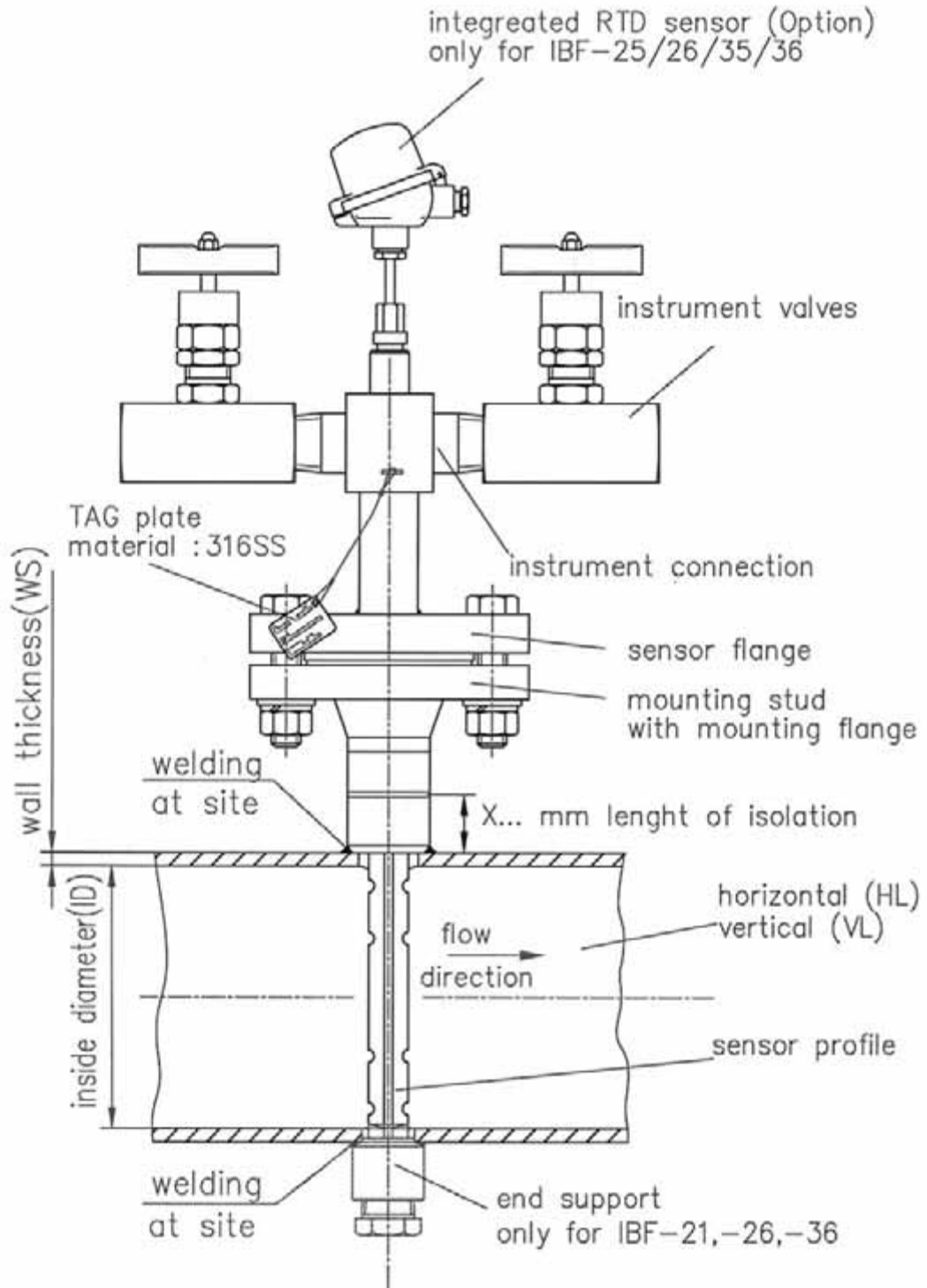
Drawing for ITABAR Series IBF

compact version electr. d.p. transmitter mounted on to the flow sensor (only with A06)



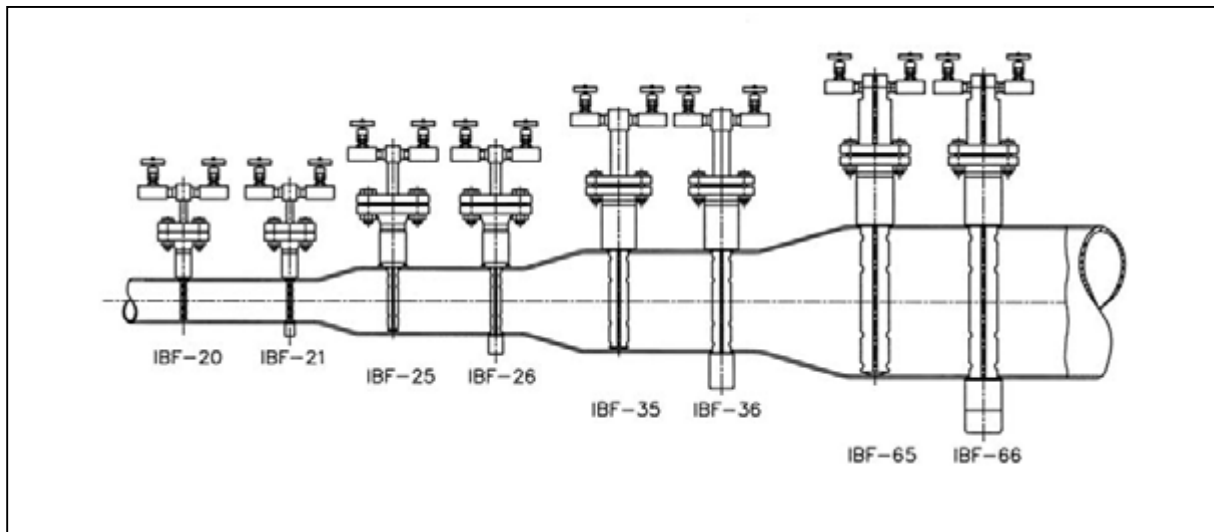
Drawing for ITABAR Series IBF

seperate installation of sensor and transmitter



Order Data for ITABAR Series IBF 20/21/25/26/35/36/65/66

1. Sensor Types



Pipe Size Inches mm		Maximal zulässiger Volumendurchfluss GPM							
		Sensor Type							
		IBF - 20	IBF - 21	IBF - 25	IBF - 26	IBF - 35	IBF - 36	IBF - 65	IBF - 66
1 ½	DN 40	126	501	---	---	---	---	---	---
2	DN 50	260	708	---	---	---	---	---	---
2 ¼	DN 65	420	1069	---	---	---	---	---	---
2 ½	DN 80	572	1443	---	---	---	---	---	---
4	DN 100	787	1936	902	2398	---	---	---	---
5	DN 125	1047	2512	1240	3168	---	---	---	---
6	DN 150	---	---	1579	3938	---	---	---	---
8	DN 200	---	---	270	5473	---	---	---	---
10	DN 250	---	---	3027	7150	---	---	---	---
12	DN 300	---	---	3841	8962	7739	18519	12416	---
14	DN 350	---	---	4637	10718	9438	22321	15334	---
16	DN 400	---	---	5403	12416	11154	26175	18229	---
20	DN 500	---	---	7013	15976	14462	33528	23540	53891
24	DN 600	---	---	8588	19470	17850	41087	29928	68085
28	DN 700	---	---	10212	23069	21350	48923	36401	82482
32	DN 800	---	---	11897	26870	34965	56962	42578	95713
36	DN 900	---	---	---	30839	---	65155	---	107936
40	DN 1000	---	---	---	34896	---	73453	---	119746
48	DN 1200	---	---	---	43010	---	90090	---	144826
56	DN 1400	---	---	---	50965	---	107487	---	172585
64	DN 1600	---	---	---	58656	---	123292	---	202708
72	DN 1800	---	---	---	66255	---	139264	---	229204
80	DN 2000	---	---	---	---	---	155236	---	255503

These values are for water of 0.999 SGU and at a temperature T = 67 °F. To calculate volumetric or mass flow of fluids with other densities see chapter 6 „Specifications of DP Sensors with WINFLOW“.

1. Order specification ITABAR-FLOW-Sensor, series IBF-20/21

1. type of Sensor

20	without end support
21	with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S	316 SS
X	1.4462 Duplex
K	1.4539
H	Hastelloy C4
Y	Incoloy 800
L	Inconel 600
M	Monel

4. sensor flange, always identically to sensor material.

SM	flange according DIN
SA	flange according ANSI

5. gasket

1	gasket strip according DIN
2	ANSI RF
3	ANSI RF SF (smooth finish)
4	RTJ

6. PN, material and DN of Sensor flange

			DIN	ANSI
A01	PN16 / 150 lbs	material: 316 SS	DN25	1"
A02	PN40 / 300 lbs	material: 316 SS	DN25	1"
A03	PN63 / 300 lbs	material: 316 SS	DN25	1"
A04	PN100 / 600 lbs	material: 316 SS	DN25	1"
A05	PN160 / 1500 lbs	material: 316 SS	DN25	1"
A06	PN250 / 1500 lbs	material: 316 SS	DN25	1"
A07	PN320 / 2500 lbs	material: 316 SS	DN25	1"
A08	PN400 / 2500 lbs	material: 316 SS	DN25	1"

A10	PN16 / 150 lbs	material: 1.4462 Duplex	DN25	1"
A11	PN40 / 300 lbs	material: 1.4462 Duplex	DN25	1"
A12	PN63 / 300 lbs	material: 1.4462 Duplex	DN25	1"
A13	PN100 / 600 lbs	material: 1.4462 Duplex	DN25	1"
A14	PN160 / 1500 lbs	material: 1.4462 Duplex	DN25	1"
A15	PN250 / 1500 lbs	material: 1.4462 Duplex	DN25	1"
A16	PN320 / 2500 lbs	material: 1.4462 Duplex	DN25	1"
A17	PN400 / 2500 lbs	material: 1.4462 Duplex	DN25	1"

A20	PN16 / 150 lbs	material: 1.4539	DN25	1"
A21	PN40 / 300 lbs	material: 1.4539	DN25	1"
A22	PN63 / 300 lbs	material: 1.4539	DN25	1"
A23	PN100 / 600 lbs	material: 1.4539	DN25	1"
A24	PN160 / 1500 lbs	material: 1.4539	DN25	1"
A25	PN250 / 1500 lbs	material: 1.4539	DN25	1"
A26	PN320 / 2500 lbs	material: 1.4539	DN25	1"
A27	PN400 / 2500 lbs	material: 1.4539	DN25	1"

A30	PN16 / 150 lbs	material: Hastelloy C4	DN25	1"
A31	PN40 / 300 lbs	material: Hastelloy C4	DN25	1"
A32	PN63 / 300 lbs	material: Hastelloy C4	DN25	1"
A33	PN100 / 600 lbs	material: Hastelloy C4	DN25	1"
A34	PN160 / 1500 lbs	material: Hastelloy C4	DN25	1"
A35	PN250 / 1500 lbs	material: Hastelloy C4	DN25	1"
A36	PN320 / 2500 lbs	material: Hastelloy C4	DN25	1"
A37	PN400 / 2500 lbs	material: Hastelloy C4	DN25	1"

A40	PN16 / 150 lbs	material: Incoloy 800	DN25	1"
A41	PN40 / 300 lbs	material: Incoloy 800	DN25	1"
A42	PN63 / 300 lbs	material: Incoloy 800	DN25	1"
A43	PN100 / 600 lbs	material: Incoloy 800	DN25	1"

1. Order specification ITABAR-FLOW-Sensor, series IBF-20/21

continued				
6. PN, material and DN of Sensor flange			DIN	ANSI
A44	PN160 / 1500 lbs	material: Incoloy 800	DN25	1"
A45	PN250 / 1500 lbs	material: Incoloy 800	DN25	1"
A46	PN320 / 2500 lbs	material: Incoloy 800	DN25	1"
A47	PN400 / 2500 lbs	material: Incoloy 800	DN25	1"
A50	PN16 / 150 lbs	material: Inconel 600	DN25	1"
A51	PN40 / 300 lbs	material: Inconel 600	DN25	1"
A52	PN63 / 300 lbs	material: Inconel 600	DN25	1"
A53	PN100 / 600 lbs	material: Inconel 600	DN25	1"
A54	PN160 / 1500 lbs	material: Inconel 600	DN25	1"
A55	PN250 / 1500 lbs	material: Inconel 600	DN25	1"
A56	PN320 / 2500 lbs	material: Inconel 600	DN25	1"
A57	PN400 / 2500 lbs	material: Inconel 600	DN25	1"
A60	PN16 / 150 lbs	material: Monel	DN25	1"
A61	PN40 / 300 lbs	material: Monel	DN25	1"
A62	PN63 / 300 lbs	material: Monel	DN25	1"
A63	PN100 / 600 lbs	material: Monel	DN25	1"
A64	PN160 / 1500 lbs	material: Monel	DN25	1"
A65	PN250 / 1500 lbs	material: Monel	DN25	1"
A66	PN320 / 2500 lbs	material: Monel	DN25	1"
A67	PN400 / 2500 lbs	material: Monel	DN25	1"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
9. material connecting piece, with flange (max. pressure rating)				
C1	C.S.	PN16 / 150 lbs	DN25	1"
S1	316 SS	PN16 / 150 lbs	DN25	1"
X1	Duplex	PN16 / 150 lbs	DN25	1"
K1	1.4539	PN16 / 150 lbs	DN25	1"
H1	Hastelloy C	PN16 / 150 lbs	DN25	1"
D1	Incoloy 800	PN16 / 150 lbs	DN25	1"
L1	Inconel 600	PN16 / 150 lbs	DN25	1"
M1	Monel	PN16 / 150 lbs	DN25	1"
C2	C.S.	PN40 / 300 lbs	DN25	1"
S2	316 SS	PN40 / 300 lbs	DN25	1"
X2	Duplex	PN40 / 300 lbs	DN25	1"
K2	1.4539	PN40 / 300 lbs	DN25	1"
H2	Hastelloy C	PN40 / 300 lbs	DN25	1"
D2	Incoloy 800	PN40 / 300 lbs	DN25	1"
L2	Inconel 600	PN40 / 300 lbs	DN25	1"
M2	Monel	PN40 / 300 lbs	DN25	1"
C3	C.S.	PN63 / 300 lbs	DN25	1"
S3	316 SS	PN63 / 300 lbs	DN25	1"
X3	Duplex	PN63 / 300 lbs	DN25	1"
K3	1.4539	PN63 / 300 lbs	DN25	1"
H3	Hastelloy C	PN63 / 300 lbs	DN25	1"
D3	Incoloy 800	PN63 / 300 lbs	DN25	1"

1. Order specification ITABAR-FLOW-Sensor, series IBF-20/21

9. material connecting piece, with flange (max. pressure rating)				
L3	Inconel 600	PN63 / 300 lbs	DN25	1"
M3	Monel	PN63 / 300 lbs	DN25	1"
C4	C.S.	PN100 / 600 lbs	DN25	1"
S4	316 SS	PN100 / 600 lbs	DN25	1"
X4	Duplex	PN100 / 600 lbs	DN25	1"
K4	1.4539	PN100 / 600 lbs	DN25	1"
H4	Hastelloy C	PN100 / 600 lbs	DN25	1"
D4	Incoloy 800	PN100 / 600 lbs	DN25	1"
L4	Inconel 600	PN100 / 600 lbs	DN25	1"
M4	Monel	PN100 / 600 lbs	DN25	1"
C5	C.S.	PN160 / 1500 lbs	DN25	1"
S5	316 SS	PN160 / 1500 lbs	DN25	1"
X5	Duplex	PN160 / 1500 lbs	DN25	1"
K5	1.4539	PN160 / 1500 lbs	DN25	1"
H5	Hastelloy C	PN160 / 1500 lbs	DN25	1"
D5	Incoloy 800	PN160 / 1500 lbs	DN25	1"
L5	Inconel 600	PN160 / 1500 lbs	DN25	1"
M5	Monel	PN160 / 1500 lbs	DN25	1"
C6	C.S.	PN250 / 1500 lbs	DN25	1"
S6	316 SS	PN250 / 1500 lbs	DN25	1"
X6	Duplex	PN250 / 1500 lbs	DN25	1"
K6	1.4539	PN250 / 1500 lbs	DN25	1"
H6	Hastelloy C	PN250 / 1500 lbs	DN25	1"
D6	Incoloy 800	PN250 / 1500 lbs	DN25	1"
L6	Inconel 600	PN250 / 1500 lbs	DN25	1"
M6	Monel	PN250 / 1500 lbs	DN25	1"
C7	C.S.	PN320 / 2500 lbs	DN25	1"
S7	316 SS	PN320 / 2500 lbs	DN25	1"
X7	Duplex	PN320 / 2500 lbs	DN25	1"
K7	1.4539	PN320 / 2500 lbs	DN25	1"
H7	Hastelloy C	PN320 / 2500 lbs	DN25	1"
D7	Incoloy 800	PN320 / 2500 lbs	DN25	1"
L7	Inconel 600	PN320 / 2500 lbs	DN25	1"
M7	Monel	PN320 / 2500 lbs	DN25	1"
C8	C.S.	PN400 / 2500 lbs	DN25	1"
S8	316 SS	PN400 / 2500 lbs	DN25	1"
X8	Duplex	PN400 / 2500 lbs	DN25	1"
K8	1.4539	PN400 / 2500 lbs	DN25	1"
H8	Hastelloy C	PN400 / 2500 lbs	DN25	1"
D8	Incoloy 800	PN400 / 2500 lbs	DN25	1"
L8	Inconel 600	PN400 / 2500 lbs	DN25	1"
M8	Monel	PN400 / 2500 lbs	DN25	1"
10. end support (only IBF-21)				
0	without end support			
C	end support, material C.S.			
S	end support, material: 316 SS			
X	end support, material: Duplex			
K	end support, material: 1.4539			
M	end support, material: Monel			
H	end support, material: Hastelloy C			
D	end support, material: Incoloy 800			
L	end support, material: Inconel 600			

1. Order specification ITABAR-FLOW-Sensor, series IBF-25/26

1. type of Sensor				
25	without end support			
26	with end support			
2. inside diameter and wall thickness.				
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify			
3. sensor material				
S	316 SS			
X	1.4462 Duplex			
K	1.4539			
H	Hastelloy C4			
Y	Incoloy 800			
L	Inconel 600			
M	Monel			
D	PVDF, max. Druck 6 bar bis DN1000			
4. sensor flange, always identically to sensor material.				
SM	flange according DIN			
SA	flange according ANSI			
5. gasket				
1	gasket strip according to DIN			
2	ANSI RF			
3	ANSI RF SF (smooth finish)			
4	RTJ			
6. PN, material and DN of Sensor flange				
			DIN	ANSI
B01	PN16 / 150 lbs	material: 316 SS	DN32	1 1/2"
B02	PN40 / 300 lbs	material: 316 SS	DN32	1 1/2"
B03	PN63 / 300 lbs	material: 316 SS	DN40	1 1/2"
B04	PN100 / 600 lbs	material: 316 SS	DN40	1 1/2"
B05	PN160 / 1500 lbs	material: 316 SS	DN40	1 1/2"
B06	PN250 / 1500 lbs	material: 316 SS	DN40	1 1/2"
B07	PN320 / 2500 lbs	material: 316 SS	DN40	1 1/2"
B08	PN400 / 2500 lbs	material: 316 SS	DN40	1 1/2"
B10	PN16 / 150 lbs	material: 1.4462 Duplex	DN32	1 1/2"
B11	PN40 / 300 lbs	material: 1.4462 Duplex	DN32	1 1/2"
B12	PN63 / 300 lbs	material: 1.4462 Duplex	DN40	1 1/2"
B13	PN100 / 600 lbs	material: 1.4462 Duplex	DN40	1 1/2"
B14	PN160 / 1500 lbs	material: 1.4462 Duplex	DN40	1 1/2"
B15	PN250 / 1500 lbs	material: 1.4462 Duplex	DN40	1 1/2"
B16	PN320 / 2500 lbs	material: 1.4462 Duplex	DN40	1 1/2"
B17	PN400 / 2500 lbs	material: 1.4462 Duplex	DN40	1 1/2"
B20	PN16 / 150 lbs	material: 1.4539	DN32	1 1/2"
B21	PN40 / 300 lbs	material: 1.4539	DN32	1 1/2"
B22	PN63 / 300 lbs	material: 1.4539	DN40	1 1/2"
B23	PN100 / 600 lbs	material: 1.4539	DN40	1 1/2"
B24	PN160 / 1500 lbs	material: 1.4539	DN40	1 1/2"
B25	PN250 / 1500 lbs	material: 1.4539	DN40	1 1/2"
B26	PN320 / 2500 lbs	material: 1.4539	DN40	1 1/2"
B27	PN400 / 2500 lbs	material: 1.4539	DN40	1 1/2"
B30	PN16 / 150 lbs	material: Hastelloy C4	DN32	1 1/2"
B31	PN40 / 300 lbs	material: Hastelloy C4	DN32	1 1/2"
B32	PN63 / 300 lbs	material: Hastelloy C4	DN40	1 1/2"
B33	PN100 / 600 lbs	material: Hastelloy C4	DN40	1 1/2"
B34	PN160 / 1500 lbs	material: Hastelloy C4	DN40	1 1/2"
B35	PN250 / 1500 lbs	material: Hastelloy C4	DN40	1 1/2"
B36	PN320 / 2500 lbs	material: Hastelloy C4	DN40	1 1/2"
B37	PN400 / 2500 lbs	material: Hastelloy C4	DN40	1 1/2"

1.Order specification ITABAR-FLOW-Sensor, series IBF-25/26

continued				
6. PN, material and DN of Sensor flange			DIN	ANSI
B40	PN16 / 150 lbs	material: Incoloy 800	DN32	1 1/2"
B41	PN40 / 300 lbs	material: Incoloy 800	DN32	1 1/2"
B42	PN63 / 300 lbs	material: Incoloy 800	DN40	1 1/2"
B43	PN100 / 600 lbs	material: Incoloy 800	DN40	1 1/2"
B44	PN160 / 1500 lbs	material: Incoloy 800	DN40	1 1/2"
B45	PN250 / 1500 lbs	material: Incoloy 800	DN40	1 1/2"
B46	PN320 / 2500 lbs	material: Incoloy 800	DN40	1 1/2"
B47	PN400 / 2500 lbs	material: Incoloy 800	DN40	1 1/2"
B50	PN16 / 150 lbs	material: Inconel 600	DN32	1 1/2"
B51	PN40 / 300 lbs	material: Inconel 600	DN32	1 1/2"
B52	PN63 / 300 lbs	material: Inconel 600	DN40	1 1/2"
B53	PN100 / 600 lbs	material: Inconel 600	DN40	1 1/2"
B54	PN160 / 1500 lbs	material: Inconel 600	DN40	1 1/2"
B55	PN250 / 1500 lbs	material: Inconel 600	DN40	1 1/2"
B56	PN320 / 2500 lbs	material: Inconel 600	DN40	1 1/2"
B57	PN400 / 2500 lbs	material: Inconel 600	DN40	1 1/2"
B60	PN16 / 150 lbs	material: Monel	DN32	1 1/2"
B61	PN40 / 300 lbs	material: Monel	DN32	1 1/2"
B62	PN63 / 300 lbs	material: Monel	DN40	1 1/2"
B63	PN100 / 600 lbs	material: Monel	DN40	1 1/2"
B64	PN160 / 1500 lbs	material: Monel	DN40	1 1/2"
B65	PN250 / 1500 lbs	material: Monel	DN40	1 1/2"
B66	PN320 / 2500 lbs	material: Monel	DN40	1 1/2"
B67	PN400 / 2500 lbs	material: Monel	DN40	1 1/2"
B70	PN16 / 150 lbs	material: PVDF, max. pressure 6 bar to DN1000	DN32	1 1/2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
S	saddle flange, size of flange: DN40, material:GGG-40/EWS coted			
	without retainer			
V	saddle flange with retainer, material: rustproof steel,			
	outside pipe diameter 87-470 mm, gasket: NBR			
3	saddle flange with retainer, material: 1.4301,			
	outside pipe diameter 75-582 mm, gasket: NBR			
Z	saddle flange with retainer, material:1.4301, for asbestos-cement pipe			
	outside pipe diameter 97-494 mm, gasket: NBR			
9. material connecting piece, with flange (max. pressure rating)				
C1	C.S.	PN16 / 150 lbs	DN32	1 1/2"
S1	316 SS	PN16 / 150 lbs	DN32	1 1/2"
X1	Duplex	PN16 / 150 lbs	DN40	1 1/2"
K1	1.4539	PN16 / 150 lbs	DN40	1 1/2"
H1	Hastelloy C	PN16 / 150 lbs	DN40	1 1/2"
D1	Incoloy 800	PN16 / 150 lbs	DN40	1 1/2"
L1	Inconel 600	PN16 / 150 lbs	DN40	1 1/2"
M1	Monel	PN16 / 150 lbs	DN40	1 1/2"
V1	PVDF	PN16 / 150 lbs	DN40	1 1/2"

1.Order specification ITABAR-FLOW-Sensor, series IBF-25/26

C2	C.S.	PN40 / 300 lbs	DN32	1 1/2"
S2	316 SS	PN40 / 300 lbs	DN32	1 1/2"
X2	Duplex	PN40 / 300 lbs	DN40	1 1/2"
K2	1.4539	PN40 / 300 lbs	DN40	1 1/2"
H2	Hastelloy C	PN40 / 300 lbs	DN40	1 1/2"
D2	Incoloy 800	PN40 / 300 lbs	DN40	1 1/2"
L2	Inconel 600	PN40 / 300 lbs	DN40	1 1/2"
M2	Monel	PN40 / 300 lbs	DN40	1 1/2"

C3	C.S.	PN63 / 300 lbs	DN32	1 1/2"
S3	316 SS	PN63 / 300 lbs	DN32	1 1/2"
X3	Duplex	PN63 / 300 lbs	DN40	1 1/2"
K3	1.4539	PN63 / 300 lbs	DN40	1 1/2"
H3	Hastelloy C	PN63 / 300 lbs	DN40	1 1/2"
D3	Incoloy 800	PN63 / 300 lbs	DN40	1 1/2"
L3	Inconel 600	PN63 / 300 lbs	DN40	1 1/2"
M3	Monel	PN63 / 300 lbs	DN40	1 1/2"

C4	C.S.	PN100 / 600 lbs	DN32	1 1/2"
S4	316 SS	PN100 / 600 lbs	DN32	1 1/2"
X4	Duplex	PN100 / 600 lbs	DN40	1 1/2"
K4	1.4539	PN100 / 600 lbs	DN40	1 1/2"
H4	Hastelloy C	PN100 / 600 lbs	DN40	1 1/2"
D4	Incoloy 800	PN100 / 600 lbs	DN40	1 1/2"
L4	Inconel 600	PN100 / 600 lbs	DN40	1 1/2"
M4	Monel	PN100 / 600 lbs	DN40	1 1/2"

C5	C.S.	PN160 / 1500 lbs	DN32	1 1/2"
S5	316 SS	PN160 / 1500 lbs	DN32	1 1/2"
X5	Duplex	PN160 / 1500 lbs	DN40	1 1/2"
K5	1.4539	PN160 / 1500 lbs	DN40	1 1/2"
H5	Hastelloy C	PN160 / 1500 lbs	DN40	1 1/2"
D5	Incoloy 800	PN160 / 1500 lbs	DN40	1 1/2"
L5	Inconel 600	PN160 / 1500 lbs	DN40	1 1/2"
M5	Monel	PN160 / 1500 lbs	DN40	1 1/2"

C6	C.S.	PN250 / 1500 lbs	DN32	1 1/2"
S6	316 SS	PN250 / 1500 lbs	DN32	1 1/2"
X6	Duplex	PN250 / 1500 lbs	DN40	1 1/2"
K6	1.4539	PN250 / 1500 lbs	DN40	1 1/2"
H6	Hastelloy C	PN250 / 1500 lbs	DN40	1 1/2"
D6	Incoloy 800	PN250 / 1500 lbs	DN40	1 1/2"
L6	Inconel 600	PN250 / 1500 lbs	DN40	1 1/2"
M6	Monel	PN250 / 1500 lbs	DN40	1 1/2"

C7	C.S.	PN320 / 2500 lbs	DN32	1 1/2"
S7	316 SS	PN320 / 2500 lbs	DN32	1 1/2"
X7	Duplex	PN320 / 2500 lbs	DN40	1 1/2"
K7	1.4539	PN320 / 2500 lbs	DN40	1 1/2"
H7	Hastelloy C	PN320 / 2500 lbs	DN40	1 1/2"
D7	Incoloy 800	PN320 / 2500 lbs	DN40	1 1/2"
L7	Inconel 600	PN320 / 2500 lbs	DN40	1 1/2"
M7	Monel	PN320 / 2500 lbs	DN40	1 1/2"

C8	C.S.	PN400 / 2500 lbs	DN32	1 1/2"
S8	316 SS	PN400 / 2500 lbs	DN32	1 1/2"
X8	Duplex	PN400 / 2500 lbs	DN40	1 1/2"
K8	1.4539	PN400 / 2500 lbs	DN40	1 1/2"
H8	Hastelloy C	PN400 / 2500 lbs	DN40	1 1/2"

1.Order specification ITABAR-FLOW-Sensor, series IBF-25/26

continued												
9. material connecting piece, with flange (max. pressure rating)												
D8	Incoloy 800	PN400 / 2500 lbs	DN40	1 1/2"								
L8	Inconel 600	PN400 / 2500 lbs	DN40	1 1/2"								
M8	Monel	PN400 / 2500 lbs	DN40	1 1/2"								
10. end support (only IBF-26)												
0	without end support											
C	end support, material C.S.											
S	end support, material: 316 SS											
X	end support, material: Duplex											
K	end support, material: 1.4539											
M	end support, material: Monel											
H	end support, material: Hastelloy C											
D	end support, material: Incoloy 800											
L	end support, material: Inconel 600											
V	end support, material: PVDF											
11. isolation												
KI	without											
X..	isolation in inches (or mm), please specify											
12. piping run												
HL	horizontal											
VL	vertikal											
13. integrated RTD resistance thermocouple (not for Sensor of PVDF)												
T0	without											
TA	3-wire											
TB	3-wire, with ex-proofness											
14. process connection, s. page 75												
15. instrument valves s. page 75												
type of sensor	inside diameter and wall thickness	material sensor	sensor flange	gasket strip	PN, material and DN of Sensor	design assembly connecting pieces	Assembly connecting piece with flange	material connecting piece, with flange	end support (only IBF-	isolation	piping run	
IBF-												

1. Order specification ITABAR-FLOW-Sensor, series IBF-35/36

1. type of Sensor

35	without end support
36	with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S	316 SS
X	1.4462 Duplex
K	1.4539
H	Hastelloy C4
Y	Incoloy 800
L	Inconel 600
M	Monel
D	PVDF, max. Druck 6 bar bis DN1000

4. sensor flange, always identically to sensor material.

SM	flange according DIN
SA	flange according ANSI

5. gasket

1	gasket strip according to DIN
2	ANSI RF
3	ANSI RF SF (smooth finish)
4	RTJ

6. PN, material and DN of Sensor flange

			DIN	ANSI
C01	PN16 / 150 lbs	material: 316 SS	DN50	2"
C02	PN40 / 300 lbs	material: 316 SS	DN50	2"
C03	PN63 / 300 lbs	material: 316 SS	DN50	2"
C04	PN100 / 600 lbs	material: 316 SS	DN50	2"
C05	PN160 / 1500 lbs	material: 316 SS	DN50	2"
C06	PN250 / 1500 lbs	material: 316 SS	DN50	2"
C07	PN320 / 2500 lbs	material: 316 SS	DN50	2"
C08	PN400 / 2500 lbs	material: 316 SS	DN50	2"
C10	PN16 / 150 lbs	material: 1.4462 Duplex	DN50	2"
C11	PN40 / 300 lbs	material: 1.4462 Duplex	DN50	2"
C12	PN63 / 300 lbs	material: 1.4462 Duplex	DN50	2"
C13	PN100 / 600 lbs	material: 1.4462 Duplex	DN50	2"
C14	PN160 / 1500 lbs	material: 1.4462 Duplex	DN50	2"
C15	PN250 / 1500 lbs	material: 1.4462 Duplex	DN50	2"
C16	PN320 / 2500 lbs	material: 1.4462 Duplex	DN50	2"
C17	PN400 / 2500 lbs	material: 1.4462 Duplex	DN50	2"
C20	PN16 / 150 lbs	material: 1.4539	DN50	2"
C21	PN40 / 300 lbs	material: 1.4539	DN50	2"
C22	PN63 / 300 lbs	material: 1.4539	DN50	2"
C23	PN100 / 600 lbs	material: 1.4539	DN50	2"
C24	PN160 / 1500 lbs	material: 1.4539	DN50	2"
C25	PN250 / 1500 lbs	material: 1.4539	DN50	2"
C26	PN320 / 2500 lbs	material: 1.4539	DN50	2"
C28	PN400 / 2500 lbs	material: 1.4539	DN50	2"
C30	PN16 / 150 lbs	material: Hastelloy C4	DN50	2"
C31	PN40 / 300 lbs	material: Hastelloy C4	DN50	2"
C32	PN63 / 300 lbs	material: Hastelloy C4	DN50	2"
C33	PN100 / 600 lbs	material: Hastelloy C4	DN50	2"
C34	PN160 / 1500 lbs	material: Hastelloy C4	DN50	2"
C35	PN250 / 1500 lbs	material: Hastelloy C4	DN50	2"
C36	PN320 / 2500 lbs	material: Hastelloy C4	DN50	2"
C37	PN400 / 2500 lbs	material: Hastelloy C4	DN50	2"

1. Order specification ITABAR-FLOW-Sensor, series IBF-35/36

continued				
6. PN, Werkstoff und DN des Sondenflansches			DIN	ANSI
C40	PN16 / 150 lbs	material: Incoloy 800	DN50	2"
C41	PN40 / 300 lbs	material: Incoloy 800	DN50	2"
C42	PN63 / 300 lbs	material: Incoloy 800	DN50	2"
C43	PN100 / 600 lbs	material: Incoloy 800	DN50	2"
C44	PN160 / 1500 lbs	material: Incoloy 800	DN50	2"
C45	PN250 / 1500 lbs	material: Incoloy 800	DN50	2"
C46	PN320 / 2500 lbs	material: Incoloy 800	DN50	2"
C47	PN400 / 2500 lbs	material: Incoloy 800	DN50	2"
C50	PN16 / 150 lbs	material: Inconel 600	DN50	2"
C51	PN40 / 300 lbs	material: Inconel 600	DN50	2"
C52	PN63 / 300 lbs	material: Inconel 600	DN50	2"
C53	PN100 / 600 lbs	material: Inconel 600	DN50	2"
C54	PN160 / 1500 lbs	material: Inconel 600	DN50	2"
C55	PN250 / 1500 lbs	material: Inconel 600	DN50	2"
C56	PN320 / 2500 lbs	material: Inconel 600	DN50	2"
C57	PN400 / 2500 lbs	material: Inconel 600	DN50	2"
C60	PN16 / 150 lbs	material: Monel	DN50	2"
C61	PN40 / 300 lbs	material: Monel	DN50	2"
C62	PN63 / 300 lbs	material: Monel	DN50	2"
C63	PN100 / 600 lbs	material: Monel	DN50	2"
C64	PN160 / 1500 lbs	material: Monel	DN50	2"
C65	PN250 / 1500 lbs	material: Monel	DN50	2"
C66	PN320 / 2500 lbs	material: Monel	DN50	2"
C67	PN400 / 2500 lbs	material: Monel	DN50	2"
C70	PN16 / 150 lbs	material: PVDF, max. pressure 6 bar to DN1000	DN50	2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
S	saddle flange, size of flange: DN40, material:GGG-40/EWS coted without retainer			
V	saddle flange with retainer, material: rustproof steel, outside pipe diameter 87-470 mm, gasket: NBR			
3	saddle flange with retainer, material: 1.4301, outside pipe diameter 75-582 mm, gasket: NBR			
Z	saddle flange with retainer, material:1.4301, for asbestos-cement pipe outside pipe diameter 97-494 mm, gasket: NBR			
9. material connecting piece, with flange (max. pressure rating)				
C1	C.S.	PN16 / 150 lbs	DN50	2"
S1	316 SS	PN16 / 150 lbs	DN50	2"
X1	Duplex	PN16 / 150 lbs	DN50	2"
K1	1.4539	PN16 / 150 lbs	DN50	2"
H1	Hastelloy C	PN16 / 150 lbs	DN50	2"
D1	Incoloy 800	PN16 / 150 lbs	DN50	2"
L1	Inconel 600	PN16 / 150 lbs	DN50	2"
M1	Monel	PN16 / 150 lbs	DN50	2"
V1	PVDF	PN16 / 150 lbs	DN50	2"

1. Order specification ITABAR-FLOW-Sensor, series IBF-35/36

C2	C.S.	PN40 / 300 lbs	DN50	2"
S2	316 SS	PN40 / 300 lbs	DN50	2"
X2	Duplex	PN40 / 300 lbs	DN50	2"
K2	1.4539	PN40 / 300 lbs	DN50	2"
H2	Hastelloy C	PN40 / 300 lbs	DN50	2"
D2	Incoloy 800	PN40 / 300 lbs	DN50	2"
L2	Inconel 600	PN40 / 300 lbs	DN50	2"
M2	Monel	PN40 / 300 lbs	DN50	2"

C3	C.S.	PN63 / 300 lbs	DN50	2"
S3	316 SS	PN63 / 300 lbs	DN50	2"
X3	Duplex	PN63 / 300 lbs	DN50	2"
K3	1.4539	PN63 / 300 lbs	DN50	2"
H3	Hastelloy C	PN63 / 300 lbs	DN50	2"
D3	Incoloy 800	PN63 / 300 lbs	DN50	2"
L3	Inconel 600	PN63 / 300 lbs	DN50	2"
M3	Monel	PN63 / 300 lbs	DN50	2"

C4	C.S.	PN100 / 600 lbs	DN50	2"
S4	316 SS	PN100 / 600 lbs	DN50	2"
X4	Duplex	PN100 / 600 lbs	DN50	2"
K4	1.4539	PN100 / 600 lbs	DN50	2"
H4	Hastelloy C	PN100 / 600 lbs	DN50	2"
D4	Incoloy 800	PN100 / 600 lbs	DN50	2"
L4	Inconel 600	PN100 / 600 lbs	DN50	2"
M4	Monel	PN100 / 600 lbs	DN50	2"

C5	C.S.	PN160 / 1500 lbs	DN50	2"
S5	316 SS	PN160 / 1500 lbs	DN50	2"
X5	Duplex	PN160 / 1500 lbs	DN50	2"
K5	1.4539	PN160 / 1500 lbs	DN50	2"
H5	Hastelloy C	PN160 / 1500 lbs	DN50	2"
D5	Incoloy 800	PN160 / 1500 lbs	DN50	2"
L5	Inconel 600	PN160 / 1500 lbs	DN50	2"
M5	Monel	PN160 / 1500 lbs	DN50	2"

C6	C.S.	PN250 / 1500 lbs	DN50	2"
S6	316 SS	PN250 / 1500 lbs	DN50	2"
X6	Duplex	PN250 / 1500 lbs	DN50	2"
K6	1.4539	PN250 / 1500 lbs	DN50	2"
H6	Hastelloy C	PN250 / 1500 lbs	DN50	2"
D6	Incoloy 800	PN250 / 1500 lbs	DN50	2"
L6	Inconel 600	PN250 / 1500 lbs	DN50	2"
M6	Monel	PN250 / 1500 lbs	DN50	2"

C7	C.S.	PN320 / 2500 lbs	DN50	2"
S7	316 SS	PN320 / 2500 lbs	DN50	2"
X7	Duplex	PN320 / 2500 lbs	DN50	2"
K7	1.4539	PN320 / 2500 lbs	DN50	2"
H7	Hastelloy C	PN320 / 2500 lbs	DN50	2"
D7	Incoloy 800	PN320 / 2500 lbs	DN50	2"
L7	Inconel 600	PN320 / 2500 lbs	DN50	2"
M7	Monel	PN320 / 2500 lbs	DN50	2"

C8	C-Stahl	PN400 / 2500 lbs	DN50	2"
S8	1.4571	PN400 / 2500 lbs	DN50	2"
X8	Duplex	PN400 / 2500 lbs	DN50	2"
K8	1.4539	PN400 / 2500 lbs	DN50	2"
H8	Hastelloy C	PN400 / 2500 lbs	DN50	2"

1. Order specification ITABAR-FLOW-Sensor, series IBF-35/36

continued										
9. material connecting piece, with flange (max. pressure rating)										
D8	Incoloy 800	PN400 / 2500 lbs	DN50	2"						
L8	Inconel 600	PN400 / 2500 lbs	DN50	2"						
M8	Monel	PN400 / 2500 lbs	DN50	2"						
10. end support (only IBF-36)										
0	without end support									
C	end support, material C.S.									
S	end support, material: 316 SS									
X	end support, material: Duplex									
K	end support, material: 1.4539									
H	end support, material: Monel									
D	end support, material: Hastelloy C									
L	end support, material: Incoloy 800									
M	end support, material: Inconel 600									
V	end support, material: PVDF									
11. isolation										
KI	without									
X..	isolation in inches (or mm), please specify									
12. piping run										
HL	horizontal									
VL	vertikal									
13. integrated RTD resistance thermocouple (not for Sensor of PVDF)										
T0	without									
TA	3-wire									
TB	3-wire, with ex-proofness									
14. process connection, s. page 75										
15. instrument valves s. page 75										

type of sensor	inside diameter and wall thickness	material sensor	sensor flange	gasket	PN, material and DN of Sensor	design assembly connecting pieces	Assembly connecting piece with flange	material connecting piece, with flange	end support	isolation	piping run									
IBF-																				

1. Order specification ITABAR-FLOW-Sensor, series IBF-65/66

1. type of sensor			
65	without end support		
66	with end support		
2. inside diameter and wall thickness.			
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify		
3. sensor material			
S	316 SS (standard)		
X	1.4462 Duplex		
K	1.4539		
H	Hastelloy C4		
Y	Incoloy 800		
L	Inconel 600		
M	Monel		
D	PVDF, max. Druck 6 bar bis DN1000		
4. sensor flange, always identically to sensor material.			
SM	flange according DIN		
SA	flange according ANSI		
5. gasket			
1	gasket strip according to DIN		
2	ANSI RF		
3	ANSI RF SF (smooth finish)		
4	RTJ		
6. PN, material and DN of Sensor flange		DIN	ANSI
D01	PN16 / 150 lbs	material: 316 SS	DN65 2 1/2"
D02	PN40 / 300 lbs	material: 316 SS	DN65 2 1/2"
D03	PN63 / 300 lbs	material: 316 SS	DN65 2 1/2"
D04	PN100 / 600 lbs	material: 316 SS	DN65 2 1/2"
D05	PN160 / 1500 lbs	material: 316 SS	DN65 2 1/2"
D06	PN250 / 1500 lbs	material: 316 SS	DN65 2 1/2"
D07	PN320 / 2500 lbs	material: 316 SS	DN65 2 1/2"
D08	PN400 / 2500 lbs	material: 316 SS	DN65 2 1/2"
D10	PN16 / 150 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D11	PN40 / 300 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D12	PN63 / 300 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D13	PN100 / 600 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D14	PN160 / 1500 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D15	PN250 / 1500 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D16	PN320 / 2500 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D17	PN400 / 2500 lbs	material: 1.4462 Duplex	DN65 2 1/2"
D20	PN16 / 150 lbs	material: 1.4539	DN65 2 1/2"
D21	PN40 / 300 lbs	material: 1.4539	DN65 2 1/2"
D22	PN63 / 300 lbs	material: 1.4539	DN65 2 1/2"
D23	PN100 / 600 lbs	material: 1.4539	DN65 2 1/2"
D24	PN160 / 1500 lbs	material: 1.4539	DN65 2 1/2"
D25	PN250 / 1500 lbs	material: 1.4539	DN65 2 1/2"
D26	PN320 / 2500 lbs	material: 1.4539	DN65 2 1/2"
D27	PN400 / 2500 lbs	material: 1.4539	DN65 2 1/2"
D30	PN16 / 150 lbs	material: Hastelloy C4	DN65 2 1/2"
D31	PN40 / 300 lbs	material: Hastelloy C4	DN65 2 1/2"
D32	PN63 / 300 lbs	material: Hastelloy C4	DN65 2 1/2"
D33	PN100 / 600 lbs	material: Hastelloy C4	DN65 2 1/2"
D34	PN160 / 1500 lbs	material: Hastelloy C4	DN65 2 1/2"
D35	PN250 / 1500 lbs	material: Hastelloy C4	DN65 2 1/2"
D36	PN320 / 2500 lbs	material: Hastelloy C4	DN65 2 1/2"
D37	PN400 / 2500 lbs	material: Hastelloy C4	DN65 2 1/2"

1. Order specification ITABAR-FLOW-Sensor, series IBF-65/66

continued				
6. PN, Werkstoff und DN des Sondenflansches			DIN	ANSI
D40	PN16 / 150 lbs	material: Incoloy 800	DN65	2 1/2"
D41	PN40 / 300 lbs	material: Incoloy 800	DN65	2 1/2"
D42	PN63 / 300 lbs	material: Incoloy 800	DN65	2 1/2"
D43	PN100 / 600 lbs	material: Incoloy 800	DN65	2 1/2"
D44	PN160 / 1500 lbs	material: Incoloy 800	DN65	2 1/2"
D45	PN250 / 1500 lbs	material: Incoloy 800	DN65	2 1/2"
D46	PN320 / 2500 lbs	material: Incoloy 800	DN65	2 1/2"
D47	PN400 / 2500 lbs	material: Incoloy 800	DN65	2 1/2"
D50	PN16 / 150 lbs	material: Inconel 600	DN65	2 1/2"
D51	PN40 / 300 lbs	material: Inconel 600	DN65	2 1/2"
D52	PN63 / 300 lbs	material: Inconel 600	DN65	2 1/2"
D53	PN100 / 600 lbs	material: Inconel 600	DN65	2 1/2"
D54	PN160 / 1500 lbs	material: Inconel 600	DN65	2 1/2"
D55	PN250 / 1500 lbs	material: Inconel 600	DN65	2 1/2"
D56	PN320 / 2500 lbs	material: Inconel 600	DN65	2 1/2"
D57	PN400 / 2500 lbs	material: Inconel 600	DN65	2 1/2"
D60	PN16 / 150 lbs	material: Monel	DN65	2 1/2"
D61	PN40 / 300 lbs	material: Monel	DN65	2 1/2"
D62	PN63 / 300 lbs	material: Monel	DN65	2 1/2"
D63	PN100 / 600 lbs	material: Monel	DN65	2 1/2"
D64	PN160 / 1500 lbs	material: Monel	DN65	2 1/2"
D65	PN250 / 1500 lbs	material: Monel	DN65	2 1/2"
D66	PN320 / 2500 lbs	material: Monel	DN65	2 1/2"
D67	PN400 / 2500 lbs	material: Monel	DN65	2 1/2"
D70	PN16 / 150 lbs	material: PVDF, max. pressure 6 bar to DN1000	DN65	2 1/2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
S	saddle flange, size of flange: DN40, material:GGG-40/EWS coted			
	without retainer			
V	saddle flange with retainer, material: rustproof steel,			
	outside pipe diameter 87-470 mm, gasket: NBR			
3	saddle flange with retainer, material: 1.4301,			
	outside pipe diameter 75-582 mm, gasket: NBR			
Z	saddle flange with retainer, material:1.4301, for asbestos-cement pipe			
	outside pipe diameter 97-494 mm, gasket: NBR			
9. material connecting piece, with flange (max. pressure rating)				
C1	C.S.	PN16 / 150 lbs	DN65	2 1/2"
S1	316 SS	PN16 / 150 lbs	DN65	2 1/2"
X1	Duplex	PN16 / 150 lbs	DN65	2 1/2"
K1	1.4539	PN16 / 150 lbs	DN65	2 1/2"
M1	Monel	PN16 / 150 lbs	DN65	2 1/2"
H1	Hastelloy C	PN16 / 150 lbs	DN65	2 1/2"
D1	Incoloy 800	PN16 / 150 lbs	DN65	2 1/2"
L1	Inconel 600	PN16 / 150 lbs	DN65	2 1/2"
V1	PVDF	PN16 / 150 lbs	DN65	2 1/2"

1. Order specification ITABAR-FLOW-Sensor, series IBF-65/66

C2	C.S.	PN40 / 300 lbs	DN65	2 1/2"
S2	316 SS	PN40 / 300 lbs	DN65	2 1/2"
X2	Duplex	PN40 / 300 lbs	DN65	2 1/2"
K2	1.4539	PN40 / 300 lbs	DN65	2 1/2"
H2	Hastelloy C	PN40 / 300 lbs	DN65	2 1/2"
D2	Incoloy 800	PN40 / 300 lbs	DN65	2 1/2"
L2	Inconel 600	PN40 / 300 lbs	DN65	2 1/2"
M2	Monel	PN40 / 300 lbs	DN65	2 1/2"

C3	C.S.	PN63 / 300 lbs	DN65	2 1/2"
S3	316 SS	PN63 / 300 lbs	DN65	2 1/2"
X3	Duplex	PN63 / 300 lbs	DN65	2 1/2"
K3	1.4539	PN63 / 300 lbs	DN65	2 1/2"
H3	Hastelloy C	PN63 / 300 lbs	DN65	2 1/2"
D3	Incoloy 800	PN63 / 300 lbs	DN65	2 1/2"
L3	Inconel 600	PN63 / 300 lbs	DN65	2 1/2"
M3	Monel	PN63 / 300 lbs	DN65	2 1/2"

C4	C.S.	PN100 / 600 lbs	DN65	2 1/2"
S4	316 SS	PN100 / 600 lbs	DN65	2 1/2"
X4	Duplex	PN100 / 600 lbs	DN65	2 1/2"
K4	1.4539	PN100 / 600 lbs	DN65	2 1/2"
H4	Hastelloy C	PN100 / 600 lbs	DN65	2 1/2"
D4	Incoloy 800	PN100 / 600 lbs	DN65	2 1/2"
L4	Inconel 600	PN100 / 600 lbs	DN65	2 1/2"
M4	Monel	PN100 / 600 lbs	DN65	2 1/2"

C5	C.S.	PN160 / 1500 lbs	DN65	2 1/2"
S5	316 SS	PN160 / 1500 lbs	DN65	2 1/2"
X5	Duplex	PN160 / 1500 lbs	DN65	2 1/2"
K5	1.4539	PN160 / 1500 lbs	DN65	2 1/2"
H5	Hastelloy C	PN160 / 1500 lbs	DN65	2 1/2"
D5	Incoloy 800	PN160 / 1500 lbs	DN65	2 1/2"
L5	Inconel 600	PN160 / 1500 lbs	DN65	2 1/2"
M5	Monel	PN160 / 1500 lbs	DN65	2 1/2"

C6	C.S.	PN250 / 1500 lbs	DN65	2 1/2"
S6	316 SS	PN250 / 1500 lbs	DN65	2 1/2"
X6	Duplex	PN250 / 1500 lbs	DN65	2 1/2"
K6	1.4539	PN250 / 1500 lbs	DN65	2 1/2"
H6	Hastelloy C	PN250 / 1500 lbs	DN65	2 1/2"
D6	Incoloy 800	PN250 / 1500 lbs	DN65	2 1/2"
L6	Inconel 600	PN250 / 1500 lbs	DN65	2 1/2"
M6	Monel	PN250 / 1500 lbs	DN65	2 1/2"

C7	C.S.	PN320 / 2500 lbs	DN65	2 1/2"
S7	316 SS	PN320 / 2500 lbs	DN65	2 1/2"
X7	Duplex	PN320 / 2500 lbs	DN65	2 1/2"
K7	1.4539	PN320 / 2500 lbs	DN65	2 1/2"
H7	Hastelloy C	PN320 / 2500 lbs	DN65	2 1/2"
D7	Incoloy 800	PN320 / 2500 lbs	DN65	2 1/2"
L7	Inconel 600	PN320 / 2500 lbs	DN65	2 1/2"
M7	Monel	PN320 / 2500 lbs	DN65	2 1/2"

C8	C.S.	PN400 / 2500 lbs	DN65	2 1/2"
S8	316 SS	PN400 / 2500 lbs	DN65	2 1/2"
X8	Duplex	PN400 / 2500 lbs	DN65	2 1/2"
K8	1.4539	PN400 / 2500 lbs	DN65	2 1/2"
H8	Hastelloy C	PN400 / 2500 lbs	DN65	2 1/2"

1. Order specification ITABAR-FLOW-Sensor, series IBF-65/66

continued										
9. material connecting piece, with flange (max. pressure rating)										
D8	Incoloy 800	PN400 / 2500 lbs						DN65	2 1/2"	
L8	Inconel 600	PN400 / 2500 lbs						DN65	2 1/2"	
M8	Monel	PN400 / 2500 lbs						DN65	2 1/2"	
10. end support (only IBF-66)										
0	without end support									
C	end support, material C.S.									
S	end support, material: 316 SS									
X	end support, material: Duplex									
K	end support, material: 1.4539									
H	end support, material: Monel									
D	end support, material: Hastelloy C									
L	end support, material: Incoloy 800									
M	end support, material: Inconel 600									
V	end support, material: PVDF									
11. isolation										
KI	without									
X..	isolation in inches (or mm), please specify									
12. piping run										
HL	horizontal									
VL	vertikal									
13. integrated RTD resistance thermocouple (not for Sensor of PVDF)										
T0	without									
TA	3-wire									
TB	3-wire, with ex-proofness									
14. process connection, s. page 75										
15. instrument valves s. page 75										

type of sensor	inside diameter and wall thickness	sensor material	sensor flange	gasket	PN, material and DN of Sensor	design assembly connecting pieces	Assembly connecting piece with flange	material connecting piece, with flange	end support	isolation	piping run								
IBF-		/																	

8.2 Series IBF-100 for Flue Gas Emissions to 235 psi (16bar)

Description

The ITABAR-sensor IBF-100 is specially designed to measure volumetric flow of flue gas.

In this model the two pressure chambers within the sensor are enlarged. The reasons are as follows:

- 1) The frequency of cleaning requirements is reduced.
- 2) Cleaning by mechanical means or with air pressure is made easy.

The design allows cleaning of the pressure chambers via the sensor's pipe mounting assembly as well as from its flanged end support. For cleaning purposes the two parallel pressure chambers have a round shape which runs over the entire length of the sensor.

The standard sensor material is 316 SS; the following materials are options: 1.4539, Hastelloy C4, Incoloy und PVDF.

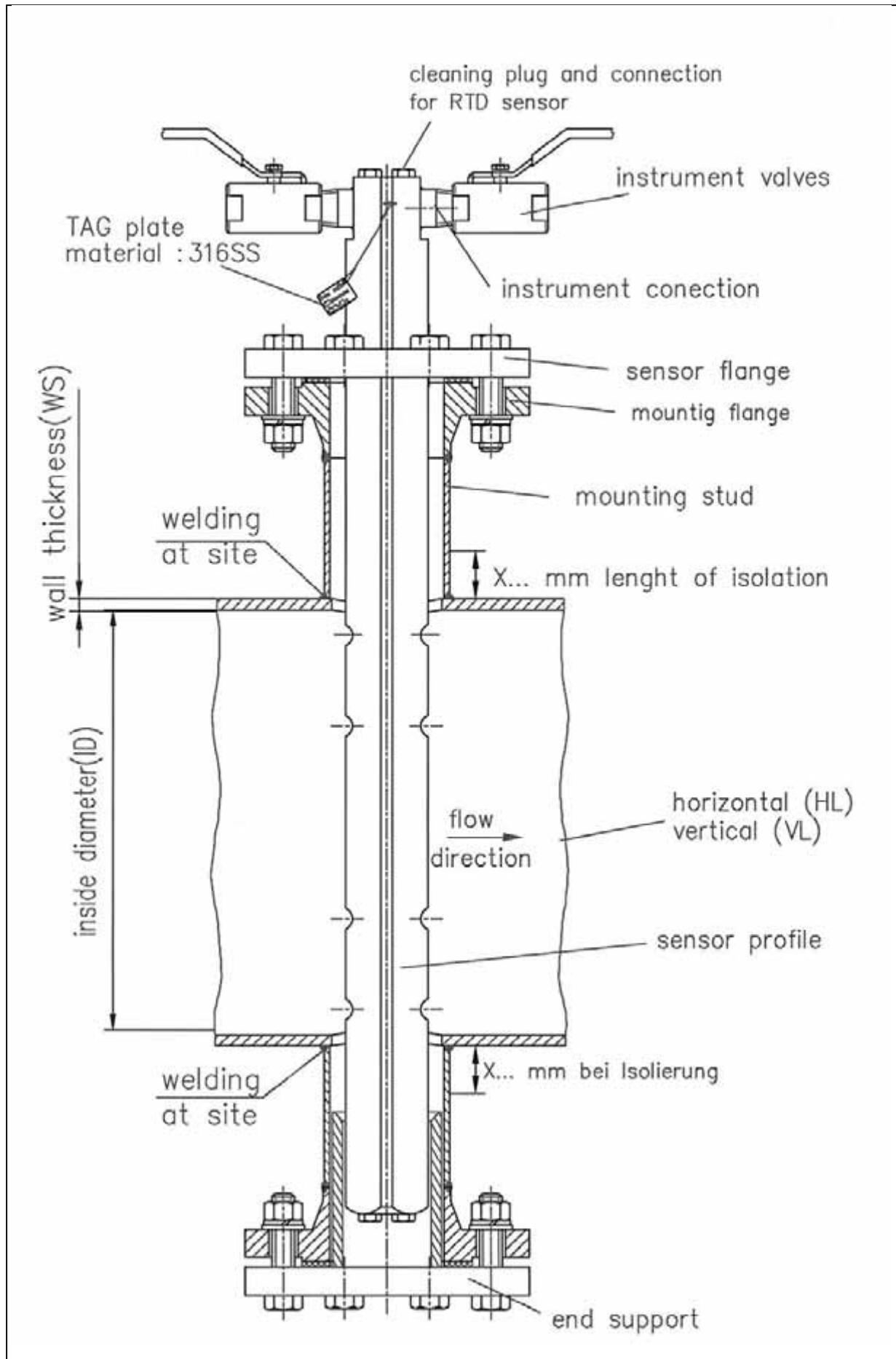
For automatic cleaning the LSP air-purge unit is available.

The flue gas sensor IBF-100 is approved for (German) governmentally ordered volumetric flow measurements of water saturated emissions (TA Luft 1986, 13. BimSchV and 17. BimSchV).



Fig. 7.7: ITABAR IBF-100

Drawings for ITABAR IBF-100



1. Order specification ITABAR-FLOW-Sensor, series IBF-100, with end support

1. type of sensor

100 | with end support

2. inside diameter and wall thickness.

ID / W.-thickn. | inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

- | | |
|---|-----------------------|
| S | 316 SS (standard) |
| K | 1.4539 |
| H | Hastelloy C4 |
| Y | Incoloy 800 |
| D | PVDF (only to 1000mm) |

4. sensor flange, always identically to sensor material.

- | | |
|----|-----------------------|
| SM | flange according DIN |
| SA | flange according ANSI |

5. gasket

- | | |
|---|----------------------------|
| 1 | gasket strip according DIN |
| 2 | ANSI RF |
| 3 | ANSI RF SF (smooth finish) |

6. PN, material and DN of Sensor flange
DIN ANSI

E1	PN16 / 150 lbs	material: 316 SS	DN80	3"
E2	PN16 / 150 lbs	material: 1.4539	DN80	3"
E3	PN16 / 150 lbs	material: Hastelloy C	DN80	3"
E4	PN16 / 150 lbs	material: Inconel 800	DN80	3"
E5	PN16 / 150 lbs	material: PVDF (only to 1000 mm)	DN80	3"

7. design assembly connecting pieces

- | | |
|---|---|
| R | assembly connecting pieces with flange (standard) |
| W | weldolet-assembly connecting pieces and flange |

8. assembly connecting piece with flange, identically to sensor flange.

- | | |
|---|--|
| 0 | without flange |
| M | flange according DIN, gasket strip form C |
| A | flange according ANSI, gasket strip RF |
| F | flange according ANSI, gasket strip SF (smooth finish) |

9. material connecting piece, with flange (max. pressure rating)
pressure rating and flange size always identically to sensor flange.

C1	PN16 / 150 lbs	material: C.S.	DN80	3"
S1	PN16 / 150 lbs	material: 316 SS	DN80	3"
K1	PN16 / 150 lbs	material: 1.4539	DN80	3"
H1	PN16 / 150 lbs	material: Hastelloy C	DN80	3"
D1	PN16 / 150 lbs	material: Inconel 800	DN80	3"
V1	PN16 / 150 lbs	material: PVDF (only to 1000 mm)	DN80	3"

11. end support

- | | |
|---|---|
| 0 | without end support (if build-laterally available.) |
| C | end support, material C.S. |
| S | end support, material: 316 SS |
| K | end support, material: 1.4539 |
| H | end support, material: Monel |
| Y | end support, material: Incoloy 800 |
| V | end support, material: PVDF |

12. isolation

- | | |
|-----|---|
| KI | without |
| X.. | isolation in inches (or mm), please specify |

13. piping run

- | | |
|----|------------|
| HL | horizontal |
| VL | vertikal |

14. integrated RTD resistance thermocouple (not for Sensor of PVDF)

- | | |
|----|---------------------------|
| T0 | without |
| TA | 3-wire |
| TB | 3-wire, with ex-proofness |

15. process connection, s. page 75
16. instrument valves s. page 75

IBF-	100	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
------	-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

type of sensor

inside diameter and wall thickness

sensor material

sensor flange

gasket

PN, material and DN of Sensor

design assembly connecting pieces

Assembly connecting piece with flange

Druckstufe Montageflansch material connecting

end support

isolation

piping run

Pictures of Shut-Off Valves for Pressure Connections



Fig. 7.15: Ball valve
PN 40 (588 psi), 1.4401 (316 SS)



Fig. 7.16: Shut off valve 1/2 " NPT,
PN 400 (5880 psi), 1.4401 (316 SS)



Fig. 7.17: 3-way-manifold
PN 400 (5880 psi), 1.4401 (316 SS)



Fig. 7.18: Shut off valve
PTFE

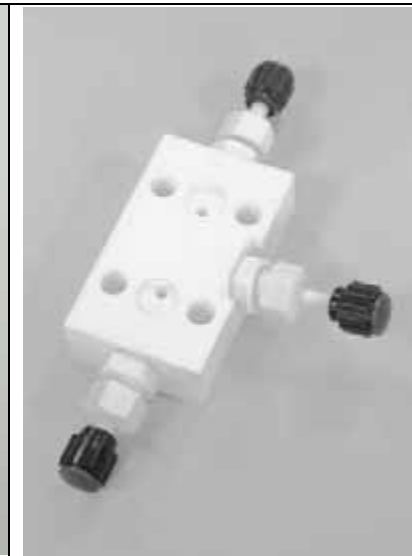


Fig. 7.19: 3-way-manifold
PTFE



Fig. 7.20: 5-way-manifold
1.4401 (316 SS)

2. Order specification ITABAR-Flow-Sensor

Instrument connection and shutt-off device

type IBF- 20, 21, 35, 36, 65, 66, 100

type IBR-15, 20, 21, 35, 36

instrument connection

A04 sensorhead with 1/4" NPT outside thread

A03 sensorhead with 1/2" NPT outside thread

flange plate to direct mount a 3-valve manifold

A06 flange plate to direct mount a 3-valve manifold material: 14571

A07 flange plate to direct mount a 3-valve manifold material: 1.4462 (Dullex)

A08 flange plate to direct mount a 3-valve manifold material: 1.4539

A09 flange plate to direct mount a 3-valve manifold material: Hastelloy C

A10 flange plate to direct mount a 3-valve manifold material: Inconel 600

A11 flange plate to direct mount a 3-valve manifold material: Monel

A13 flange plate to direct mount a 3-valve manifold material: PVDF

flange plate to direct mount a 5-valve manifold

A15 flange plate to direct mount a 5-valve manifold material: 14571

A16 flange plate to direct mount a 5-valve manifold material: 1.4462 (Dullex)

A17 flange plate to direct mount a 5-valve manifold material: 1.4539

A18 flange plate to direct mount a 5-valve manifold material: Hastelloy C

A19 flange plate to direct mount a 5-valve manifold material: Inconel 600

A20 flange plate to direct mount a 5-valve manifold material: Monel

A21 flange plate to direct mount a 5-valve manifold material: PVDF

shut-off device for effect pressure pipe.

A00 without shut-off-device

A55 ball valves PN40, case C.S. / female thread 1/2" NPT , packing: Teflon

A56 ball valves PN40, case 1.4401. / female thread 1/2" NPT , packing: Teflon

A57 ball valve PN40, case C.S. / female thread 1/4" NPT , packing: Teflon

A58 ball valves PN40, case 1.4401. / female thread 1/4" NPT , packing: Teflon

A59 shut-off valves 1/4" NPT, PN400, case C.S. / female thread 1/4" NPT packing: graphite

A60 shut-off valves 1/4" NPT, PN400, case 1.4401 / female thread 1/4" NPT packing: graphite

A61 shut-off valve 1/2" NPT, PN400, case C.S. / female thread 1/2" NPT packing: graphite

A62 shut-off valves 1/2" NPT, PN400, case 1.4401 / female thread 1/2" NPT packing: graphite

A63 shut-off valves 1/2" NPT, PN10, PTFE

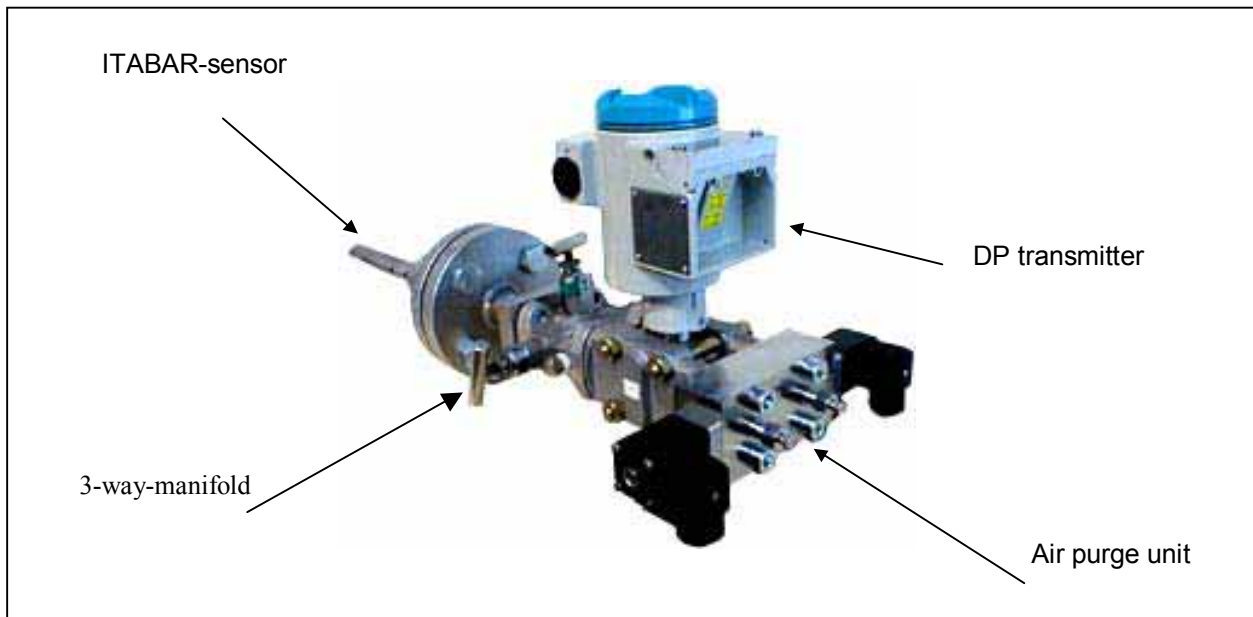
A64 shut-off valves G 1/2", PVDF

A66 direct mount, with 3-valve manifold, PN400, case 1.4401 / packing: PTFE (only with A06-A13)

A67 direct mount, with 3-valve manifold, PN10, case PTFE / packing: PTFE (only with A06-A13)

A71 direct mount, with 5-valve manifold, PN400, case 1.4401 / packing: PTFE (only with A15-A21)

8.4 Air Purge Unit LSP-compact



Description

When measuring the flow of emissions or air containing particles it is possible that particles attach themselves in- and outside of the sensor walls, and – depending on the degree of coating – reduce the measurement accuracy or even eliminate the signal from the sensor altogether.

To manually clean the DP sensor in regular intervals is in many instances not a practical solution. The removal, thorough cleaning and re-installation is time consuming and expensive. Furthermore no signal is available during the cleaning process.

The LSP-compact air-purge unit allows such regular cleaning to be done automatically and with considerable cost savings.

The LSP-compact unit mainly consists of a purge block with a 2/2-way-valve which is directly addressable via a customer supplied relais or SPS . It is also possible to activate the LPS via the DigiFlow flow computer. The DigiFlow is programmable for purge duration, purge frequency, Slowing-down time . At the same time the DigiFlow maintains the last signal value during the cleaning process.

The LPS is delivered with all necessary mounting hardware and is installed by screwing one side of the purge block directly onto the DP transmitter. The pressure piping is attached to the other side. The vent screws are threaded into the purge block. It is thus ensured that not only the sensor but also the sensing chambers of the DP transmitter are purged of impurities. The standard $\frac{1}{2}$ " NPT connections for the purge air supply are located on the sides of the block.

This compact design with few components avoids more complicated installation procedures in a separate enclosure.

Specifications Air Purge Unit LSP-compact	
Medium:	Air
Valve type:	2/2 –way valve, direct-controlled
Function:	normally closed
Kv- flow value:	1,01 GPM
Nominal stroke:	0.04 inches
On-time ?:	100 %
Material of internal parts:	Stainless steel
Material Dichtungen:	FPM
Connection:	¼“ NPT
Orientation:	user selectable
nominal size	0.12 inches
Leak rate:	bubble tight
Protection class:	I
Isolation class:	F
Protection	IP 65 / Nema 4 (IEC 144)
Material of purge block	Aluminum or 316 SS (1.4571)

VERSIONS:	w/out Ex-protection	EEx d - Version
Ex protection:	NONE	EEx d IIC T4/T5 TO EN 50014 and EN 50018
Nominal voltage:	230 V / 50 Hz, 115 V /50 Hz and 24 V DC	230 V / 50 Hz, 115 V /50 Hz, 24 V DC and 24 V / 50 Hz
Electrical connections:	to DIN 43650	cable H05RN-F3G, 3 x 0,75 mm ² , 3 m long with cable glands and strain relief
Power consumption	21 VA (start up); 12 VA /8 W (operat.)	Nominal power cons. 7 W
Max. air supply pressure:	88,2 psi	58,8 psi
Medium temperature:	-34 ... +323 °F	-34 ... +306°F
Environmental temperature:	max. +187 °F	max. +136°F

Code	w/out Ex protection			Ex protection EEx d IIC T5			
Material of purge block:	230 V 50 Hz	115 V 50 Hz	24 V DC	230 V 50 Hz	115 V 50 Hz	24 V 50 Hz	24 V DC
Aluminum	EJG-1A	EJG-2A	EJG-3A	EJG-6A	EJG-7A	EJG-8A	EJG-9A
St Steel (1.4571)	EJG-1S	EJG-2S	EJG-3S	EJG-6S	EJG-7S	EJG-8S	EJG-9S

9.0 Model Series FTN to 88 psi (PN6)

Description

The FTN ITABAR-sensor series is designed to measure the volumetric flow of liquids, gases and steam.

The construction features a welding boss between the pipe and the sensor-related parts and a compression fitting to seal the sensor profile. A safety chain between the installed sensor and the pipe serves as a protective device during the removal process.

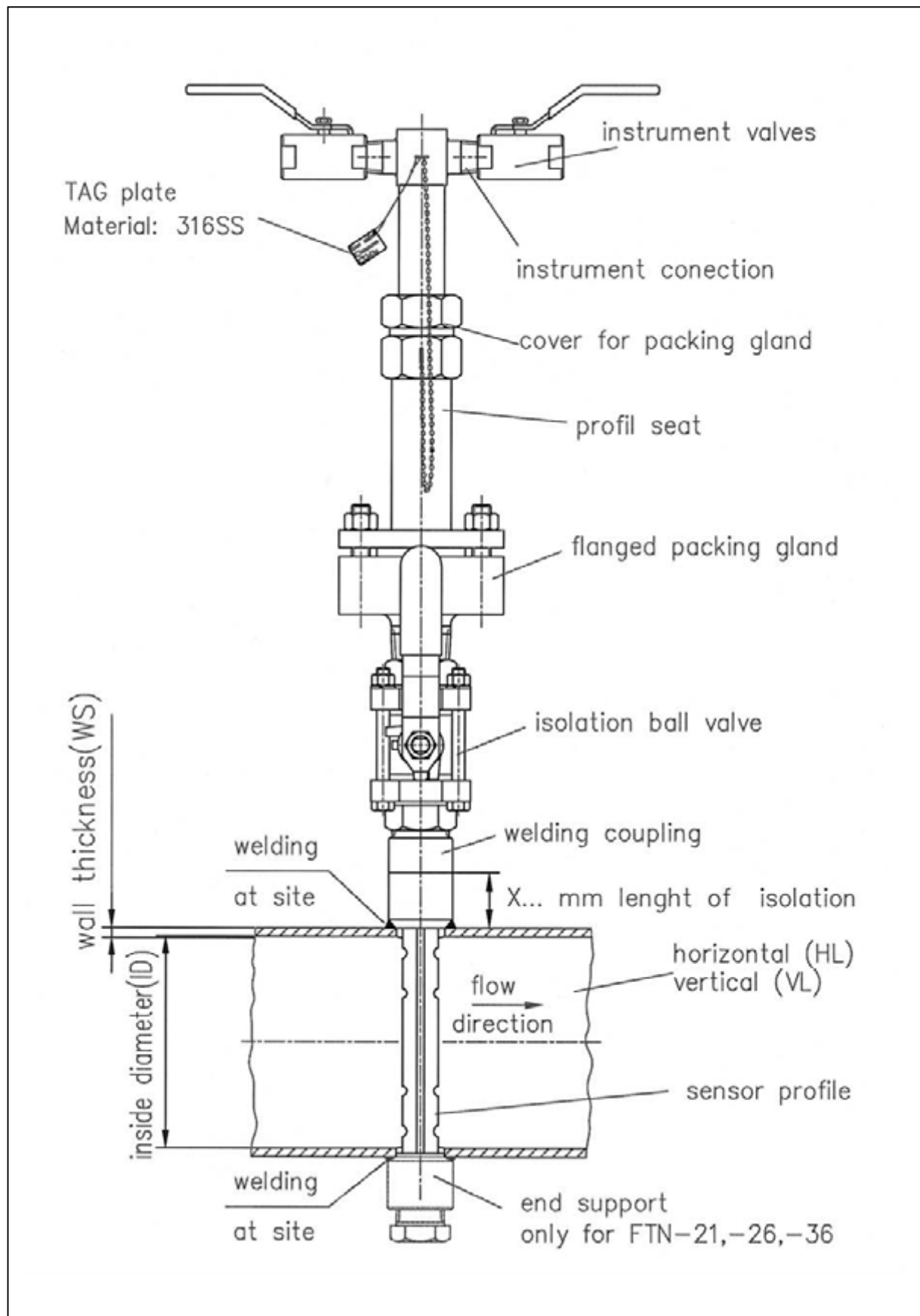
A FTN sensor is usable up to an operating pressure of 88 psi and an operating temperature of up to 200°C.

In cases where the WINFLOW sizing program recommends a counter end support because of the high flow velocity it is better to select the next size sensor model. During the initial installation it is not possible to install a sensor counter support. During subsequent installations under pressure it can also be difficult to meet the counter support at the opposite end of the pipe. Furthermore the maximum installation values listed in the WINFLOW-program must be observed.



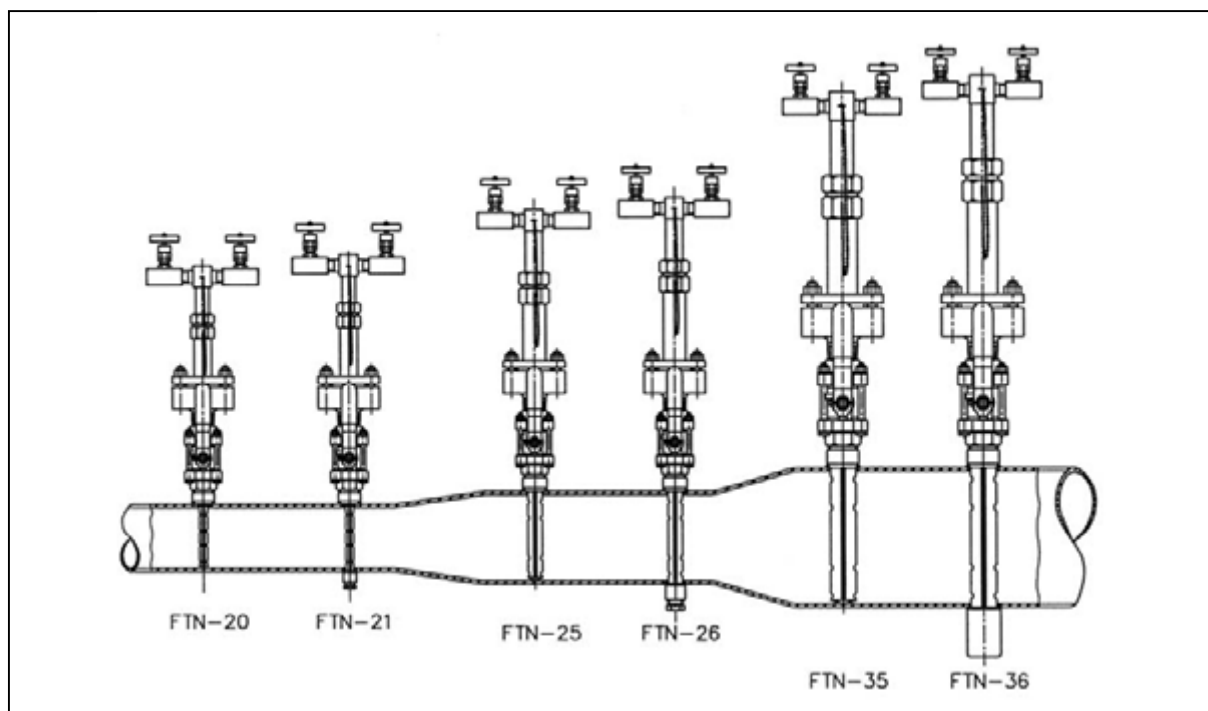
Fig.:9.1: Pitot tube sensor FTN-25

Construction Drawing for ITABAR Series FTN



Order Data for Model Series FTN20/21/25/26/35/36 to 88 psi (PN6)

1. Sensor Type



Pipe diameter		Maximum allowable volumetric flow in GPM					
		Sensor type					
Inches	mm	FTN -20	FTN -21	FTN -25	FTN -26	FTN -35	FTN -36
1 1/2	DN 40	175	502	---	---	---	---
2	DN 50	260	708	---	---	---	---
2 1/4	DN 65	409	1069	---	---	---	---
3	DN 80	572	1443	---	---	---	---
4	DN 100	787	1936	902	2398	---	---
5	DN 125	1047	2512	1240	3168	---	---
6	DN 150	---	---	1579	3938	---	---
8	DN 200	---	---	2270	5473	---	---
10	DN 250	---	---	3027	7150	---	---
12	DN 300	---	---	3841	8962	7739	18519
14	DN 350	---	---	4637	10718	9438	22321
16	DN 400	---	---	5403	12460	11154	26158
20	DN 500	---	---	7013	15976	14462	33528
24	DN 600	---	---	8588	19483	17850	41087
28	DN 700	---	---	10212	23069	21370	48923
32	DN 800	---	---	11910	26870	24965	56962
36	DN 900	---	---	---	30839	---	65155
40	DN 1000	---	---	---	34896	---	73189
48	DN 1200	---	---	---	43010	---	90090
56	DN 1400	---	---	---	---	---	106695
64	DN 1600	---	---	---	---	---	123292
72	DN 1800	---	---	---	---	---	139264
80	DN 2000	---	---	---	---	---	---

1. Order specification ITABAR-FLOW-Sensor, series FTN-20 / 21

1. type of sensor	
20	without end support
21	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material 316 SS
5. end support (only FTN-21)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. isolation valve for the sensor profile	
A01	ball valve 1", material: C.S. PN16 / 150 lbs
A02	ball valve 1", material: 1.4401 PN16 / 150 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS 1.4571
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
11. piping run	
HL	horizontal
VL	vertikal
12. process connection, s. page 91	
13. instrument valves s. page 91	

FTN- /

1. Order specification ITABAR-FLOW-Sensor, series FTN-25/26

1. type of sensor	
20	without end support
21	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material 316 SS
5. end support (only FTN-26)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. isolation valve for the sensor profile	
A05	ball valve 1 1/2", material: C.S. PN16 / 150 lbs
A06	ball valve 1 1/2", material: 1.4401 PN16 / 150 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS 1.4571
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
11. piping run	
HL	horizontal
VL	vertikal
12. integrated RTD resistance thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
13. process connection, s. page 91	
14. instrument valves s. page 91	

FTN- /

1. Order specification ITABAR-FLOW-Sensor, series FTN-35 / 36

1. type of sensor	
35	without end support
36	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material 316 SS
5. end support (only FTN-36)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. isolation valve for the sensor profile	
A09	ball valve 2", material: C.S. PN16 / 150 lbs
A10	ball valve 2", material: 1.4401 PN16 / 150 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
11. piping run	
HL	horizontal
VL	vertikal
12. integrated RTD resistance thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
13. process connection, s. page 91	
14. instrument valves s. page 91	

FTN- /

9.1 Model Series FTM to 588 psi (PN 40)

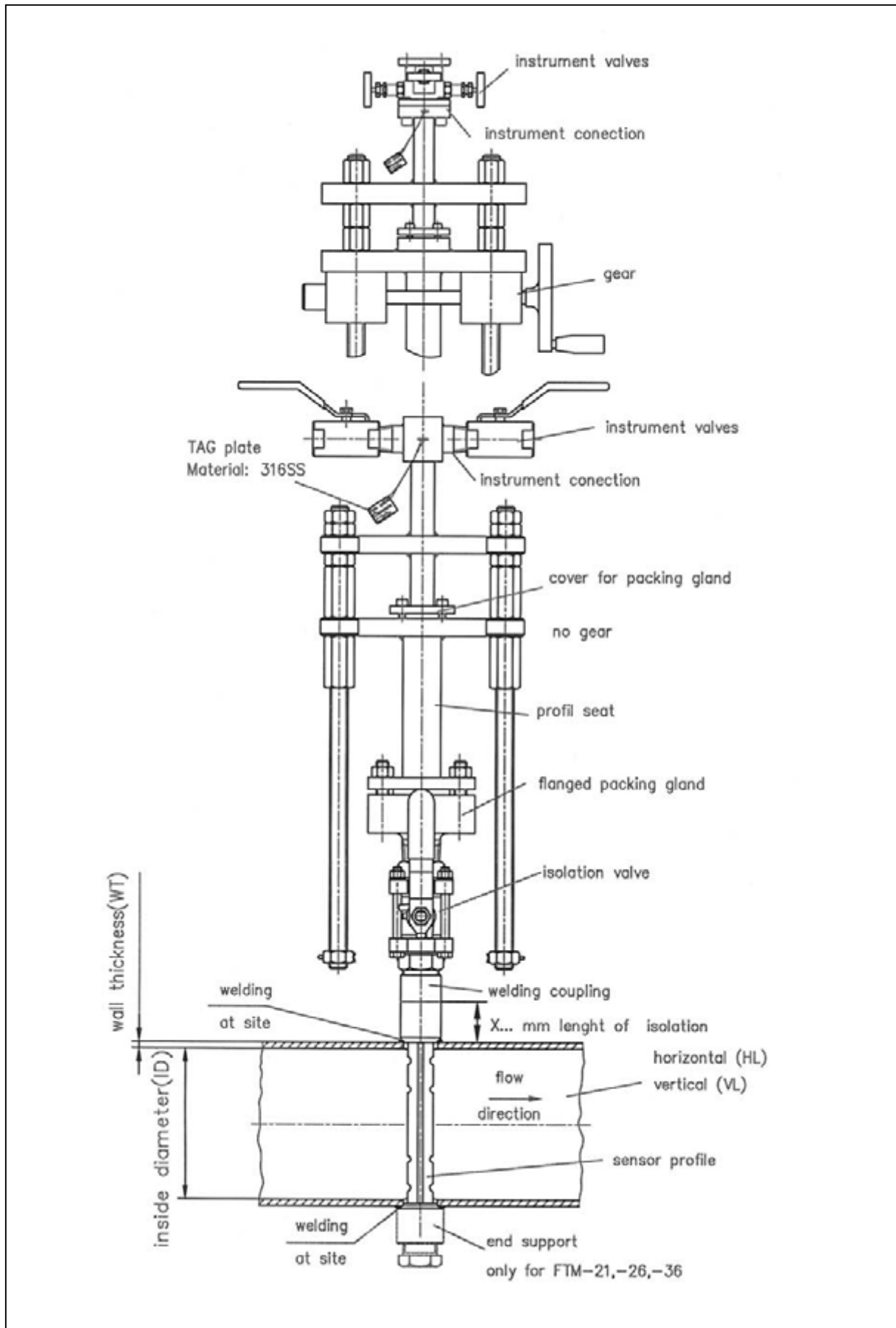
Description

The FTM ITABAR-Sensor series is designed to measure volumetric flow of liquids and gases. The insertion or removal of the sensor is made easy by two guide-rod spindles or (as an option) via a hand wheel driven gearbox. The FTM sensor is applicable to an operating pressure of up to 588 psi (PN40) and an operating temperature of up to 300°C.



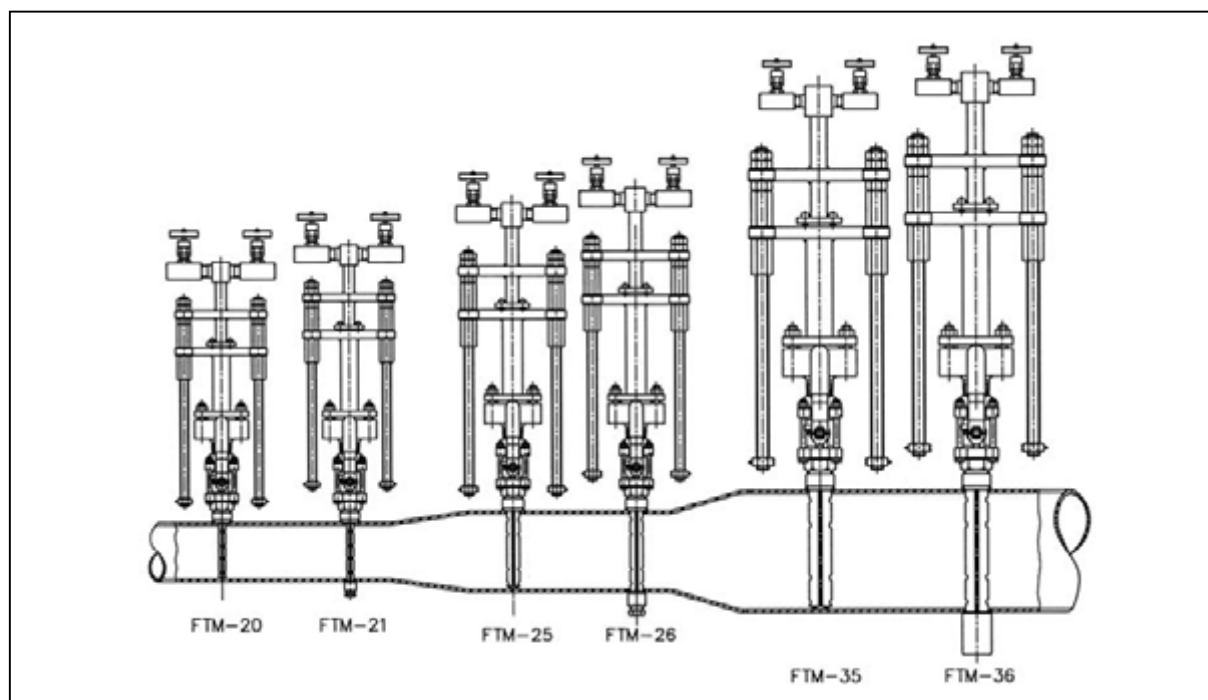
Fig. 9.2: FTM-20 with gear box and hand wheel (option)

Drawing for ITABAR Series FTM



Order Data for ITABAR Series FTM 20/21/25/26/35/36 (PN40)

1. Sensor Type, with guide rod spindles



Pipe diameter inches mm		Maximum allowable volumetric flow in GPM					
		Sensor type					
		FTM -20	FTM -21	FTM -25	FTM -26	FTM -35	FTM -36
1 1/2	DN 40	175	502	---	---	---	---
2	DN 50	260	708	---	---	---	---
2 1/4	DN 65	409	1069	---	---	---	---
3	DN 80	572	1443	---	---	---	---
4	DN 100	787	1936	902	2398	---	---
5	DN 125	1047	2512	1240	3168	---	---
6	DN 150	---	---	1579	3938	---	---
8	DN 200	---	---	2270	5473	---	---
10	DN 250	---	---	3027	7150	---	---
12	DN 300	---	---	3841	8962	7739	18519
14	DN 350	---	---	4637	10718	9438	22321
16	DN 400	---	---	5403	12460	11154	26158
20	DN 500	---	---	7013	15976	14462	33528
24	DN 600	---	---	8588	19483	17850	41087
28	DN 700	---	---	10212	23069	21370	48923
32	DN 800	---	---	11910	26870	24965	56962
36	DN 900	---	---	---	30839	---	65155
40	DN 1000	---	---	---	34896	---	73189
48	DN 1200	---	---	---	43010	---	90090
56	DN 1400	---	---	---	---	---	106695
64	DN 1600	---	---	---	---	---	123292
72	DN 1800	---	---	---	---	---	139264
80	DN 2000	---	---	---	---	---	---

1. Order specification ITABAR-FLOW-Sensor, series FTM-20 / 21

1. type of sensor

- 20 without end support
- 21 with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S 316 SS

4. welding coupling

- 0 without
- 1 material: C.S.
- 2 material 316 SS

5. end support (only FTM-21)

- 0 without end support
- C end support, material: C.S.
- S end support, material: 316 SS

6. isolation valve for the sensor profile

A01	ball valve 1", material: C.S.	PN16 / 150 lbs
A02	ball valve 1", material: 1.4401	PN16 / 150 lbs
S01	gate valve 1", material: C.S.	PN16 / 150 lbs
S02	gate valve 1", material: 1.4401	PN16 / 150 lbs
A03	ball valve 1", material: C.S.	PN40 / 300 lbs
A04	ball valve 1", material: 1.4401	PN40 / 300 lbs
S03	gate valve 1", material: C.S.	PN40 / 300 lbs
S04	gate valve 1", material: 1.4401	PN40 / 300 lbs

7. flanged packing gland

S material: 316 SS

8. cage nipple

- PC material: C.S.
- PS material: 316 SS

9. packing material for the flanged and welded packing gland

- 1 packing material: PTFE, max 200°C
- 2 packing material: Graphit, max 400°C

10. thermal isolation

- KI without
- X.. thermal isolation in inches or mm, please specify

11. piping run

- HL horizontal
- VL vertikal

12. gear

- 0 without gear
- 1 with gear

13. process connection, s. page 91

14. instrument valves s. page 91

FTM- /

1. Order specification ITABAR-FLOW-Sensor, series FTM-25 / 26

1. type of sensor	
25	without end support
26	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material 316 SS
5. end support (only FTM-26)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. isolation valve for the sensor profile	
A05	ball valve 1 1/2", material: C.S. PN16 / 150 lbs
A06	ball valve 1 1/2", material: 1.4401 PN16 / 150 lbs
S05	gate valve 1 1/2", material: C.S. PN16 / 150 lbs
S06	gate valve 1 1/2", material: 1.4401 PN16 / 150 lbs
A07	ball valve 1 1/2", material: C.S. PN40 / 300 lbs
A08	ball valve 1 1/2", material 1.4401 PN40 / 300 lbs
S07	gate valve 1 1/2", material: C.S. PN40 / 300 lbs
S08	gate valve 1 1/2", material: 1.4401 PN40 / 300 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
11. piping run	
HL	horizontal
VL	vertikal
12. gear	
0	without gear
1	with gear
13. integrated RTD resistance thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
14. process connection, s. page 91	
15. instrument valves s. page 91	

FTM- /

1. Order specification ITABAR-FLOW-Sensor, series FTM-35 / 36

1. Sondentyp	
35	ohne Gegenlager
36	mit Gegenlager
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS (standard)
4. welding coupling	
0	without
1	material: C.S.
2	material 316 SS
5. end support (only FTM-36)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. isolation valve for the sensor profile	
A09	ball valve 2", material: C.S. PN16 / 150 lbs
A10	ball valve 2", material: 1.4401 PN16 / 150 lbs
S09	gate valve 2", material: C.S. PN16 / 150 lbs
S10	gate valve 2", material: 1.4401 PN16 / 150 lbs
A11	ball valve 2", material: C.S. PN40 / 300 lbs
A12	ball valve 2", material 1.4401 PN40 / 300 lbs
S11	gate valve 2", material: C.S. PN40 / 300 lbs
S12	gate valve 2", material: 1.4401 PN40 / 300 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
11. piping run	
HL	horizontal
VL	vertikal
12. gear	
0	without gears
1	with gears
13. integrated RTD resistance thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
14. process connection, s. page 91	
15. instrument valves s. page 91	

FTM- /

2. Order specification ITABAR-Flow-Sensor, series Flo-Tap

Instrument connection and shutt-off device

type FTN- 20, 21, 25, 26, 35, 36

type FTM- 20, 21, 25, 26, 35, 36

instrument connection

A04	sensorhead with 1/4" NPT outside thread
A03	sensorhead with 1/2" NPT outside thread
A06	flange plate to direct mount a 3-valve manifold
A07	flange plate to direct mount a 5-valve manifold



shut-off device for effect pressure pipe.

A00	without shut-off device
A55	ball valve PN40, case C.S. / female thread 1/2" NPT , packing: Teflon
A56	ball valve PN40, case 1.4401. / female thread 1/2" NPT , packing: Teflon
A57	ball valve PN40, case C.S. / female thread 1/4" NPT , packing: Teflon
A58	ball valve PN40, case 1.4401. / female thread 1/4" NPT , packing: Teflon
A59	shut-off valve 1/4" NPT, PN400, case C.S. / female thread 1/4" NPT packing: graphite
A60	shut-off valve 1/4" NPT, PN400, case 1.4401 / female thread 1/4" NPT packing: graphite
A61	shut-off valve 1/2" NPT, PN400, case C.S. / female thread 1/2" NPT packing: graphite
A62	shut-off valve 1/2" NPT, PN400, case 1.4401 / female thread 1/2" NPT packing: graphite
A90	shut-off valve 1/2" NPT, 800 lbs, C-Stahl / female thread 1/2" NPT , packing: graphite
A91	shut-off vave 1/2" NPT, 800 lbs, 1.4401 / female thread 1/2" NPT, packing: graphite
A63	shut-off valve 1/2" NPT, PN10, PTFE
A64	shut-off valve G 1/2", PVDF
A66	direct mount, with 3-valve manifold, PN400, case 1.4401 / packing: PTFE (only with A06)
A67	direct mount, with 3-valve manifold, PN10, case PTFE / packing: PTFE (only with A06)
A71	direct mount, with 5-valve manifold, PN400, case 1.4401 / packing: PTFE (only with A07)



9.2 Model Series FTH to 1470 psi (PN 100)

Description

The FTH pitot tube sensor is designed to measure the volumetric flow of liquids and gases.

The installation is done via a flanged connection. The flanged packing gland above the shut off valve ensures proper sealing of the sensor as well as a shortening of the leverage arm.

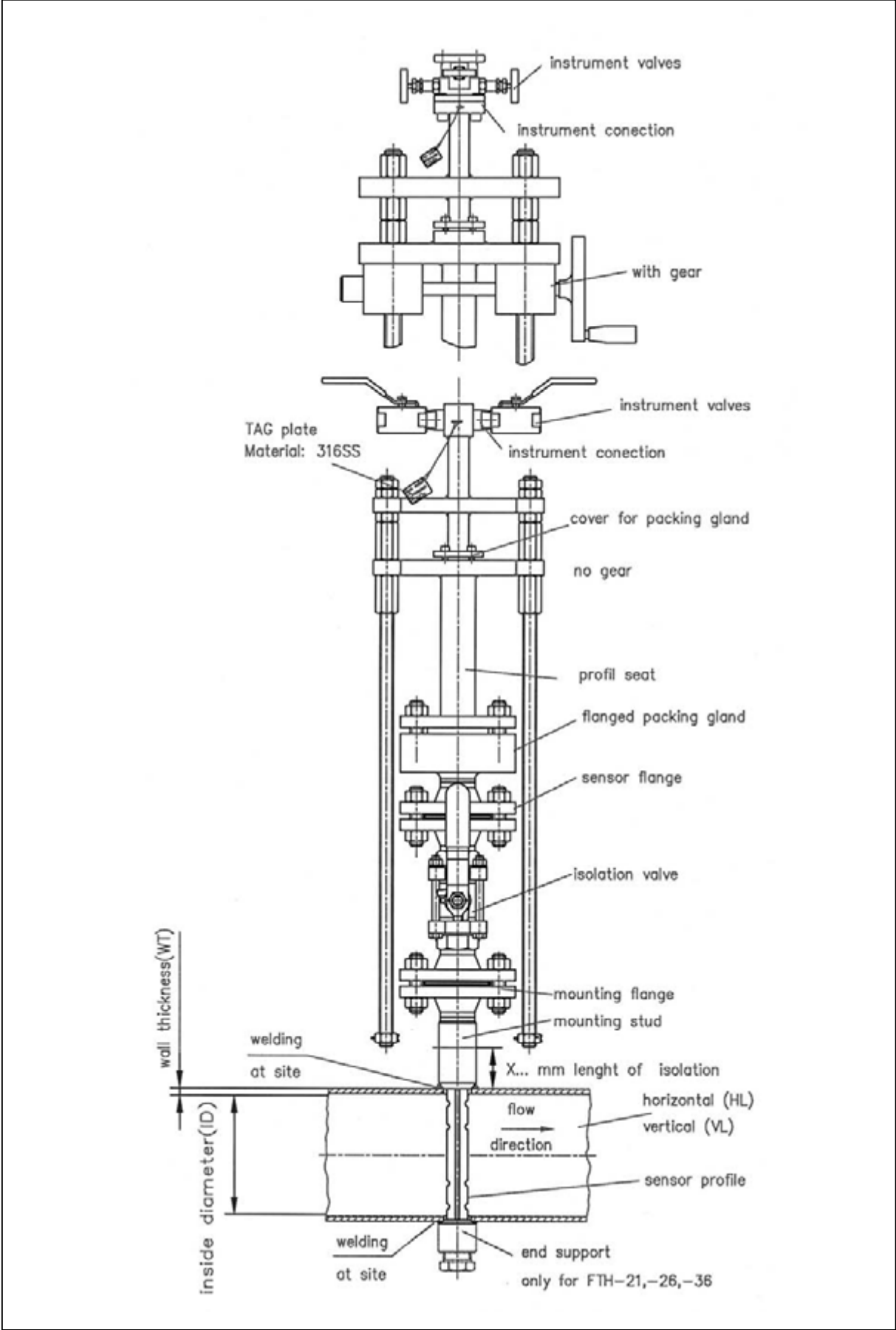
The installation / removal of the sensor is facilitated via a pair of guiding spindles or a gear box with hand wheel (optional).

The FTH sensor is designed for applications with a maximum operating pressure of 1470 psi and a maximum operating temperature of 400°C.



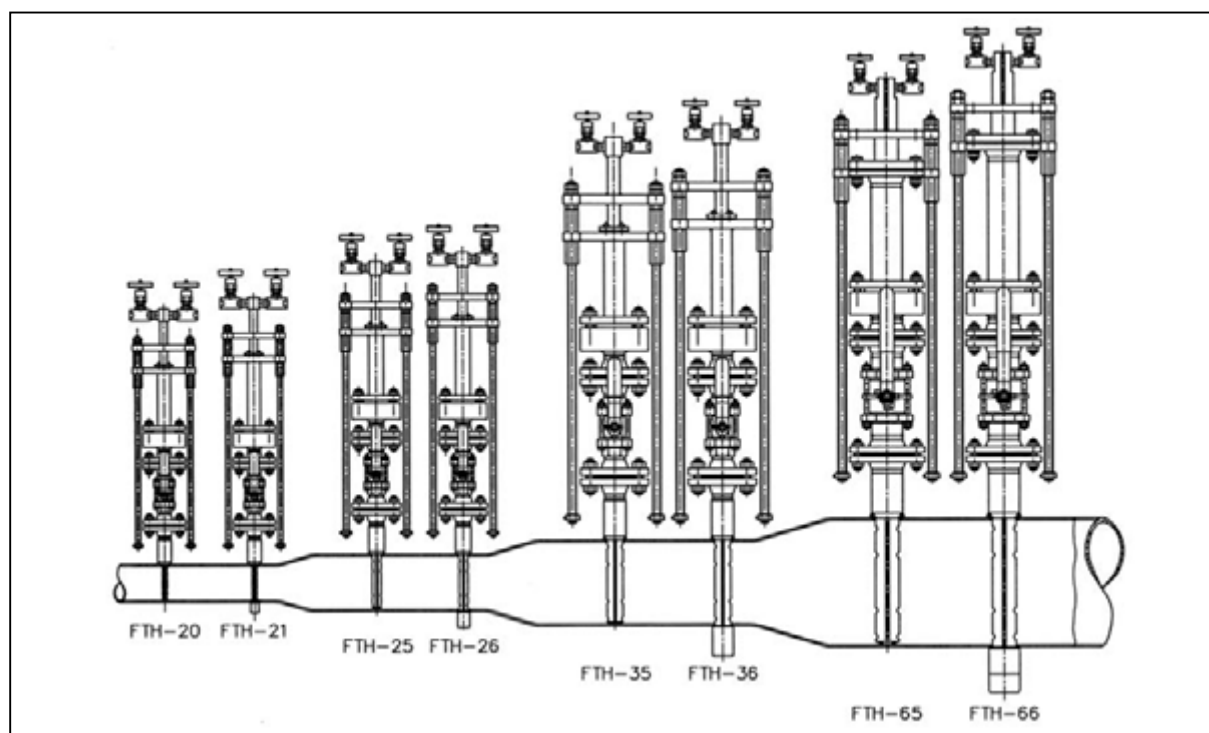
Fig. 9.3: Pitot tube sensor FTH-20 w/o gear box

Drawing for ITABAR Series FTH



Order Data for ITABAR Series FTH 20/21/25/26/35/36/65/66 PN 100

1. Sensor Type, with guide rod spindles



Pipe diameter inches mm		Maximum allowable volumetric flow in GPM							
		Sensor type							
		FTH -20	FTH -21	FTH -25	FTH -26	FTH -35	FTH -36	FTH -65	FTH -66
1 1/2	DN 40	175	502	---	---	---	---	---	---
2	DN 50	260	708	---	---	---	---	---	---
2 1/4	DN 65	409	1069	---	---	---	---	---	---
3	DN 80	572	1443	---	---	---	---	---	---
4	DN 100	787	1936	902	2398	---	---	---	---
5	DN 125	1047	2512	1240	3168	---	---	---	---
6	DN 150	---	---	1579	3938	---	---	---	---
8	DN 200	---	---	2270	5473	---	---	---	---
10	DN 250	---	---	3027	7150	---	---	---	---
12	DN 300	---	---	3841	8962	7739	18519	12416	24846
14	DN 350	---	---	4637	10718	9438	22321	15334	35728
16	DN 400	---	---	5403	12460	11154	26158	18229	42156
20	DN 500	---	---	7013	15976	14462	33528	23540	53891
24	DN 600	---	---	8588	19483	17850	41087	29928	68085
28	DN 700	---	---	10212	23069	21370	48923	36401	82482
32	DN 800	---	---	11910	26870	24965	56962	42358	95713
36	DN 900	---	---	---	30839	---	65155	---	107936
40	DN 1000	---	---	---	34896	---	73189	---	119746
48	DN 1200	---	---	---	43010	---	90090	---	144826
56	DN 1400	---	---	---	---	---	238695	---	172585
64	DN 1600	---	---	---	---	---	123292	---	202708
72	DN 1800	---	---	---	---	---	139264	---	229204
80	DN 2000	---	---	---	---	---	---	---	---

1. Order specification ITABAR-FLOW-Sensor, series FTH-20 / 21

1. type of sensor		
20	without end support	
21	with end support	
2. inside diameter and wall thickness.		
ID / W.-thickn	inside diameter and wall thickness in inches (or mm), please specify	
3. sensor material		
S	316 SS (standrad)	
X	1.4462 Duplex	
K	1.4539	
H	Hastelloy C4	
M	Monel	
4. sensor flange, always identically to sensor material.		
SM	flange according DIN	
SA	flange according ANSI	
5. gasket		
1	gasket strip according to DIN	
2	ANSI RF	
3	ANSI RF SF (smooth finish)	
4	RTJ	
6. PN, material and DN of Sensor flange		
	DIN	ANSI
B01	PN16 / 150 lbs material: 316 SS 1.4571	DN25 1"
B02	PN40 / 300 lbs material: 316 SS 1.4571	DN25 1"
B03	PN63 / 300 lbs material: 316 SS 1.4571	DN25 1"
B04	PN100 / 600 lbs material: 316 SS 1.4571	DN25 1"
B10	PN16 / 150 lbs material: 1.4462 (Duplex)	DN25 1"
B11	PN40 / 300 lbs material: 1.4462 (Duplex)	DN25 1"
B12	PN63 / 300 lbs material: 1.4462 (Duplex)	DN25 1"
B13	PN100 / 600 lbs material: 1.4462 (Duplex)	DN25 1"
B20	PN16 / 150 lbs material: 1.4539	DN25 1"
B21	PN40 / 300 lbs material: 1.4539	DN25 1"
B22	PN63 / 300 lbs material: 1.4539	DN25 1"
B23	PN100 / 600 lbs material: 1.4539	DN25 1"
B30	PN16 / 150 lbs material: Hastelloy C4	DN25 1"
B31	PN40 / 300 lbs material: Hastelloy C4	DN25 1"
B32	PN63 / 300 lbs material: Hastelloy C4	DN25 1"
B33	PN100 / 600 lbs material: Hastelloy C4	DN25 1"
B60	PN16 / 150 lbs material: Monel	DN25 1"
B61	PN40 / 300 lbs material: Monel	DN25 1"
B62	PN63 / 300 lbs material: Monel	DN25 1"
B63	PN100 / 600 lbs material: Monel	DN25 1"
7. design assembly connecting pieces		
R	assembly connecting pieces with flange (standard)	
W	Weldolet-assembly connecting pieces and flange	
8. assembly connecting piece with flange, identically to sensor flange.		
0	without flange	
M	flange according DIN, gasket strip form C	
A	flange according ANSI, gasket strip RF	
F	flange according ANSI, gasket strip SF (smooth finish)	
T	flange according ANSI, gasket strip RTJ	

1. Bestellaangaben ITABAR-DURCHFLUSS-Sonde, Baureihe FTH-20 / 21

9. material connecting piece, with flange (max. pressure rating)				
always identically to sensor flange.				
C1	C.S.	PN16 / 150 lbs	DN25	1"
S1	316 SS	PN16 / 150 lbs	DN25	1"
X1	Duplex	PN16 / 150 lbs	DN25	1"
K1	1.4539	PN16 / 150 lbs	DN25	1"
H1	Hastelloy C	PN16 / 150 lbs	DN25	1"
M1	Monel	PN16 / 150 lbs	DN25	1"
C2	C.S.	PN40 / 300 lbs	DN25	1"
S2	316 SS	PN40 / 300 lbs	DN25	1"
X2	Duplex	PN40 / 300 lbs	DN25	1"
K2	1.4539	PN40 / 300 lbs	DN25	1"
H2	Hastelloy C	PN40 / 300 lbs	DN25	1"
M2	Monel	PN40 / 300 lbs	DN25	1"
C3	C.S.	PN63 / 300 lbs	DN25	1"
S3	316 SS	PN63 / 300 lbs	DN25	1"
X3	Duplex	PN63 / 300 lbs	DN25	1"
K3	1.4539	PN63 / 300 lbs	DN25	1"
H3	Hastelloy C	PN63 / 300 lbs	DN25	1"
M3	Monel	PN63 / 300 lbs	DN25	1"
C4	C.S.	PN100 / 600 lbs	DN25	1"
S4	316 SS	PN100 / 600 lbs	DN25	1"
X4	Duplex	PN100 / 600 lbs	DN25	1"
K4	1.4539	PN100 / 600 lbs	DN25	1"
H4	Hastelloy C	PN100 / 600 lbs	DN25	1"
M4	Monel	PN100 / 600 lbs	DN25	1"
10. end support (only FTH-21)				
0	without support			
C	end support, material: C.S.			
S	end support, material: 316 SS			
X	end support, material: Duplex			
K	end support, material: 1.4539			
H	end support, material: Hastelloy C			
M	end support, material: Monel			
11. isolation valve for the sensor profile				
s. page 98				
12. flanged packing gland				
S	material: 316 SS (standard)			
X	1.4462 Duplex			
K	1.4539			
H	Hastelloy C			
M	Monel			
13. cage nipple				
PC	material: C.S. (standard)			
PS	material: 316 SS			
PX	1.4462 Duplex			
P3	1.4539			
PH	Hastelloy C			
PM	Monel			
14. packing material for the flanged and welded packing gland				
1	packing material: PTFE, max 200°C			
2	packing material: Graphit, max 400°C			
15. gears				
0	without gears			
1	with gears			
16. thermal isolation				
KI	without			
X..	thermal isolation in inches or mm, please specify			

2. Order specification ITABAR-Flow-Sensor, series Flo-Tap

Instrument connection and shutt-off device

type FTH- 20, 21

isolation valve for the sensor profile, DIN

MF01	ball valve, DN25 / PN16, material: C.S.
MF02	ball valve DN25 / PN16, material: 1.4401
MF03	ball valve DN25 / PN40, material: C.S.
MF04	ball valve DN25 / PN40, material: 1.4401
MF05	ball valve DN25 / PN40, material: Duplex
MF06	ball valve DN25 / PN40, material: Monel
MF07	ball valve DN25 / PN40, material: Hastelloy C
MS01	gate valve DN25 / PN100, material: C.S.
MS02	gate valve DN25 / PN100, material: 1.4401



isolation valve for the sensor profile, ANSI

AF01	ball valve, 1" ANSI 150 lbs, material: C.S.
AF02	ball valve, 1" ANSI 150 lbs, material: 1.4401
AF03	ball valve, 1" ANSI 300 lbs, material: C.S.
AF04	ball valve, 1" ANSI 300 lbs, material: 1.4401
AF05	ball valve, 1" ANSI 300 lbs, material: Duplex
AF06	ball valve, 1" ANSI 300 lbs, material: Monel
AF07	ball valve, 1" ANSI 300 lbs, material: Hastelloy C
AS01	gate valve, 1" ANSI / 600lbs, material: C.S.
AS02	gate valve, 1" ANSI / 600lbs, material: 1.4401



1. Order specification ITABAR-FLOW-Sensor, series FTH-25/26

1. type of sensor

25 without end support

26 with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S 316 SS (standrad)

X 1.4462 Duplex

K 1.4539

H Hastelloy C

M Monel

4. sensor flange, always identically to sensor material.

SM flange according DIN

SA flange according ANSI

5. gasket

1 gasket strip according to DIN

2 ANSI RF

3 ANSI RF SF (smooth finish)

4 RTJ

6. PN, material and DN of Sensor flange

DIN

ANSI

B01 PN16 / 150 lbs material: 316 SS 1.4571 DN32 1 1/2"

B02 PN40 / 300 lbs material: 316 SS 1.4571 DN32 1 1/2"

B03 PN63 / 300 lbs material: 316 SS 1.4571 DN40 1 1/2"

B04 PN100 / 600 lbs material: 316 SS 1.4571 DN40 1 1/2"

B10 PN16 / 150 lbs material: 1.4462 (Duplex) DN32 1 1/2"

B11 PN40 / 300 lbs material: 1.4462 (Duplex) DN32 1 1/2"

B12 PN63 / 300 lbs material: 1.4462 (Duplex) DN40 1 1/2"

B13 PN100 / 600 lbs material: 1.4462 (Duplex) DN40 1 1/2"

B20 PN16 / 150 lbs material: 1.4539 DN32 1 1/2"

B21 PN40 / 300 lbs material: 1.4539 DN32 1 1/2"

B22 PN63 / 300 lbs material: 1.4539 DN40 1 1/2"

B23 PN100 / 600 lbs material: 1.4539 DN40 1 1/2"

B30 PN16 / 150 lbs material: Hastelloy C4 DN32 1 1/2"

B31 PN40 / 300 lbs material: Hastelloy C4 DN32 1 1/2"

B32 PN63 / 300 lbs material: Hastelloy C4 DN40 1 1/2"

B33 PN100 / 600 lbs material: Hastelloy C4 DN40 1 1/2"

B30 PN16 / 150 lbs material: Monel DN32 1 1/2"

B31 PN40 / 300 lbs material: Monel DN32 1 1/2"

B32 PN63 / 300 lbs material: Monel DN40 1 1/2"

B33 PN100 / 600 lbs material: Monel DN40 1 1/2"

7. design assembly connecting pieces

R assembly connecting pieces with flange (standard)

W Weldolet-assembly connecting pieces and flange

8. assembly connecting piece with flange, identically to sensor flange.

0 without flange

M flange according DIN, gasket strip form C

A flange according ANSI, gasket strip RF

F flange according ANSI, gasket strip SF (smooth finish)

T flange according ANSI, gasket strip RTJ

9. material connecting piece, with flange (max. pressure rating)

always identically to sensor flange.

C1 C.S. PN16 / 150 lbs DN32 1 1/2"

S1 316 SS PN16 / 150 lbs DN32 1 1/2"

X1 Duplex PN16 / 150 lbs DN32 1 1/2"

K1 1.4539 PN16 / 150 lbs DN32 1 1/2"

H1 Hastelloy C PN16 / 150 lbs DN32 1 1/2"

M1 Monel PN16 / 150 lbs DN32 1 1/2"

1. Order specification ITABAR-FLOW-Sensor, series FTH-25/26

C2	C.S.	PN40 / 300 lbs	DN32	1 1/2"
S2	316 SS	PN40 / 300 lbs	DN32	1 1/2"
X2	Duplex	PN40 / 300 lbs	DN32	1 1/2"
K2	1.4539	PN40 / 300 lbs	DN32	1 1/2"
H2	Hastelloy C	PN40 / 300 lbs	DN32	1 1/2"
M2	Monel	PN40 / 300 lbs	DN32	1 1/2"

C3	C.S.	PN63 / 300 lbs	DN40	1 1/2"
S3	316 SS	PN63 / 300 lbs	DN40	1 1/2"
X3	Duplex	PN63 / 300 lbs	DN40	1 1/2"
K3	1.4539	PN63 / 300 lbs	DN40	1 1/2"
H3	Hastelloy C	PN63 / 300 lbs	DN40	1 1/2"
M3	Monel	PN63 / 300 lbs	DN40	1 1/2"

C4	C.S.	PN100 / 600 lbs	DN40	1 1/2"
S4	316 SS	PN100 / 600 lbs	DN40	1 1/2"
X4	Duplex	PN100 / 600 lbs	DN40	1 1/2"
K4	1.4539	PN100 / 600 lbs	DN40	1 1/2"
H4	Hastelloy C	PN100 / 600 lbs	DN40	1 1/2"
M4	Monel	PN100 / 600 lbs	DN40	1 1/2"

10. end support (only FTH-26)

0	without support
C	end support, material: C.S.
S	end support, material: 316 SS
X	end support, material: Duplex
K	end support, material: 1.4539
H	end support, material: Hastelloy C
M	end support, material: Monel

11. isolation valve for the sensor profile

s. page 102

12. flanged packing gland

S	material: 316 SS (standard)
X	1.4462 Duplex
K	1.4539
H	Hastelloy C
M	Monel

13. cage nipple

PC	material: C.S. (standard)
PS	material: 316 SS
PX	1.4462 Duplex
P3	1.4539
PH	Hastelloy C
PM	Monel

14. packing material for the flanged and welded packing gland

1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C

15. gears

0	without gears
1	with gears

16. thermal isolation

KI	without
X..	thermal isolation in inches or mm, please specify

17. piping run

HL	horizontal
VL	vertikal

18. integ. RTD resit. thermocouple

T0	without
TA	3-wire
TB	3-wire, with ex-proofness

2. Order specification ITABAR-Flow-Sensor, series Flo-Tap

Instrument connection and shut-off device

isolation valve for the sensor profile, DIN

MF08	ball valve, DN32 / PN16, material: C.S.
MF09	ball valve, DN32 / PN16, material: 1.4401
MF10	ball valve, DN32 / PN16, material Duplex
MF11	ball valve, DN32 / PN16, material: Monel
MF12	ball valve, DN32 / PN16, material: Hastelloy C
MF13	ball valve, DN32 / PN40, material: C.S.-Stahl
MF14	ball valve, DN32 / PN40, material: 1.4401
MF15	ball valve, DN32 / PN40, material: Duplex
MF16	ball valve, DN32 / PN40, material: Monel
MF17	ball valve, DN32 / PN40, material: Hastelloy C
MF18	ball valve, DN40 / PN63, material C.S.
MF19	ball valve, DN40 / PN63, material: 1.4401
MF20	ball valve, DN40 / PN63, material: Duplex
MF21	ball valve, DN40 / PN63, material: Monel
MF22	ball valve, DN40 / PN63, material: Hastelloy C
MS10	gate valve DN40 / PN100, material: C.S.
MS11	gate valve DN40 / PN100, material: 1.4401



isolation valve for the sensor profile, ANSI

AF08	ball valve, 1 1/2" ANSI 150 lbs, material: C.S.
AF09	ball valve, 1 1/2" ANSI 150 lbs, material: 1.4401
AF10	ball valve, 1 1/2" ANSI 150 lbs, material: Duplex
AF11	ball valve, 1 1/2" ANSI 150 lbs, material: Monel
AF12	ball valve, 1 1/2" ANSI 150 lbs, material: Hastelloy C
AF13	ball valve, 1 1/2" ANSI 300 lbs, material: C.S.
AF14	ball valve, 1 1/2" ANSI 300 lbs, material: 1.4401
AF15	ball valve, 1 1/2" ANSI 300 lbs, material: Duplex
AF16	ball valve, 1 1/2" ANSI 300 lbs, material: Monel
AF17	ball valve, 1 1/2" ANSI 300 lbs, material: Hastelloy C
AS10	gate valve 1 1/2" ANSI 600 lbs, material: C.S.
AS11	gate valve, 1 1/2" ANSI 600 lbs, material: 1.4401



1. Order specification ITABAR-FLOW-Sensor, series FTH-35/36

1. type of sensor				
35	without end support			
36	with end support			
2. inside diameter and wall thickness.				
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify			
3. sensor material				
S	316 SS (standrad)			
X	1.4462 Duplex			
K	1.4539			
H	Hastelloy C			
M	Monel			
4. sensor flange, always identically to sensor material.				
SM	flange according DIN			
SA	flange according ANSI			
5. gasket				
1	gasket strip according to DIN			
2	ANSI RF			
3	ANSI RF SF (smooth finish)			
4	RTJ			
6. PN, material and DN of Sensor flange				
			DIN	ANSI
C01	PN16 / 150 lbs	material: 316 SS	DN50	2"
C02	PN40 / 300 lbs	material: 316 SS	DN50	2"
C03	PN63 / 300 lbs	material: 316 SS	DN50	2"
C04	PN100 / 600 lbs	material: 316 SS	DN50	2"
C10	PN16 / 150 lbs	material: 1.4462 (Duplex)	DN50	2"
C11	PN40 / 300 lbs	material: 1.4462 (Duplex)	DN50	2"
C12	PN63 / 300 lbs	material: 1.4462 (Duplex)	DN50	2"
C13	PN100 / 600 lbs	material: 1.4462 (Duplex)	DN50	2"
C20	PN16 / 150 lbs	material: 1.4539	DN50	2"
C21	PN40 / 300 lbs	material: 1.4539	DN50	2"
C22	PN63 / 300 lbs	material: 1.4539	DN50	2"
C23	PN100 / 600 lbs	material: 1.4539	DN50	2"
C30	PN16 / 150 lbs	material: Hastelloy C4	DN50	2"
C31	PN40 / 300 lbs	material: Hastelloy C4	DN50	2"
C32	PN63 / 300 lbs	material: Hastelloy C4	DN50	2"
C33	PN100 / 600 lbs	material: Hastelloy C4	DN50	2"
C40	PN16 / 150 lbs	material: Monel	DN50	2"
C41	PN40 / 300 lbs	material: Monel	DN50	2"
C42	PN63 / 300 lbs	material: Monel	DN50	2"
C43	PN100 / 600 lbs	material: Monel	DN50	2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
9. material connecting piece, with flange (max. pressure rating)				
always identically to sensor flange.				
C1	C.S.	PN16 / 150 lbs	DN50	2"
S1	316 SS	PN16 / 150 lbs	DN50	2"
X1	Duplex	PN16 / 150 lbs	DN50	2"
K1	1.4539	PN16 / 150 lbs	DN50	2"
H1	Hastelloy C	PN16 / 150 lbs	DN50	2"
M1	Monel	PN16 / 150 lbs	DN50	2"

1. Order specification ITABAR-FLOW-Sensor, series FTH-35/36

C2	C.S.	PN40 / 300 lbs	DN50	2"
S2	316 SS	PN40 / 300 lbs	DN50	2"
X2	Duplex	PN40 / 300 lbs	DN50	2"
K2	1.4539	PN40 / 300 lbs	DN50	2"
H2	Hastelloy C	PN40 / 300 lbs	DN50	2"
M2	Monel	PN40 / 300 lbs	DN50	2"

C3	C.S.	PN63 / 300 lbs	DN50	2"
S3	316 SS	PN63 / 300 lbs	DN50	2"
X3	Duplex	PN63 / 300 lbs	DN50	2"
K3	1.4539	PN63 / 300 lbs	DN50	2"
H3	Hastelloy C	PN63 / 300 lbs	DN50	2"
M3	Monel	PN63 / 300 lbs	DN50	2"

C4	C.S.	PN100 / 600 lbs	DN50	2"
S4	316 SS	PN100 / 600 lbs	DN50	2"
X4	Duplex	PN100 / 600 lbs	DN50	2"
K4	1.4539	PN100 / 600 lbs	DN50	2"
H4	Hastelloy C	PN100 / 600 lbs	DN50	2"
M4	Monel	PN100 / 600 lbs	DN50	2"

10. end support (only FTH-36)

0	without support
C	end support, material: C.S.
S	end support, material: 316 SS
X	end support, material: Duplex
K	end support, material: 1.4539
H	end support, material: Hastelloy C
M	end support, material: Monel

11. isolation valve for the sensor profile

s. page 106

7. flanged packing gland

S	material: 316 SS (standard)
X	1.4462 Duplex
K	1.4539
H	Hastelloy C
M	Monel

13. cage nipple

PC	material: C.S. (standard)
PS	material: 316 SS
PX	1.4462 Duplex
P3	1.4539
PH	Hastelloy C
PM	Monel

14. packing material for the flanged and welded packing gland

1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C

15. gears

0	without gears
1	with gears

16. thermal isolation

KI	without
X..	thermal isolation in inches or mm, please specify

17. piping run

HL	horizontal
VL	vertikal

18. integ. RTD resit. thermocouple

T0	without
TA	3-wire
TB	3-wire, with ex-proofness

1. Order specification ITABAR-FLOW-Sensor, series FTH-35/36

FTH-																														
type of sensor	inside diameter and wall thickness	sensormaterial	sensor flange	gasket strip	PN, material and DN of Sensor	design assembly connecting pieces	assembly connecting piece with flange	material connecting piece, with flange	end support	isolation valve for the sensor profile	flanged packing gland	cage nipple	packing material for the flanged	gears	isolation	piping run	Integ. RTD resist. thermocouple													

19. process connection,	
	s. page 111
20. Instrum. valves	
	s. page 111

2. Order specification ITABAR-Flow-Sensor, series Flo-Tap

Instrument connection and shutt-off device	
isolation valve for the sensor profile, DIN	
MF30	ball valve DN50 / PN16, material: C.S.
MF31	ball valve DN50 / PN16, material: 1.4401
MF32	ball valve DN50 / PN16, material: Duplex
MF33	ball valve DN50 / PN16, material: Monel
MF34	ball valve DN50 / PN16, material: Hastelloy C
MF35	ball valve DN50 / PN40, material: C.S.
MF36	ball valve DN50 / PN40, material: 1.4401
MF37	ball valve DN50 / PN40, material: Duplex
MF38	ball valve DN50 / PN40, material: Monel
MF39	ball valve DN50 / PN40, material: Hastelloy C
MF40	ball valve DN50 / PN63, material: C.S.
MF41	ball valve DN50 / PN63, material: 1.4401
MF42	ball valve DN50 / PN63, material: Duplex
MF43	ball valve DN50 / PN63, material: Monel
MF44	ball valve DN50 / PN63, material: Hastelloy C
MS20	gate valve, DN50 / PN100, material: C.S.
MS21	gate valve DN50 / PN100, material: 1.4401



isolation valve for the sensor profile, ANSI	
AF30	ball valve 2" ANSI 150 lbs, material: C.S.
AF31	ball valve 2" ANSI 150 lbs, material: 1.4401
AF32	ball valve 2" ANSI 150 lbs, material: Duplex
AF33	ball valve 2" ANSI 150 lbs, material: Monel
AF34	ball valve 2" ANSI 150 lbs, material: Hastelloy C
AF35	ball valve 2" ANSI 300 lbs, material: C.S.
AF36	ball valve, 2" ANSI 300 lbs, Werkstoff: 1.4401
AF37	ball valve 2" ANSI 300 lbs, material: Duplex
AF38	ball valve 2" ANSI 300 lbs, material: Monel
AF39	ball valve 2" ANSI 300 lbs, material: Hastelloy C
AS20	gate valve 2" ANSI 600 lbs, material: C.S.
AS21	gate valve 2" ANSI 600 lbs, material: 1.4401



1. Order specification ITABAR-FLOW-Sensor, series FTH-65/66

1. type of sensor

- 65 without end support
- 66 with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

- S 316 SS (standrad)
- X 1.4462 Duplex
- K 1.4539
- H Hastelloy C
- M Monel

4. sensor flange, always identically to sensor material.

- SM flange according DIN
- SA flange according ANSI

5. gasket

- 1 gasket strip according to DIN
- 2 ANSI RF
- 3 ANSI RF SF (smooth finish)
- 4 RTJ

6. PN, material and DN of Sensor flange

			DIN	ANSI
D01	PN16 / 150 lbs	material: 316 SS	DN65	2 1/2"
D02	PN40 / 300 lbs	material: 316 SS	DN65	2 1/2"
D03	PN63 / 300 lbs	material: 316 SS	DN65	2 1/2"
D04	PN100 / 600 lbs	material: 316 SS	DN65	2 1/2"
D10	PN16 / 150 lbs	material: 1.4462 (Duplex)	DN65	2 1/2"
D11	PN40 / 300 lbs	material: 1.4462 (Duplex)	DN65	2 1/2"
D12	PN63 / 300 lbs	material: 1.4462 (Duplex)	DN65	2 1/2"
D13	PN100 / 600 lbs	material: 1.4462 (Duplex)	DN65	2 1/2"
D20	PN16 / 150 lbs	material: 1.4539	DN65	2 1/2"
D21	PN40 / 300 lbs	material: 1.4539	DN65	2 1/2"
D22	PN63 / 300 lbs	material: 1.4539	DN65	2 1/2"
D23	PN100 / 600 lbs	material: 1.4539	DN65	2 1/2"
D30	PN16 / 150 lbs	material: Hastelloy C4	DN65	2 1/2"
D31	PN40 / 300 lbs	material: Hastelloy C4	DN65	2 1/2"
D32	PN63 / 300 lbs	material: Hastelloy C4	DN65	2 1/2"
D33	PN100 / 600 lbs	material: Hastelloy C4	DN65	2 1/2"
D40	PN16 / 150 lbs	material: Monel	DN65	2 1/2"
D41	PN40 / 300 lbs	material: Monel	DN65	2 1/2"
D42	PN63 / 300 lbs	material: Monel	DN65	2 1/2"
D43	PN100 / 600 lbs	material: Monel	DN65	2 1/2"

7. design assembly connecting pieces

- R assembly connecting pieces with flange (standard)
- W Weldolet-assembly connecting pieces and flange

8. assembly connecting piece with flange, identically to sensor flange.

- O without flange
- M flange according DIN, gasket strip form C
- A flange according ANSI, gasket strip RF
- F flange according ANSI, gasket strip SF (smooth finish)
- T flange according ANSI, gasket strip RTJ

9. material connecting piece, with flange (max. pressure rating)

always identically to sensor flange.

C1	C.S.	PN16 / 150 lbs	DN65	2 1/2"
S1	316 SS	PN16 / 150 lbs	DN65	2 1/2"
X1	Duplex	PN16 / 150 lbs	DN65	2 1/2"
K1	1.4539	PN16 / 150 lbs	DN65	2 1/2"
H1	Hastelloy C	PN16 / 150 lbs	DN65	2 1/2"
M1	Monel	PN16 / 150 lbs	DN65	2 1/2"

1.Order specification ITABAR-FLOW-Sensor, series FTH-65/66

C2	C.S.	PN40 / 300 lbs	DN65	2 1/2"
S2	316 SS	PN40 / 300 lbs	DN65	2 1/2"
X2	Duplex	PN40 / 300 lbs	DN65	2 1/2"
K2	1.4539	PN40 / 300 lbs	DN65	2 1/2"
H2	Hastelloy C	PN40 / 300 lbs	DN65	2 1/2"
M2	Monel	PN40 / 300 lbs	DN65	2 1/2"

C3	C.S.	PN63 / 300 lbs	DN65	2 1/2"
S3	316 SS	PN63 / 300 lbs	DN65	2 1/2"
X3	Duplex	PN63 / 300 lbs	DN65	2 1/2"
K3	1.4539	PN63 / 300 lbs	DN65	2 1/2"
H3	Hastelloy C	PN63 / 300 lbs	DN65	2 1/2"
M3	Monel	PN63 / 300 lbs	DN65	2 1/2"

C4	C.S.	PN100 / 600 lbs	DN65	2 1/2"
S4	316 SS	PN100 / 600 lbs	DN65	2 1/2"
X4	Duplex	PN100 / 600 lbs	DN65	2 1/2"
K4	1.4539	PN100 / 600 lbs	DN65	2 1/2"
H4	Hastelloy C	PN100 / 600 lbs	DN65	2 1/2"
M4	Monel	PN100 / 600 lbs	DN65	2 1/2"

10. end support (only FTH-66)

0	without support
C	end support, material: C.S.
S	end support, material: 316 SS
X	end support, material: Duplex
K	end support, material: 1.4539
H	end support, material: Hastelloy C
M	end support, material: Monel

11. isolation valve for the sensor profile

s. page 110

7. flanged packing gland

S	material: 316 SS (standard)
X	1.4462 Duplex
K	1.4539
H	Hastelloy C
M	Monel

13. cage nipple

PC	material: C.S. (standard)
PS	material: 316 SS
PX	1.4462 Duplex
P3	1.4539
PH	Hastelloy C
PM	Monel

14. packing material for the flanged and welded packing gland

1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C

15. gears

0	without gears
1	with gears

16. thermal isolation

KI	without
X..	thermal isolation in inches or mm, please specify

17. piping run

HL	horizontal
VL	vertical

18. integ. RTD resit. thermocouple

T0	without
TA	3-wire
TB	3-wire, with ex-proofness

2. Order specification ITABAR-Flow-Sensor, series Flo-Tap

shut-off device for type FTH-65/66

isolation valve for the sensor profile, DIN

MF50	ball valve, DN65 / PN16, material: C.S.
------	---

MF51	ball valve, DN65 / PN16, material: 1.4401
------	---

MF52	ball valve, DN65 / PN16, material: Duplex
------	---

MF53	ball valve, DN65 / PN16, material: Monel
------	--

MF54	ball valve, DN65 / PN16, material: Hastelloy C
------	--

MF55	ball valve, DN65 / PN40, material: C.S.
------	---

MF56	ball valve, DN65 / PN40, material: 1.4401
------	---

MF57	ball valve, DN65 / PN40, material: Duplex
------	---

MF57	ball valve, DN65 / PN40, material: Monel
------	--

MF58	ball valve, DN65 / PN40, material: Hastelloy C
------	--

MF59	ball valve, DN65 / PN63, material: C.S.
------	---

MF60	ball valve, DN65 / PN63, material: 1.4401
------	---

MF61	ball valve, DN65 / PN63, material: Duplex
------	---

MF62	ball valve, DN65 / PN63, material: Monel
------	--

MF63	ball valve, DN65 / PN63, material: Hastelloy C
------	--

MS30	gate valve, DN65 / PN100, material: C.S.
------	--

MS31	gate valve, DN65 / PN100, material: 1.4401
------	--



isolation valve for the sensor profile, ANSI

AF50	ball valve, 2 1/2" ANSI 150 lbs, material: C.S.
------	---

AF51	ball valve, 2 1/2" ANSI 150 lbs, material: 1.4401
------	---

AF52	ball valve, 2 1/2" ANSI 150 lbs, material: Duplex
------	---

AF53	ball valve, 2 1/2" ANSI 150 lbs, material: Monel
------	--

AF54	ball valve, 2 1/2" ANSI 150 lbs, material: Hastelloy C
------	--

AF55	ball valve, 2 1/2" ANSI 300 lbs, material: C.S.
------	---

AF56	ball valve, 2 1/2" ANSI 300 lbs, material: 1.4401
------	---

AF57	ball valve, 2 1/2" ANSI 300 lbs, material: Duplex
------	---

AF58	ball valve, 2 1/2" ANSI 300 lbs, Werkstoff: Monel
------	---

AF59	ball valve, 2 1/2" ANSI 300 lbs, material: Hastelloy C
------	--

AS30	gate valve, 2 1/2" ANSI 600 lbs, material: C.S.
------	---

AS31	gate valve, 2 1/2" ANSI 600 lbs, material: 1.4401
------	---



2. Order specification ITABAR-Flow-Sensor, series Flo-Tap

Instrument connection and shut-off device

type FTH- 20, 21, 25, 26, 35, 36, 65, 66

instrument connection

A04	sensorhead with 1/4" NPT outside thread
A03	sensorhead with 1/2" NPT outside thread
A06	flange plate to direct mount a 3-valve manifold
A07	flange plate to direct mount a 5-valve manifold

shut-off device for effect pressure pipe.

A00	ohne Absperrorgan
A55	ball valve PN40, case C.S. / female thread 1/2" NPT , packing: Teflon
A56	ball valve PN40, case 1.4401. / female thread 1/2" NPT , packing: Teflon
A57	ball valve PN40, case C.S. / female thread 1/4" NPT , packing: Teflon
A58	ball valve PN40, case 1.4401. / female thread 1/4" NPT , packing: Teflon
A59	shut-off valve 1/4" NPT, PN400, case C.S. / female thread 1/4" NPT packing: graphite
A60	shut-off valve 1/4" NPT, PN400, case 1.4401 / female thread 1/4" NPT packing: graphite
A61	shut-off valve 1/2" NPT, PN400, case C.S. / female thread 1/2" NPT packing: graphite
A62	shut-off valve 1/2" NPT, PN400, case 1.4401 / female thread 1/2" NPT packing: graphite
A90	shut-off valve 1/2" NPT, 800 lbs, C.S. / female thread 1/2" NPT, packing: graphite
A91	shut-off valve 1/2" NPT, 800 lbs, 1.4401 / female thread 1/2" NPT, packing: graphite
A63	shut-off valve 1/2" NPT, PN10, PTFE
A64	shut-off valve G 1/2", PVDF
A66	direct mount, with 3-valve manifold, PN400, case 1.4401 / packing: PTFE (only with A06)
A67	direct mount, with 3-valve manifold, PN10, case PTFE / packing: PTFE (only with A06)
A71	direct mount, with 5-valve manifold, PN400, case 1.4401 / packing: PTFE (only with A07)

10. DP Sensors for Steam

10.1 Selection Criteria

The tables in this section offer an overview of DP sensors used in steam flow measurement, their design elements and the various installation options.

The tables in Fig 8.8 allow the material selection for all important components, depending on operating pressures and temperatures. The operating limits mentioned are determined by the assembly parts, (e.g. threaded weld-o-lets and assembly flanges). For a particular process condition other components – such as sensor profile, condensate pots and shut-off valves - can be selected with the help of pressure- and temperature tables.

Condensate pots are required for steam flow measurement so that a constant transition from steam to condensate and vice versa is assured. Furthermore the water buffer inside the condensate pots serves as temperature protection for the connected DP transmitter. If not otherwise specified by the customer the condensate pots are supplied welded to the shut-off valves.

In cases where a double shut-off assembly with two shut-off valves is needed the order code is to be expanded accordingly.

The following selection process for steam flow sensors is recommended:

A. Selection of Proper Sensor Type

1. Material selection of sensor types and their assembly parts; the material has to fit the pipe material in order for the welding to be compatible.
2. Pressure rating selection of assembly parts; must be able to handle the operating pressure and temperature of the steam.
3. If applicable: Selection of wet-tap or non-wet-tap option and model
4. If applicable: Selection of mechanical connecting parts between assembly portion of the sensor and the pipe.

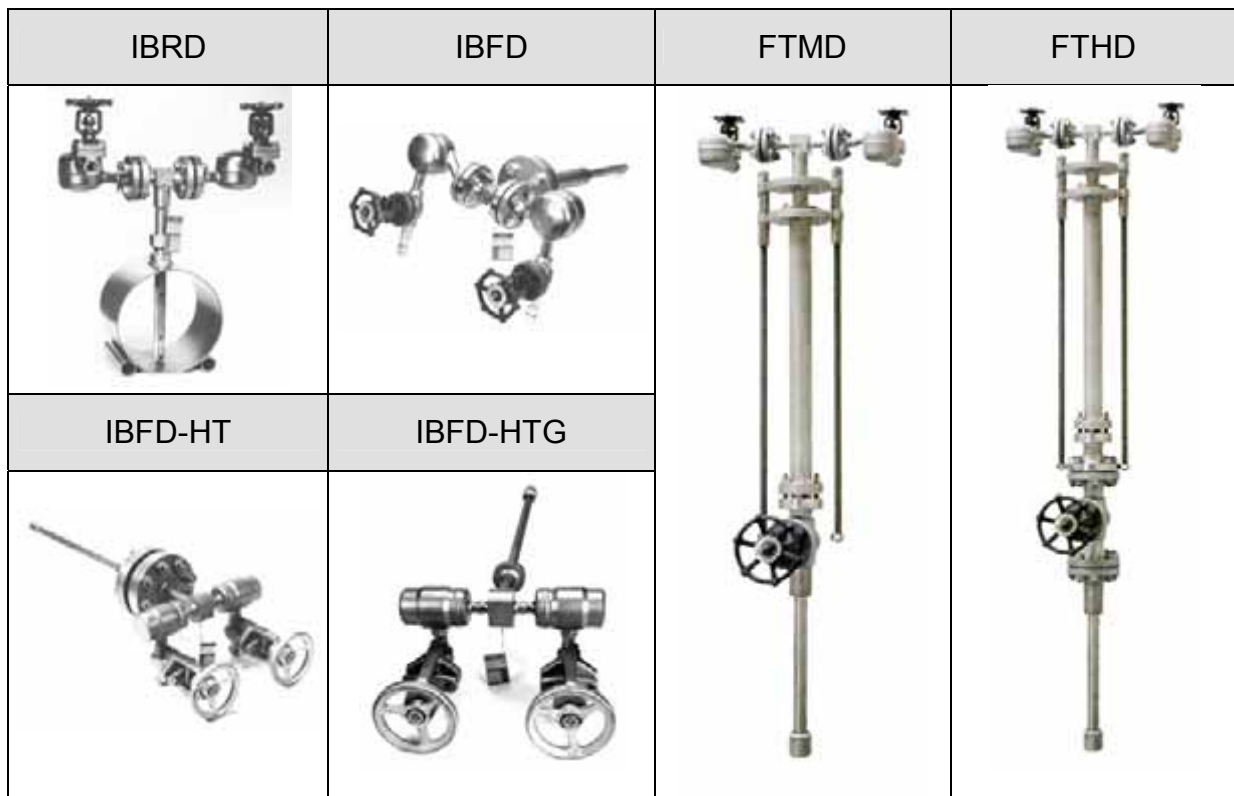
The WINFLOW sizing program helps the customer to select the correct sensor type depending on the maximum flow volume and the pipe size.

C. Selection of Options

The selection of the various options is done in the sequence suggested by the sensor's „Order Code Information“. It is important to note that the materials of the sensor (sensor profile, condensate pots, valves) not necessarily have to be identical with the material of the assembly parts. The following options are available :

1. Selection of the sensor material : the material of the sensor profile must meet the application's operating pressure and temperature requirements
2. Selection of the condensate pots : the material and version of the condensate pots must meet the application's operating pressure and temperature requirements.
3. Selection of the valves for the pressure connections appropriate for the steam's operating pressure and temperature.

Steam Sensor Overview



Features:	IBRD	IBFD	IBFD-HT	IBFD-HTG	FTMD	FTHD
Installation / Removal:						
Installation under pressure possible	---	---	---	---	X	X
Pipe to be emptied for installation	X	X	X	X	---	---
Material of mounting assembly parts (in order to weld it should be same as pipe material)						
C-steel	X	X	---	---	X	X
(1.4571) st steel	---	---	---	---	X	X
15 Mo 3, 13 CrMo 4 4, 10 CrMo 9 10, 10 CrMoVNb 91	---	X	X	X	---	---
Sensor material (to be selected for specific operating conditions)						
St steel (1.4571) (to max 1615 °F, IBRD max. 680°F)	X	X	---	---	X	X
1.5415, 15 Mo 3 (to max. 1802 °F)	---	---	X	X	---	---
1.7335, 13 CrMo 4 4 (to max. 1870 °F)	---	---	X	X	---	---
1.7380, 10 CrMo 9 10 (to max. 1938 °F)	---	---	X	X	---	---
1.4903, 10 CrMoVNb 91 (to max. 2210 °F)	---	---	X	X	---	---
Type of mounting assembly:						
Threaded weld-o-let (to max. 680 °F)	X	---	---	---	---	---
Welding boss (to max. 680 °F)	---	---	---	---	X	---
Flanged weld assembly	---	X	X	---	---	X
Weld assembly w/out flange	---	---	---	X	---	---
Further design features:						
Single-piece welded construction	---	---	---	X		
Threaded shut-off valves for sensor profile	---	---	---	---	X	---
Flanged shut-off valves for sensor profile	---	---	---	---	---	X
Screw-rods for easy removal	---	---	---	---	X	X
Option: wheel for removal	---	---	---	---	X	X

**International Comparison of standards
 Comparaison Internationale des Normes
 Internationaler Normenvergleich**

**Structural and constructional steels
 Aciers de construction
 Baustähle**

Exchangeability only possible after a thorough examination of the individual case
 Interchangeabilité est seulement admissible après examen soigneux du cas singulier.
 Die Möglichkeit einer Austauschbarkeit muß von Fall zu Fall entschieden werden

Bundesrepublik Deutschland République Fédérale d'Allemagne Federal Republic of Germany	W.-Nr DIN	1.5415 15 Mo 3	1.7335 10CrMo 4 4	1.7380 10 CrMo 9 10
Belgien Belgique Belgium	NBN	16 Mo 3	14 CrMo 45	-
Frankreich France France	AFNOR	15 D 3	15 CD 3.5 15 CD 4.5	12 CD 9.10 10 CD 9.10
Großbritannien Grande-Bretagne Great Britain	B.S.	-	620-440 620-470 620-540 1501-620;621	1501-622/515 1501-622/690 1502-622 3604-622
Italien Italie Italy	UNI	16 Mo 3 (KG;KW)	14 CrMo 3 16 CrMo 3	12 CrMo 910;KW;KG G 14 CrMo 910
Japan Japon Japan	JIS	-	SFVA F 12	SFVA F 22 A;B SCMV 4 SCPH 32-CF
Schweden Suède Sweden	SS	2912	2216	2218
Sowjetunion U.R.S.S U.S.S.R.	GOST	-	12ChM 15ChM	12Ch8
Spanien Espagne Spain	UNE	F.2601-16 Mo 3	F.2631 - 14 CrMo 4 5	TU.H
U.S.A. U.S.A. U.S.A.	AISI/SAE/ASTM	A 204 Gr. A 4017	A 182 - F11;F12 A387 Gr. 12 Cl.2	A 182 F22 A387 Gr. 22 Cl.2

10.2 Type IBRD to 235.2 PSI (16 bar) and 670°F (200°C)

Description

The ITABAR steam sensors series IBRD are designed to measure steam up to 235.2 PSI (16 bar) and 670°F (200°C). The standard sensor material is 316 st steel (1.4571). The installation is normally done with threaded weld-o-lets. For safety reasons it is important to ensure the tightness of the threaded connection. Tightening of the threaded nut should be done with a wrench.

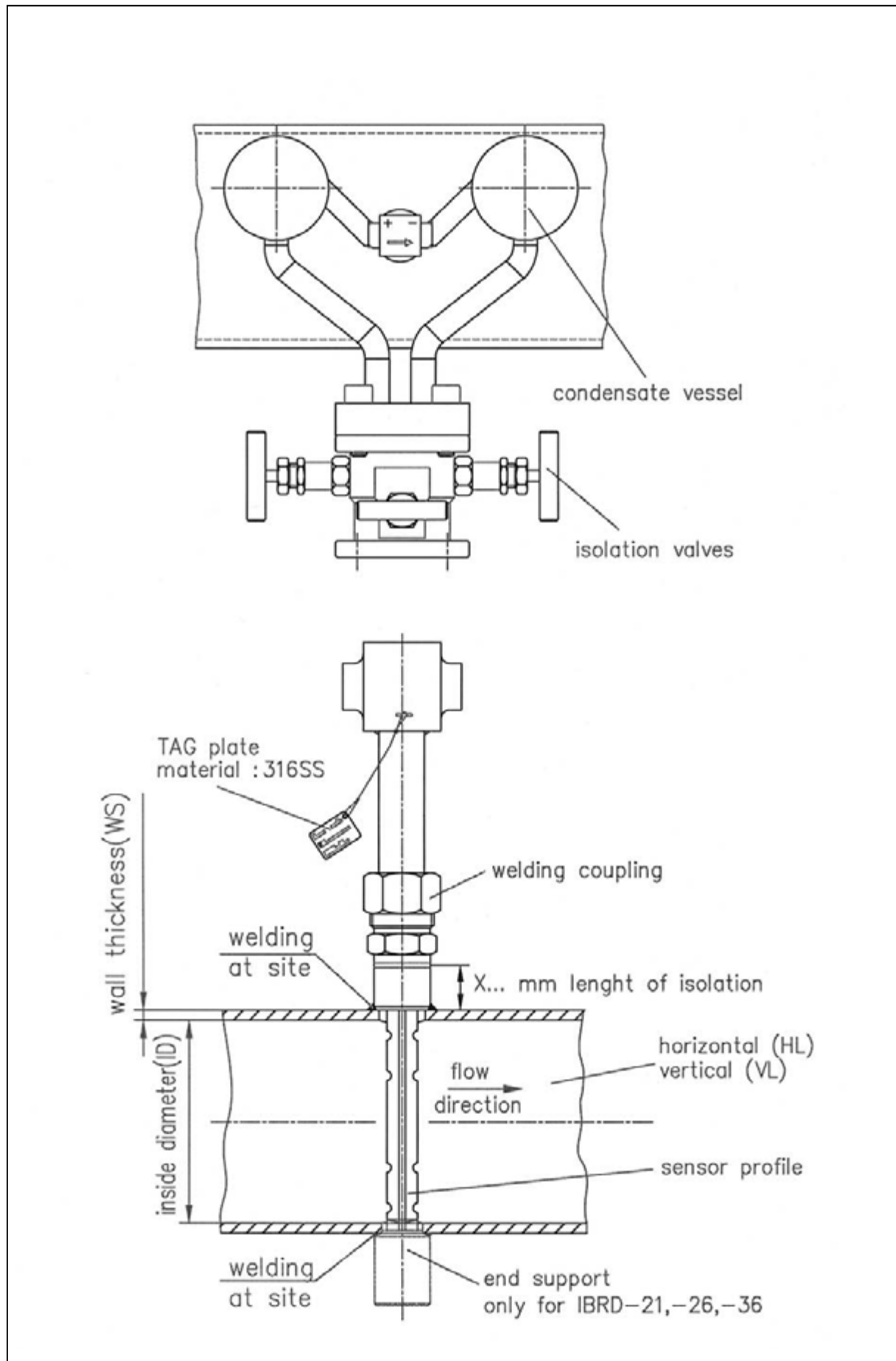


Fig. 8.1: Compact version of a flow sensor used to measure steam mass flow. The components: DP sensor with welded condensate pots, wet-tap temperature sensor, flange plate with 3-way-manifold and DP transmitter to measure the differential pressure, the operating pressure and the operating temperature, and to calculate mass flow.



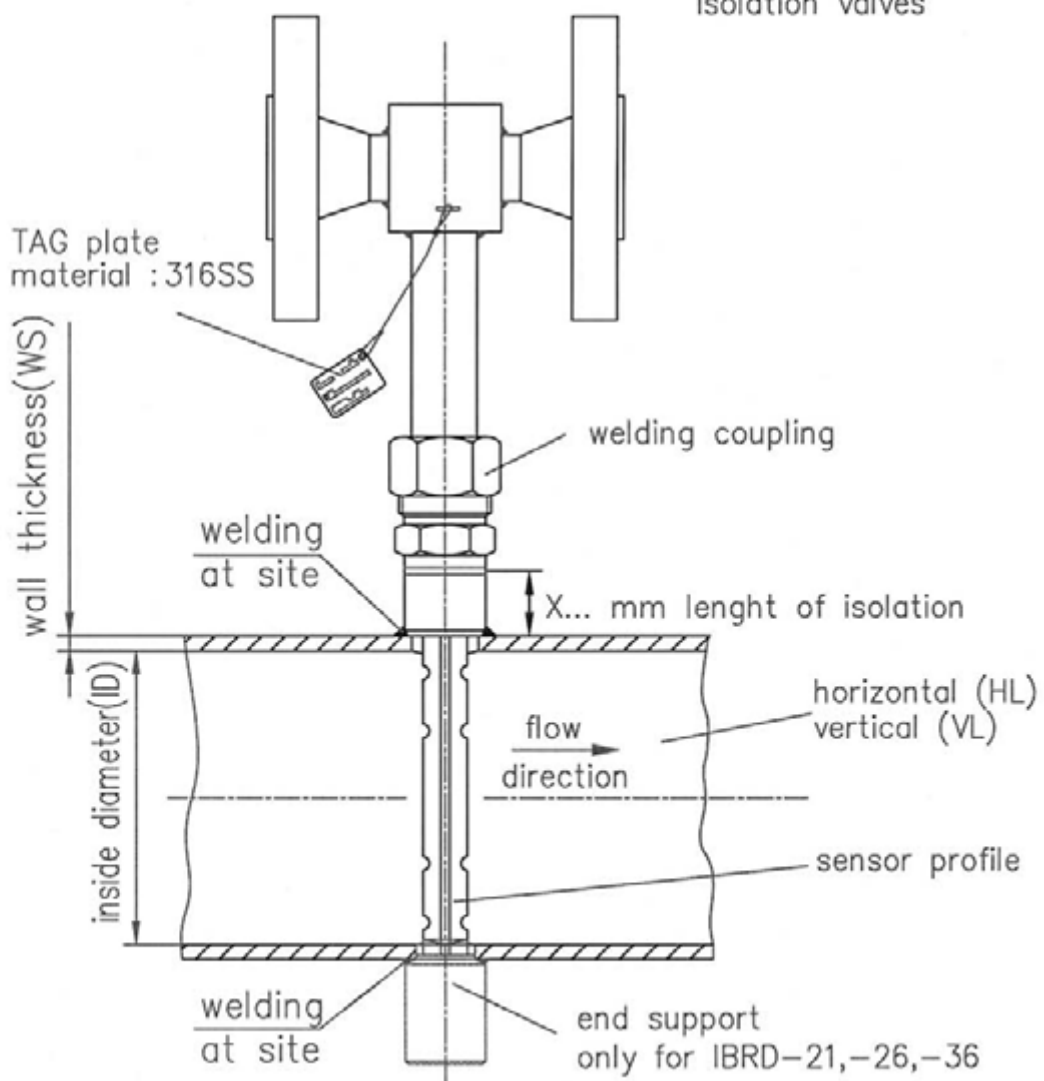
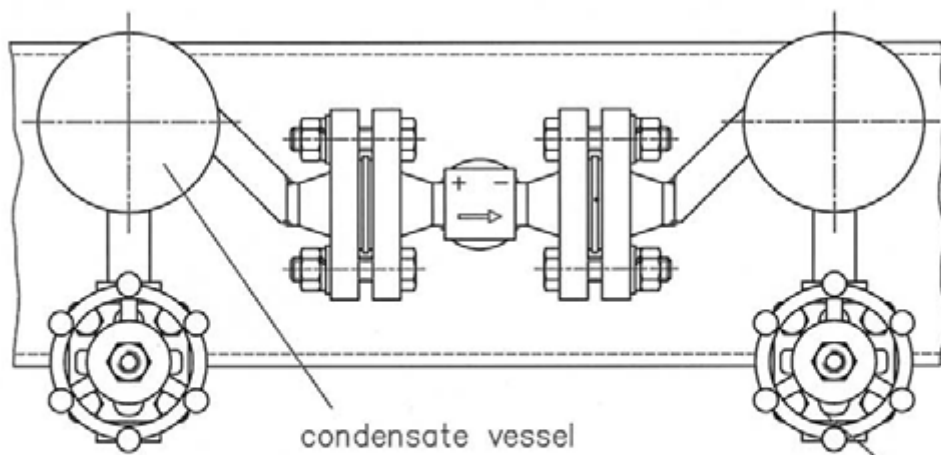
Fig. 8.2: DP sensor to measure volumetric steam flow. The components: threaded weld-o-let, sensor head with flanges, condensate pots and screwed on ANSI-Slide valve 800 lbs

Compact Version ITABAR Series IBRD with Flange Plate



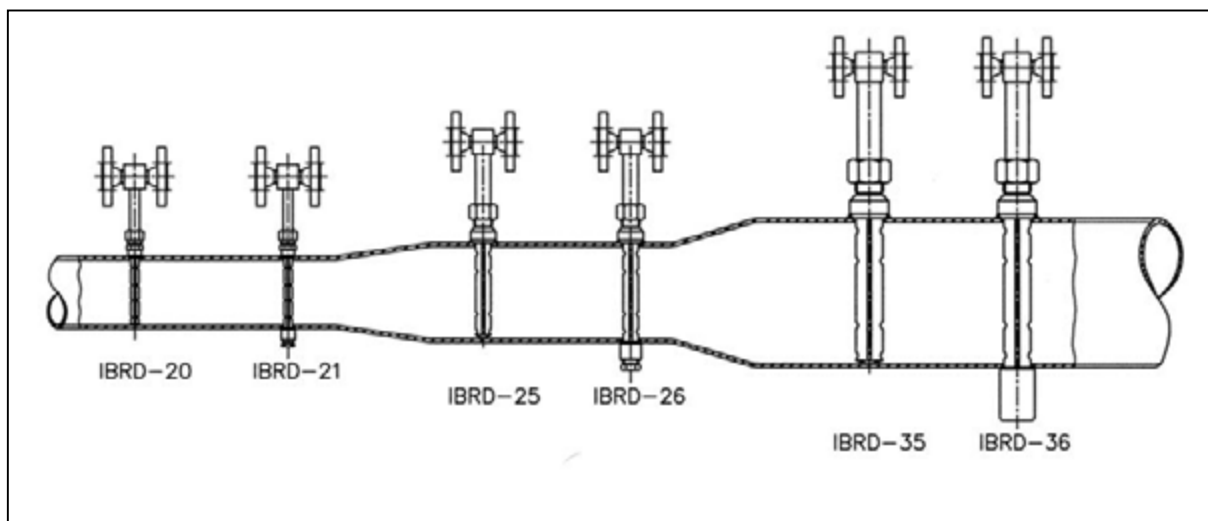
ITABAR Series IBRD, Flanged Connection at Sensor Head

seperate installation of sensor and transmitter



Oder Data for ITABAR Series IBRD 20/21/25/25/35/36

1. Sensor Type



Pipe Size inches mm		Maxium Flow Volume GPM					
		Sensor Type					
		IBRD -20	IBRD -21	IBRD -25	IBRD -26	IBRD -35	IBRD -36
1 ½	DN 40	228	541	---	---	---	---
2	DN 50	329	770	---	---	---	---
2 ¼	DN 65	501	1161	---	---	---	---
2 ½	DN 80	686	1566	---	---	---	---
4	DN 100	924	2099	1126	2618	---	---
5	DN 125	1201	2996	1504	3454	---	---
6	DN 150	---	---	1878	4285	---	---
8	DN 200	---	---	2622	5926	---	---
10	DN 250	---	---	3418	7695	---	---
12	DN 300	---	---	4272	9596	8830	19826
14	DN 350	---	---	5090	11418	10608	23786
16	DN 400	---	---	5882	13173	12390	27755
20	DN 500	---	---	7519	16830	15787	35323
24	DN 600	---	---	9116	20394	19245	43040
28	DN 700	---	---	10753	24059	22818	51013
32	DN 800	---	---	12491	27913	26470	59171

These values are for water of 0.999 SGU and at a temperature T = 68 °F. To calculate volumetric or mass flow of fluids with other densities see chapter 6 „Specifications of DP Sensors with WINFLOW“.

Selection and Specification of a Steam Flow Sensor P-max. 235,2 psi, T-max. 680°F

To Be Decided By Customer Before Sensor Selection

1. Remote mounting of DP transmitter – separate from the sensor (connections via Ermeto coupling, or compact version (DP transmitter integral with sensor))
2. Sensor to be equipped with integral PT100 temperature sensor

Existing Process Data

Pipe size (ID) and pipe wall thickness, pipe material
Pipe configuration at sensor location; insulation of pipe (thickness)
Flow volume
Process pressure (abs.)
Process temperature

Example:

1. Pipe ID: 13,64 inches, wall thickness: 0,18 inches
2. Pipe material : C.S. (St 35.8)
3. Insulation: 3,94 inches
4. Pipe configuration: horizontal
5. Flow max. 35000 kg/h (saturated steam)
6. Pressure: 6 bar A (88,2 PSI/ abs.)
7. Temperature 158,85°C (540,09 °F)
8. Selected option : integrated PT-100 temperature sensor

The sensor type IBRD-25 or IBRD-26 are selected via the pipe diameter in the table on page 117,. The Winflow program supplies information about the sensor type.

The above mentioned Winflow calculation will determine sensor type IBRD-25. The differential pressure according to process data entered is 40,3 mbar.

Sensor type IBRD-25 can be used up to a max. flow of (lb/hr) 57310 kg/h. Should the flow volume be higher than allowed for the selected sensor the WINFLOW program will issue a message: "Please select another sensor type". The customer can then for example select a sensor type IBRD-26 (w/end support).

Order code example:

IBRD-25-ID346,6/4,5mm-S-1-0-K1-C-X100-HL-TA-A81

INTRA-AUTOMATION GmbH

D-41515 Grevenbroich * Otto-Hahn-Str. 20 * Tel: +49 2181-68761 * Fax: +49 2181-64492

WINFLOW 2.75 (I) Diff. Pressure Calculation ITABAR - Flow - Sensor

Company: Mustermann
Name(capital letters):
Street:
Zip Code/City:
Offer-/Com. No:
P. Order Number:
Tag No.:
Serial No.:
Pipe Data: ID= 346,600/4,500 mm - horizontal
Date: 18.04.2002
Person in charge U.P.

Calculation: Mass rate Gas & steam
Fluid: Saturated steam

Pipe Internal Dimensions: 346,600 mm
Flowing Temperature: 158,850 °C
Flowing Pressure: 6,000 bar A
Density: 3,167 kg/m³
Viscosity: 0,0140 cPs
K-Factor: 0,6345 without unit

Base Temperature	273,15 Kelvin
Base Pressure	101,30 kPa

	QMax	QNorm	QMin	
Flow Rate	35.000,00	28.000,00	7.000,00	kg/H
Reynolds No.	2.550.490	2.040.392	510.098	without unit
Permanent press. loss	3,290	2,100	0,130	mbar
Expansionsfactor	0,999	0,999	1,000	without unit
Velocity:	32,53	26,03	6,51	m/sec.
Differential Pressure	40,381	25,828	1,613	mbar

Itabar-Type: IBRD-25-346,6/4,5mm-S-1-0-K1-C-X100-HL-TA-A81
Material Sensor:
Note:

Max. DeltaP	112,70 mbar	Max. Flow Rate	58.521,05 kg/H
Natural Freq.:	145,24 hz	Operat. Freq.:	101,44 hz

1. Order specification ITABAR-FLOW-Sensor, series IBRD-20/21

1. type of sensor	
20	without end support
21	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material: 316 SS
5. material end support (only IBRD-21)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. instrument connection and condensate vessels	
	s. page 122
7. isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
8. piping run	
HL	horizontal
VL	vertikal
	9. instrument valves s. page 122

IBRD- / S

1. Order specification ITABAR-FLOW-Sensor, series IBRD-25/26

1. type of sensor	
25	without end support
26	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material: 316 SS
5. material end support (only IBRD-26)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. instrument connection and condensate vessels	
	s. page 122
7. isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
8. piping run	
HL	horizontal
VL	vertikal
9. integrated RTD resit. thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
	10. instrument valves s. page 122

IBRD- / S

1. Order specification ITABAR-FLOW-Sensor, series IBRD-35/36

1. type of sensor	
35	without end support
36	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
0	without
1	material: C.S.
2	material 316 SS
5. material end support (only IBRD-36)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316 SS
6. instrument connection and condensate vessels	
	s. page 122
7. isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
8. piping run	
HL	horizontal
VL	vertikal
9. integrated RTD resit. thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
10. instrument valves s. page 122	

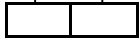
IBRD- / / / / / / / / / /

Order specification condensate vessel**IBRD 20, 21, 25, 26, 35, 36****flanged joint at sensor head**

K0	without condensate vessel
K1	condensate vessel, weld sockets 21,3mm, edge form 21 according DIN 2559

material and size for condensat vessel

H	Kesselbach H11	size: Ø 88,9 x 5 mm
S	material: 316 SS	size: Ø 88,9 x 3,2 mm

**Order specification instrument connection and shut-off valve****Typ IBRD- 20, 21, 25, 26, 35, 36****shut-off device for effect pressure pipe, standard with weld together condensat vessel**

A00	without shut-off valve
A81	ANSI gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material: A105 (C22) case: A105, packing: graphite-fiber glass
A82	ANSI gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material: 316L case: 316L, packing: graphite-fibre glas

**Order specification condensate vessel (only compact construction)****IBRD 20, 21, 25, 26, 35, 36****flanged joint of sensor head**

A1	condensate vessel with sensor head, effect pressure pipe and mountig flange welds directly
----	--

material and size condensate vessel

H	Kesselbach H11	size: Ø 88,9 x 5 mm
S	material 316 SS	size: Ø 88,9 x 3,2 mm

**Order specification connection, only with A1****type IBRD- 20, 21, 25, 26, 35, 36****connection**

A06	flange plate for für 3-way-valve block
A07	flange plate for 5-way-valve block

**Order specification for shut-off valve, only with A1****type IBRD- 20, 21, 25, 26, 35, 36****shut-off valve for effect pressure pipe and mountig flange welds directly**

A00	without shut- off valve
A66	3-way-mainfold, PN400, 1.4401 / packing: graphit
A71	5-way-mainfold, PN400, 1.4401 / packing: graphite



Picture of Condensate Pots

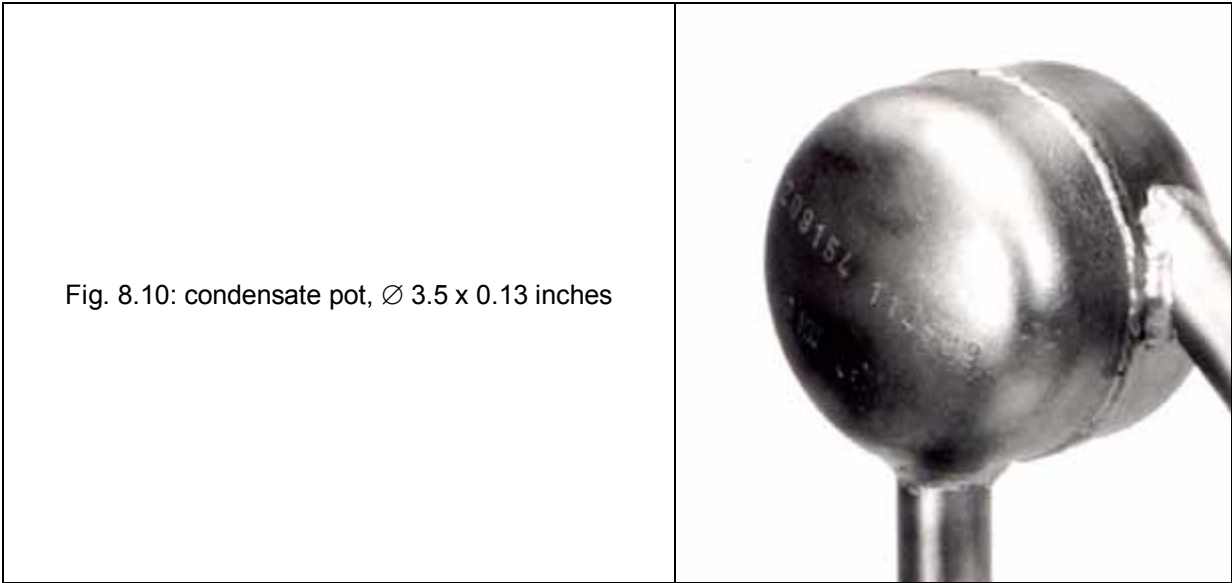


Fig. 8.10: condensate pot, Ø 3.5 x 0.13 inches

8.8.2 Pressure- Temperature Tables for Shut-Off Valves

Code	Maximum operating pressure (PSI) at temperature in °F											
	0	340	510	680	1020	1190	1360	1445	1570	1615	1700	1734
A81	2013	1955	1911	1866	1778	1602	1411	1176	1014	837	632	-
A82	2028	1955	1911	1866	1778	1602	1425	1308	1249	1205	1102	-



Fig. 8.13: Construction of small slidegate valve. A09

10.3 Sensor Series IBFD 100 bar (1470 psi) and 1591°F (475°C)

Description

The ITABAR-sensor series IBFD is designed to measure the flow of saturated and superheated steam. The installation assembly includes a flanged connection and thus allows the sensor to be used in high pressure applications (to 1470psi). The maximum possible temperature is 1591°F. The standard sensor material is 316 stainless steel (1.4571).

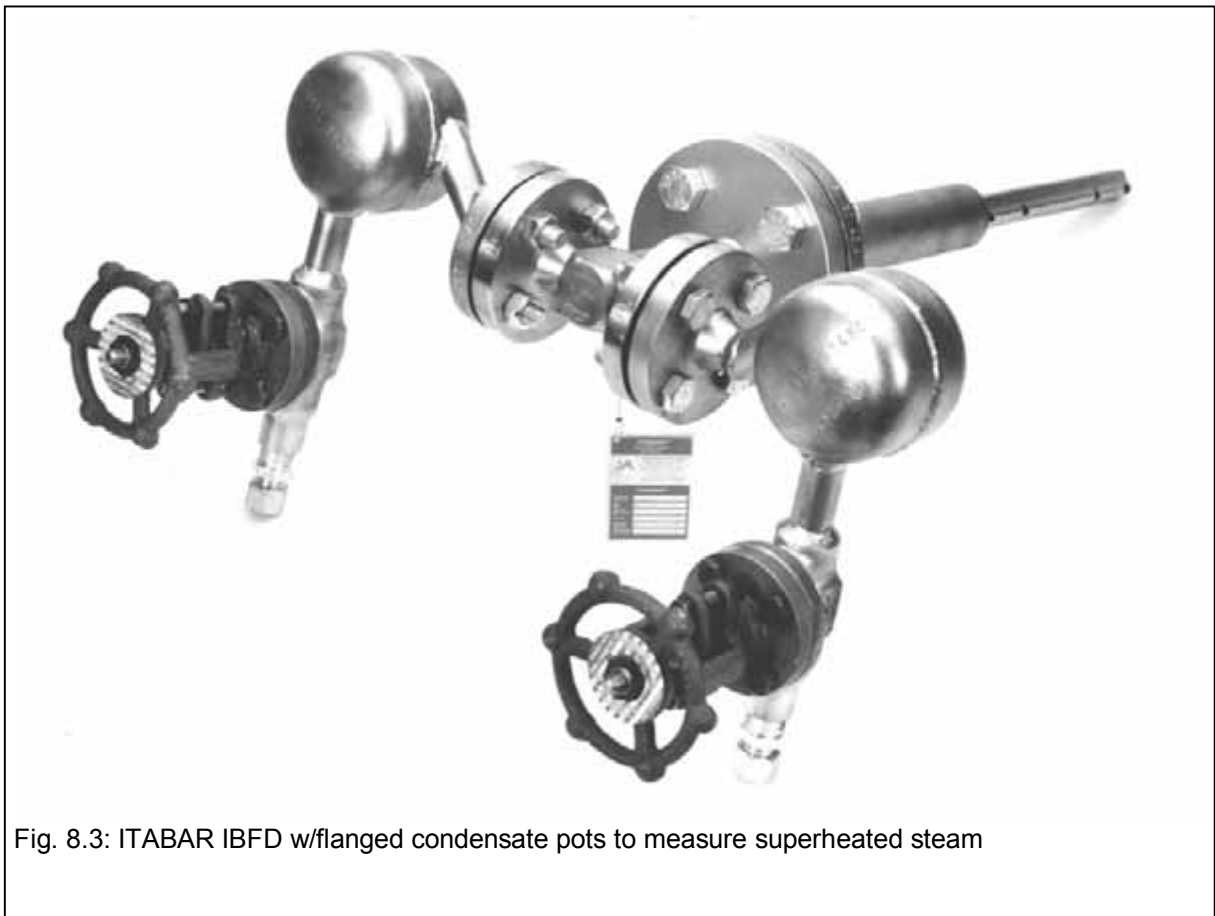
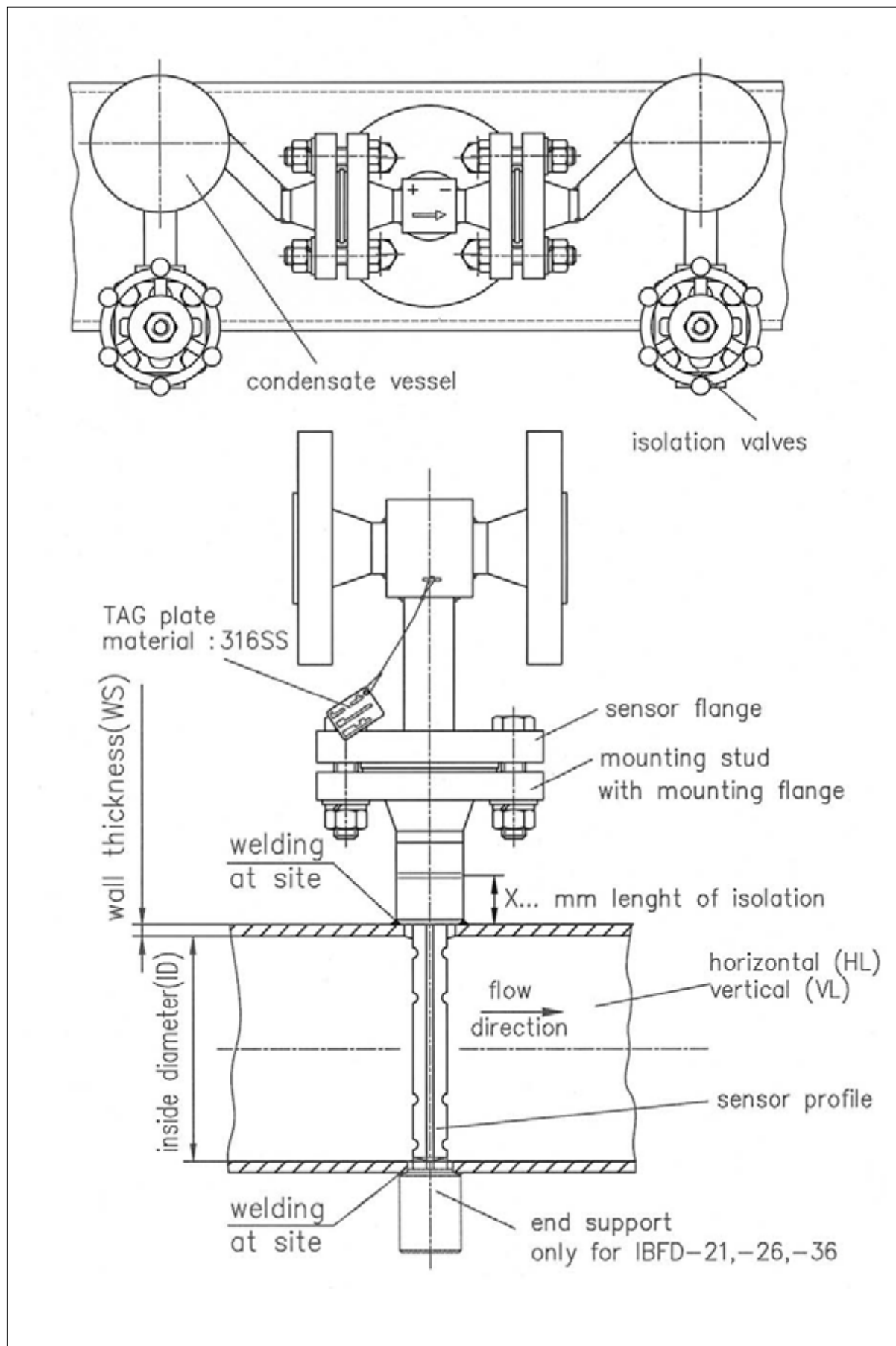


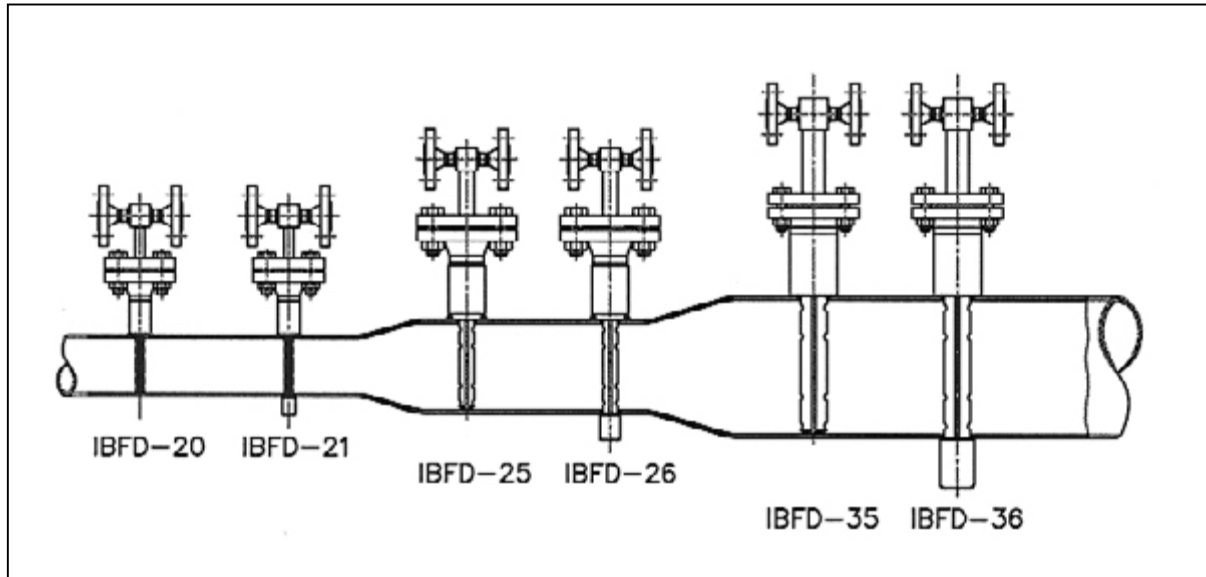
Fig. 8.3: ITABAR IBFD w/flanged condensate pots to measure superheated steam

Drawings for ITABAR Series IBFD



Order Data for ITABAR Series IBFD

1. Sensor Type



Pipe ID inches mm		Maxium Flow Volume GPM					
		IBFD - 20	IBFD - 21	IBFD - 25	IBFD - 26	IBFD - 35	IBFD - 36
1 ½	DN 40	126	501	---	---	---	---
2	DN 50	260	708	---	---	---	---
2 ¼	DN 65	420	1069	---	---	---	---
2 ½	DN 80	572	1443	---	---	---	---
4	DN 100	787	1936	902	2398	---	---
5	DN 125	1047	2512	1240	3168	---	---
6	DN 150	---	---	1579	3938	---	---
8	DN 200	---	---	270	5473	---	---
10	DN 250	---	---	3027	7150	---	---
12	DN 300	---	---	3841	8962	7739	18519
14	DN 350	---	---	4637	10718	9438	22321
16	DN 400	---	---	5403	12416	11154	26175
20	DN 500	---	---	7013	15976	14462	33528
24	DN 600	---	---	8588	19470	17850	41087
28	DN 700	---	---	10212	23069	21350	48923
32	DN 800	---	---	11897	26870	34965	56962
36	DN 900	---	---	---	30839	---	65155
40	DN 1000	---	---	---	34896	---	73453

These values are for water of 0.999 SGU and at a temperature T = 68 °F. To calculate volumetric or mass flow of fluids with other densities see chapter 6 „Specifications of DP Sensors with WINFLOW“.

1. Order specification ITABAR-FLOW-Sensor, series IBFD-20 / 21

1. type of sensor					
20	without end support				
21	with end support				
2. inside diameter and wall thickness.					
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify				
3. sensor material					
S	material 316 SS (standard)				
4. sensor flange, always identically to sensor material.					
SM	flange according DIN				
SA	flange according ANSI				
5. gasket					
1	gasket strip according to DIN				
2	ANSI RF				
3	ANSI RF SF (smooth finish)				
4	RTJ				
6. PN and DN of Sensor flange				DIN	ANSI
1	PN16 / 150 lbs		DN25	1"	
2	PN40 / 300 lbs		DN25	1"	
3	PN63 / 300 lbs		DN25	1"	
4	PN100 / 600 lbs		DN25	1"	
7. design assembly connecting pieces					
R	assembly connecting pieces with flange (standard)				
W	Weldolet-assembly connecting pieces and flange				
8. assembly connecting piece with flange, identically to sensor flange.					
0	without flange				
M	flange according DIN, gasket strip form C				
A	flange according ANSI, gasket strip RF				
F	flange according ANSI, gasket strip SF (smooth finish)				
T	flange according ANSI, gasket strip RTJ				
9. material connecting piece, with flange (max. press. rat.)				DIN	ANSI
always identically to sensor flange.					
C1	C.S.	PN16 / 150 lbs	DN25	1"	
S1	316 SS	PN16 / 150 lbs	DN25	1"	
P1	1.5415, 15 Mo 3	PN16 / 150 lbs	DN25	1"	
R1	1.7335, 13CrMo 4 4	PN16 / 150 lbs	DN25	1"	
C2	C.S.	PN40 / 300 lbs	DN25	1"	
S2	316 SS	PN40 / 300 lbs	DN25	1"	
P2	1.5415, 15 Mo 3	PN40 / 300 lbs	DN25	1"	
R2	1.7335, 13CrMo 4 4	PN40 / 300 lbs	DN25	1"	
C3	C.S.	PN63 / 300 lbs	DN25	1"	
S3	316 SS	PN63 / 300 lbs	DN25	1"	
P3	1.5415, 15 Mo 3	PN63 / 300 lbs	DN25	1"	
R3	1.7335, 13CrMo 4 4	PN63 / 300 lbs	DN25	1"	
C4	C.S.	PN100 / 600 lbs	DN25	1"	
S4	316 SS	PN100 / 600 lbs	DN25	1"	
P4	1.5415, 15 Mo 3	PN100 / 600 lbs	DN25	1"	
R4	1.7335, 13CrMo 4 4	PN100 / 600 lbs	DN25	1"	
10. end support (IBFD-21)					
0	without support				
C	end support, material: C.S.				
S	end support, material: identically to sensor flange.				
11. condensate vessel with connection					
	s. page 133				

1.Order specification ITABAR-FLOW-Sensor, series IBFD-20 / 21

type of sensor															12. thermal isolation	
inside diameter and wall thickness															KI	without
sensor material															X..	thermal isolation in inches or mm, please specify
sensor flange															13. piping run	
gasket															HL	horizontal
PN, material and DN of Sensor flange															VL	vertikal
design assembly connecting pieces															14. process connection,	
assembly connecting piece with flange															s. page 133	
material connecting piece. with flange															15. Instrum. valves	
end support															s. page 133	
condesat vessel with connection																
isolation																
piping run																

1. Order specification ITABAR-FLOW-Sensor, series IBFD-25 / 26

1. type of sensor				
25	without end support			
26	with end support			
2. inside diameter and wall thickness.				
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify			
3. sensor material				
S	material 316 SS (standard)			
4. sensor flange, always identically to sensor material.				
SM	flange according DIN			
SA	flange according ANSI			
5. gasket				
1	Gasket strip according to DIN			
2	ANSI RF			
3	ANSI RF SF (smooth finish)			
4	RTJ			
6. PN and DN of Sensor flange				
			DN	ANSI
1	PN16 / 150 lbs		DN32	1 1/2"
2	PN40 / 300 lbs		DN32	1 1/2"
3	PN63 / 300 lbs		DN40	1 1/2"
4	PN100 / 600 lbs		DN40	1 1/2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
9. material connecting piece, with flange (max. press. rat.)				
			DN	ANSI
always identically to sensor flange.				
C1	C.S.	PN16 / 150 lbs	DN32	1 1/2"
S1	316 SS	PN16 / 150 lbs	DN32	1 1/2"
P1	1.5415, 15 Mo 3	PN16 / 150 lbs	DN32	1 1/2"
R1	1.7335, 13CrMo 4 4	PN16 / 150 lbs	DN32	1 1/2"
C2	C.S.	PN40 / 300 lbs	DN32	1 1/2"
S2	316 SS	PN40 / 300 lbs	DN32	1 1/2"
P2	1.5415, 15 Mo 3	PN40 / 300 lbs	DN32	1 1/2"
R2	1.7335, 13CrMo 4 4	PN40 / 300 lbs	DN32	1 1/2"
C3	C.S.	PN63 / 300 lbs	DN40	1 1/2"
S3	316 SS	PN63 / 300 lbs	DN40	1 1/2"
P3	1.5415, 15 Mo 3	PN63 / 300 lbs	DN40	1 1/2"
R3	1.7335, 13CrMo 4 4	PN63 / 300 lbs	DN40	1 1/2"
C4	C.S.	PN100 / 600 lbs	DN40	1 1/2"
S4	316 SS	PN100 / 600 lbs	DN40	1 1/2"
P4	1.5415, 15 Mo 3	PN100 / 600 lbs	DN40	1 1/2"
R4	1.7335, 13CrMo 4 4	PN100 / 600 lbs	DN40	1 1/2"
10. end support (only IBFD-26)				
0	without end support			
C	end support material: C.S.			
S	end support, material: identically to sensor flange.			
11. condensate vessel with connection				
	s. page 133			
12. thermal isolation				
KI	without			
X..	thermal isolation in inches or mm, please specify			

1. Order specification ITABAR-FLOW-Sensor, series IBFD-25 / 26

IBFD-																			
type of sensor																			
inside diameter and wall thickness																			
sensor material																			
sensor flange																			
gasket																			
PN, material and DN of Sensor flange																			
design assembly connecting pieces																			
assembly connecting piece with flange																			
material connecting piece, with flange																			
end support																			
condesat vessel with connection																			
isolation																			
pipings run																			
										13. piping run									
										HL	horizontal								
										VL	vertikal								
										14. integrated RTD resist. thermocouple									
										T0	without								
										TA	3-wire								
										TB	3-wire, with ex-proofness								
										15. process connection, s. page 133									
										16. Instrum. Valves, s. page 133									

1. Order specification ITABAR-FLOW-Sensor, series IBFD-35 / 36

1. type of sensor				
35	without end support			
36	with end support			
2. inside diameter and wall thickness.				
ID / W.-thickn	inside diameter and wall thickness in inches (or mm), please specify			
3. sensor material				
S	material 316 SS (standard)			
4. sensor flange, always identically to sensor material.				
SM	flange according DIN			
SA	flange according ANSI			
5. gasket				
1	Gasket strip according to DIN			
2	ANSI RF			
3	ANSI RF SF (smooth finish)			
4	RTJ			
6. PN and DN of Sensor flange				
			DN	ANSI
1	PN16 / 150 lbs		DN50	2"
2	PN40 / 300 lbs		DN50	2"
3	PN63 / 300 lbs		DN50	2"
4	PN100 / 600 lbs		DN50	2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			
8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
9. material connecting piece, with flange (max. press. rat.)				
			DN	ANSI
always identically to sensor flange.				
C1	C.S.	PN16 / 150 lbs	DN50	2"
S1	316 SS	PN16 / 150 lbs	DN50	2"
P1	1.5415, 15 Mo 3	PN16 / 150 lbs	DN50	2"
R1	1.7335, 13CrMo 4 4	PN16 / 150 lbs	DN50	2"
C2	C.S.	PN40 / 300 lbs	DN50	2"
S2	316 SS	PN40 / 300 lbs	DN50	2"
P2	1.5415, 15 Mo 3	PN40 / 300 lbs	DN50	2"
R2	1.7335, 13CrMo 4 4	PN40 / 300 lbs	DN50	2"
C3	C.S.	PN63 / 300 lbs	DN50	2"
S3	316 SS	PN63 / 300 lbs	DN50	2"
P3	1.5415, 15 Mo 3	PN63 / 300 lbs	DN50	2"
R3	1.7335, 13CrMo 4 4	PN63 / 300 lbs	DN50	2"
C4	C.S.	PN100 / 600 lbs	DN50	2"
S4	316 SS	PN100 / 600 lbs	DN50	2"
P4	1.5415, 15 Mo 3	PN100 / 600 lbs	DN50	2"
R4	1.7335, 13CrMo 4 4	PN100 / 600 lbs	DN50	2"
10. end support (only IBFD-36)				
0	without end support			
C	end support material: C.S.			
S	end support, material: identically to sensor flange.			
11. condensate vessel with connection				
	s. page 133			
12. thermal isolation				
KI	without			
X..	thermal isolation in inches or mm, please specify			

1. Order specification ITABAR-FLOW-Sensor, series IBFD-35 / 36

IBFD-	type of sensor		inside diameter and wall thickness		sensor material		sensor flange		gasket		PN, material and DN of Sensor flange		design assembly connecting pieces		assembly connecting piece with flange		material connecting piece, with flange		end support		condesate vessel with connection		isolation		piping run	
		/																								

13. piping run	
HL	horizontal
VL	vertikal
14. integrated RTD resit. thermocouple	
T0	without
TA	3-wire
TB	3-wire, with ex-proofness
15. process connection, s. page 133	
	16. Instrum. Valves, s. page 133

Order specification condensate vessel

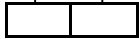
IBFD 20, 21, 25, 26, 35, 36

flanged joint at sensor head

K0	without condensate vessel
K1	condensate vessel, weld sockets 21,3mm, edge form 21 according DIN 2559

material and size for condensat vessel

H	Kesselbach H11	size: Ø 88,9 x 5 mm
S	material: 316 SS	size: Ø 88,9 x 3,2 mm



Order specification instrument connection and shut-off valve

Typ IBFD- 20, 21, 25, 26, 35, 36

shut-off device for effect pressure pipe, standard with weld together condensat vessel

A00	without shut-off valve
A81	ANSI gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material: A105 (C22) case: A105, packing: graphite-fiber glass
A82	ANSI gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material: 316L case: 316L, packing: graphite-fibre glas



Order specification condensate vessel (only compact construction)

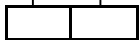
IBFD 20, 21, 25, 26, 35, 36

flanged joint of sensor head

A1	condensate vessel with sensor head, effect pressure pipe and mountig flange welds directly
----	--

material and size condensate vessel

H	Kesselbach H11	size: Ø 88,9 x 5 mm
S	material 316 SS	size: Ø 88,9 x 3,2 mm



Order specification connection, only with A1

type IBFD- 20, 21, 25, 26, 35, 36

connection

A06	flange plate for für 3-way-valve block
A07	flange plate for 5-way-valve block



Order specification for shut-off valve, only with A1

type IBFD- 20, 21, 25, 26, 35, 36

shut-off valve for effect pressure pipe and mountig flange welds directly

A00	without shut- off valve
A66	3-way-mainfold, PN400, 1.4401 / packing: graphit
A71	5-way-mainfold, PN400, 1.4401 / packing: graphite



Picture of Condensate Pots

Fig. 8.10: condensate pot, \varnothing 3.5 x 0.13 inches



8.8.2 Pressure- Temperature Tables for Shut-Off Valves

Code	Maximum operating pressure (PSI) at temperature in °F											
	0	340	510	680	1020	1190	1360	1445	1570	1615	1700	1734
A81	2013	1955	1911	1866	1778	1602	1411	1176	1014	837	632	-
A82	2028	1955	1911	1866	1778	1602	1425	1308	1249	1205	1102	-



Fig. 8.13: Construction of small slidegate valve. A09

11.0 Series IBFD-HT for Superheated Steam to 5880 psi and 2210°F

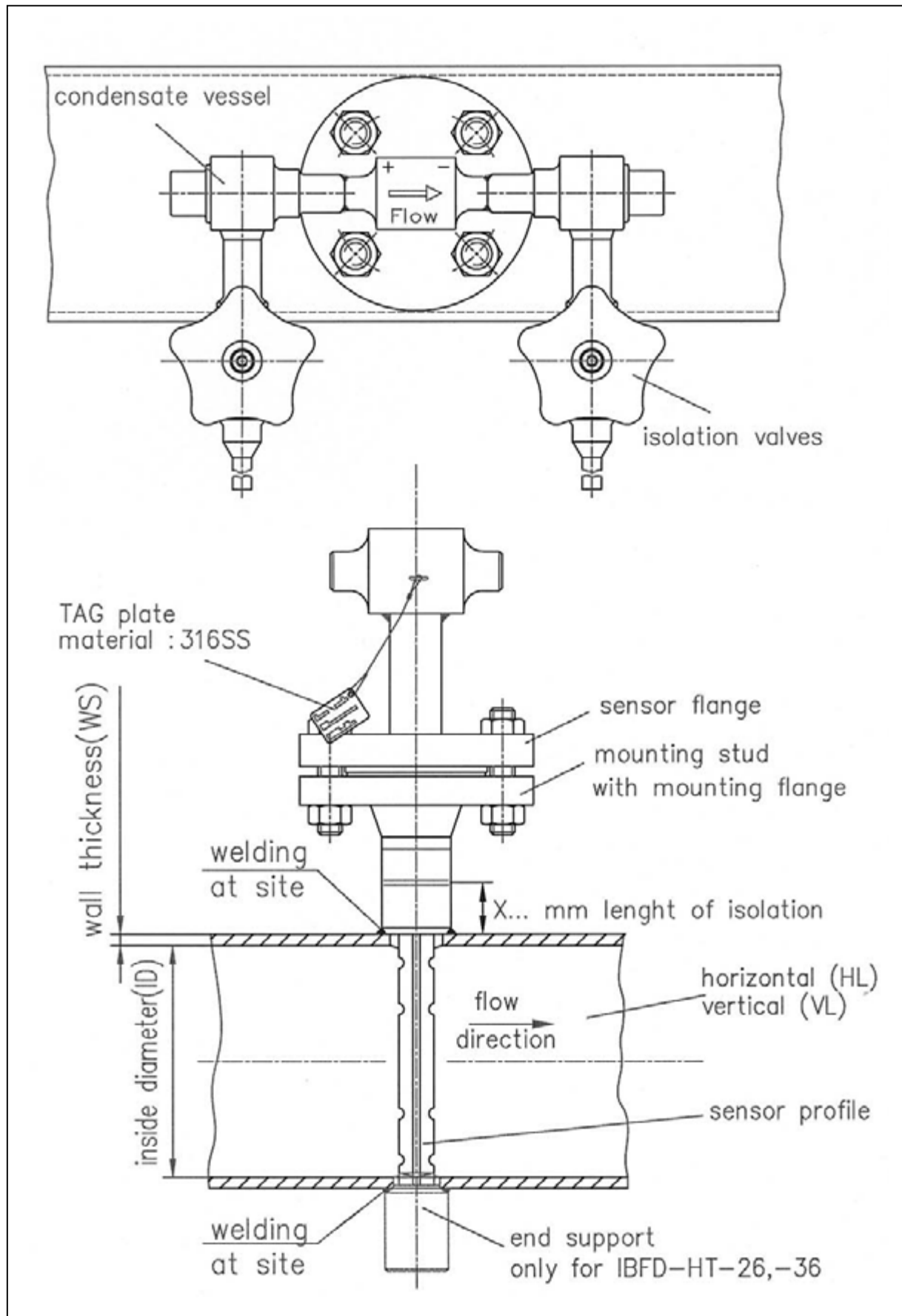
Description

With its strengthened sensor head and assembly parts sensor type IBFD-HT is especially designed for use in superheated steam applications with high operating pressures and temperatures.

Materials	Max. Steam Temperature
1.5415 (15 Mo 3)	1802 °F
1.7335 (10 CrMo 4 4)	1870 °F
1.7380 (10 CrMo 9 10)	1938°F
1.4903 (10 CrMoVNB 91)	2210°F

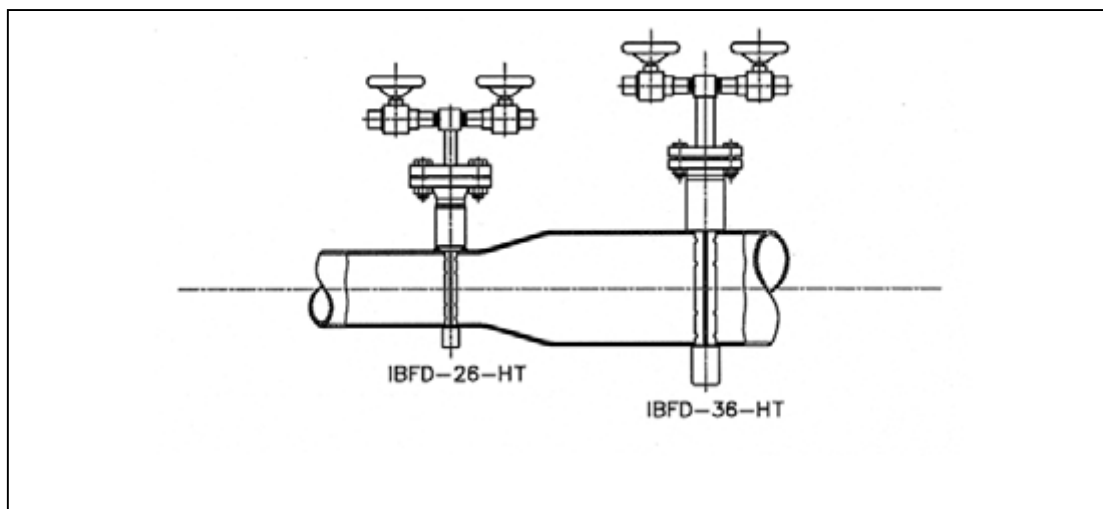


Drawing for ITABAR Series IBFD-HT



Order Data for ITABAR Series IBFD-HT

1. Sensor Type



Pipe ID Inches	Maximal zulässiger Volumendurchfluss GPM	
	IBFD -26-HT	IBFD -36-HT
4	4857	---
5	6415	---
6	7972	---
8	11083	---
10	14476	---
12	18145	19826
14	21696	23786
16	25137	27755
20	32340	35323
24	39419	42803

These values are for water of 0.999 SGU and at a temperature $T = 68 \text{ }^{\circ}\text{F}$. To calculate volumetric or mass flow of fluids with other densities see chapter 6 „Specifications of DP Sensors with WINFLOW“.

Selection and Specification of a Steam- flow-Sensor
P-max. 5880 PSI (400 bar), P-T-max. 2210 °F

Order Example for ITABAR Flow Sensor, HT-Version

Existing Process Data

Pipe size	12"
Medium	Steam
Pressure	3822 PSI (260 bar)
Temperature	2176°F (640°C)
Material of existing pipe	10 CrMo 910

1. Determine the material of the pipe (to determine welding compatibility), in this example 10 CrMo 910.
2. From table , page 151, determine pressure specs of assembly welding boss.
3. From table, 135 determine compatible material – 10 CrMoVNb 91
4. With Winflow program determine the right sensor type (considering flow velocity). In this case the recommended sensor is IBFD-26-HT.
5. Selection of condensate pots and shut-off valves, see table page 153/154. If a combination condensate pots / shut-off valves is required see table 155. For the case of this example the table does not offer a combination. Thus condensate pots and shut-off valves must be ordered seperately.
6. Isolation of pipe – in this example 200 mm
7. Pipe configuration – in this example vertical

Oder code example

IBFD-26-HT-ID300/14mm-C-SM-1-D8-W-M-S37-C-K8-A22-A22-X200-VL

INTRA-AUTOMATION GmbH

D-41515 Grevenbroich * Otto-Hahn-Str. 20 * Tel: +49 2181-68761 * Fax: +49 2181-64492

WINFLOW 2.75 (I) Diff. Pressure Calculation ITABAR - Flow - Sensor

Company: Mustermann
 Name(capital letters):
 Street:
 Zip Code/City:
 Offer-/Com. No:
 P. Order Number:
 Tag No.:
 Serial No.:
 Pipe Data: ID= 300,000/15,000 mm - horizontal
 Date: 18.04.2002
 Person in charge U.P.

Calculation: Mass rate Gas & steam
 Fluid: Superheated steam

Pipe Internal Dimension: 300,000 mm
 Flowing Temperature: 640,000 °C
 Flowing Pressure: 260,000 bar A
 Density: 68,669 kg/m³
 Viscosity: 0,0359 cPs
 K-Factor: 0,6274 without unit

Base Temperature	273,15 Kelvin
Base Pressure	101,30 kPa

	QMax	QNorm	QMin	
Flow Rate	50.000,00	40.000,00	10.000,00	kg/H
Reynolds No.	1.637.037	1.309.630	327.407	without unit
Permanent press. loss	6,290	4,020	0,250	mbar
Expansionsfactor	1,000	1,000	1,000	without unit
Velocity:	2,86	2,29	0,57	m/sec.
Differential Pressure	6,913	4,424	0,277	mbar

Itabar-Type: IBFD-26 HT-C-SM-1-D6-W-M-S37-C-K8-A22-A22-X200-VL
 Material Sensor: A335 GRADE P11 (10CrMoVNb 91)
 Note:

Max. DeltaP 1.905,20 mbar Max. Flow Rate 830.064,63 kg/H
 Natural Freq.: 121,16

1. Order specification ITABAR-FLOW-Sensor, series IBFD-26-HT

1. type of sensor				
26-HT	IBFD-26-HT			
2. inside diameter and wall thickness.				
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify			
3. sensor material				
			max. op. temperature	
P	1.5415 (15 Mo 3)		530°C	
V	1.7335 (13 CrMo 4 4)		550°C	
R	1.7380 (10 CrMo 9 10)		570°C	
C	1.4903 (10 CrMoVNb 91)		650°C	
4. sensor flange, always identically to sensor material.				
SM	flange according DIN			
SA	flange according ANSI			
5. seal sensor flange				
1	flanges acc. DIN, gasket strip form C, up to PN250 form Form E.			
2	flanges acc. ANSI, Dichtleiste RF			
3	Flansch nach ANSI, Dichtleiste SF (smooth finish)			
4	Flansch nach ANSI, Dichtleiste RTJ			
6. PN, material and DN of Sensor flange				
			DIN	ANSI
A1	PN16 / 150 lbs	material: 1.5415 (15 Mo 3)	DN32	1 1/2"
A2	PN40 / 300 lbs	material: 1.5415 (15 Mo 3)	DN32	1 1/2"
A3	PN63 / 300 lbs	material: 1.5415 (15 Mo 3)	DN40	1 1/2"
A4	PN100 / 600 lbs	material: 1.5415 (15 Mo 3)	DN40	1 1/2"
A5	PN160 /1500 lbs	material: 1.5415 (15 Mo 3)	DN40	1 1/2"
A6	PN250 / 1500 lbs	material: 1.5415 (15 Mo 3)	DN40	1 1/2"
A7	PN320 / 2500 lbs	material: 1.5415 (15 Mo 3)	DN40	1 1/2"
A8	PN400 / 2500 lbs	material: 1.5415 (15 Mo 3)	DN40	1 1/2"
B1	PN16 / 150 lbs	material: 1.7335 (13 CrMo 4 4)	DN32	1 1/2"
B2	PN40 / 300 lbs	material: 1.7335 (13 CrMo 4 4)	DN32	1 1/2"
B3	PN63 / 300 lbs	material: 1.7335 (13 CrMo 4 4)	DN40	1 1/2"
B4	PN100 / 600 lbs	material: 1.7335 (13 CrMo 4 4)	DN40	1 1/2"
B5	PN160 /1500 lbs	material: 1.7335 (13 CrMo 4 4)	DN40	1 1/2"
B6	PN250 / 1500 lbs	material: 1.7335 (13 CrMo 4 4)	DN40	1 1/2"
B7	PN320 / 2500 lbs	material: 1.7335 (13 CrMo 4 4)	DN40	1 1/2"
B8	PN400 / 2500 lbs	material: 1.7335 (13 CrMo 4 4)	DN40	1 1/2"
C1	PN16 / 150 lbs	material: 1.7380 (10 CrMo 9 10)	DN32	1 1/2"
C2	PN40 / 300 lbs	material: 1.7380 (10 CrMo 9 10)	DN32	1 1/2"
C3	PN63 / 300 lbs	material: 1.7380 (10 CrMo 9 10)	DN40	1 1/2"
C4	PN100 / 600 lbs	material: 1.7380 (10 CrMo 9 10)	DN40	1 1/2"
C5	PN160 /1500 lbs	material: 1.7380 (10 CrMo 9 10)	DN40	1 1/2"
C6	PN250 / 1500 lbs	material: 1.7380 (10 CrMo 9 10)	DN40	1 1/2"
C7	PN320 / 2500 lbs	material: 1.7380 (10 CrMo 9 10)	DN40	1 1/2"
C8	PN400 / 2500 lbs	material: 1.7380 (10 CrMo 9 10)	DN40	1 1/2"
D1	PN16 / 150 lbs	material: 1.4903 (10 CrMoVNb 91)	DN32	1 1/2"
D2	PN40 / 300 lbs	material: 1.4903 (10 CrMoVNb 91)	DN32	1 1/2"
D3	PN63 / 300 lbs	material: 1.4903 (10 CrMoVNb 91)	DN40	1 1/2"
D4	PN100 / 600 lbs	material: 1.4903 (10 CrMoVNb 91)	DN40	1 1/2"
D5	PN160 /1500 lbs	material: 1.4903 (10 CrMoVNb 91)	DN40	1 1/2"
D6	PN250 / 1500 lbs	material: 1.4903 (10 CrMoVNb 91)	DN40	1 1/2"
D7	PN320 / 2500 lbs	material: 1.4903 (10 CrMoVNb 91)	DN40	1 1/2"
D8	PN400 / 2500 lbs	material: 1.4903 (10 CrMoVNb 91)	DN40	1 1/2"
7. design assembly connecting pieces				
R	assembly connecting pieces with flange (standard)			
W	Weldolet-assembly connecting pieces and flange			

1. Order specification ITABAR-FLOW-Sensor, series IBFD-26-HT

8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
9. material connecting piece, with flange (max. press. rat.)				
always identically to sensor flange.			DIN	ANSI
S15	1.5415 (15 Mo 3)	PN16 / 150 lbs	DN32	1 1/2"
S44	1.7335 (13 CrMo 4 4)	PN16 / 150 lbs	DN32	1 1/2"
S91	1.7380 (10 CrMo 9 10)	PN16 / 150 lbs	DN32	1 1/2"
S30	1.4903 (10 CrMoVNb 91)	PN16 / 150 lbs	DN32	1 1/2"
(not weld together with material 1.7335)				
S16	1.5415 (15 Mo 3)	PN40 / 300 lbs	DN32	1 1/2"
S45	1.7335 (13 CrMo 4 4)	PN40 / 300 lbs	DN32	1 1/2"
S92	1.7380 (10 CrMo 9 10)	PN40 / 300 lbs	DN32	1 1/2"
S31	1.4903 (10 CrMoVNb 91)	PN40 / 300 lbs	DN32	1 1/2"
(not weld together with material 1.7335)				
S17	1.5415 (15 Mo 3)	PN63 / 300 lbs	DN40	1 1/2"
S46	1.7335 (13 CrMo 4 4)	PN63 / 300 lbs	DN40	1 1/2"
S93	1.7380 (10 CrMo 9 10)	PN63 / 300 lbs	DN40	1 1/2"
S32	1.4903 (10 CrMoVNb 91)	PN63 / 300 lbs	DN40	1 1/2"
(not weld together with material 1.7335)				
S18	1.5415 (15 Mo 3)	PN100 / 600 lbs	DN40	1 1/2"
S47	1.7335 (13 CrMo 4 4)	PN100 / 600 lbs	DN40	1 1/2"
S94	1.7380 (10 CrMo 9 10)	PN100 / 600 lbs	DN40	1 1/2"
S33	1.4903 (10 CrMoVNb 91)	PN100 / 600 lbs	DN40	1 1/2"
(not weld together with material 1.7335)				
S19	1.5415 (15 Mo 3)	PN160 / 1500 lbs	DN40	1 1/2"
S48	1.7335 (13 CrMo 4 4)	PN160 / 1500 lbs	DN40	1 1/2"
S95	1.7380 (10 CrMo 9 10)	PN160 / 1500 lbs	DN40	1 1/2"
S34	1.4903 (10 CrMoVNb 91)	PN160 / 1500 lbs	DN40	1 1/2"
(not weld together with material 1.7335)				
S20	1.5415 (15 Mo 3)	PN250 / 1500 lbs	DN40	1 1/2"
S49	1.7335 (13 CrMo 4 4)	PN250 / 1500 lbs	DN40	1 1/2"
S96	1.7380 (10 CrMo 9 10)	PN250 / 1500 lbs	DN40	1 1/2"
S35	1.4903 (10 CrMoVNb 91)	PN250 / 1500 lbs	DN40	1 1/2"
(not weld together with material 1.7335)				
S21	1.5415 (15 Mo 3)	PN320 / 2500 lbs	DN40	1 1/2"
S50	1.7335 (13 CrMo 4 4)	PN320 / 2500 lbs	DN40	1 1/2"
S97	1.7380 (10 CrMo 9 10)	PN320 / 2500 lbs	DN40	1 1/2"
S36	1.4903 (10 CrMoVNb 91)	PN320 / 2500 lbs	DN40	1 1/2"
(not weld together with material 1.7335)				
S22	1.5415 (15 Mo 3)	PN400 / 2500 lbs	DN40	1 1/2"
S51	1.7335 (13 CrMo 4 4)	PN400 / 2500 lbs	DN40	1 1/2"
S97	1.7380 (10 CrMo 9 10)	PN400 / 2500 lbs	DN40	1 1/2"
S37	1.4903 (10 CrMoVNb 91)	PN400 / 2500 lbs	DN40	1 1/2"
(not weld together with material 1.7335)				
10. end support				
0	without end support (if build-laterally available.)			
P	material: 1.5415 (15 Mo 3)			
V	material: 1.7335 (13 CrMo 4 4)			
R	material: 1.7380 (10 CrMo 9 10)			
C	material: 1.4903 (10 CrMoVNb 91)			
11. condensate vessel with connection				
	s. page 153			

1. Bestellanlagen ITABAR-DURCHFLUSS-Sonde, Baureihe IBFD-26-HT

1. Bestellanlagen ITABAR-DURCHFLUSS-Sonde, Baureihe IBFD-26-HT																
IBFD-	type of sensor	26-HT														
	inside diameter and wall thickness	/														
	sensor material															
	sensor flange															
	gasket															
	PN, material and DN of Sensor flange															
	design assembly connecting pieces															
	assembly connecting piece with flange															
	material connecting piece..with flange															
	end support															
	condesate vessel with connection															
	process connection															
	12. process connection												s. page 153			
13. thermal isolation												<table border="1"> <tr> <td>KI</td> <td>without</td> </tr> <tr> <td>X..</td> <td>thermal isolation in inches or mm, please specify</td> </tr> </table>	KI	without	X..	thermal isolation in inches or mm, please specify
KI	without															
X..	thermal isolation in inches or mm, please specify															
14. piping run												<table border="1"> <tr> <td>HL</td> <td>horizontal</td> </tr> <tr> <td>VL</td> <td>vertikal</td> </tr> </table>	HL	horizontal	VL	vertikal
HL	horizontal															
VL	vertikal															

1. Order specification ITABAR-FLOW-Sensor, series IBFD-36-HT

1. type of sensor	
36-HT	IBFD-36-HT
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
	max. op. temperature
P	1.5415 (15 Mo 3) 530°C
V	1.7335 (13 CrMo 4 4) 550°C
R	1.7380 (10 CrMo 9 10) 570°C
C	1.4903 (10 CrMoVNb 91) 650°C
4. sensor flange, always identically to sensor material.	
SM	flange according DIN
SA	flange according ANSI
5. seal sensor flange	
1	flanges acc. DIN, gasket strip form C, up to PN250 form Form E.
2	flanges acc. ANSI, Dichtleiste RF
3	Flansch nach ANSI, Dichtleiste SF (smooth finish)
4	Flansch nach ANSI, Dichtleiste RTJ
6.PN, material and DN of Sensor flange	
	DIN
	ANSI
A1	PN16 / 150 lbs material: 1.5415 (15 Mo 3) DN32 1 1/2"
A2	PN40 / 300 lbs material: 1.5415 (15 Mo 3) DN32 1 1/2"
A3	PN63 / 300 lbs material: 1.5415 (15 Mo 3) DN40 1 1/2"
A4	PN100 / 600 lbs material: 1.5415 (15 Mo 3) DN40 1 1/2"
A5	PN160 /1500 lbs material: 1.5415 (15 Mo 3) DN40 1 1/2"
A6	PN250 / 1500 lbs material: 1.5415 (15 Mo 3) DN40 1 1/2"
A7	PN320 / 2500 lbs material: 1.5415 (15 Mo 3) DN40 1 1/2"
A8	PN400 / 2500 lbs material: 1.5415 (15 Mo 3) DN40 1 1/2"
B1	PN16 / 150 lbs material: 1.7335 (13 CrMo 4 4) DN32 1 1/2"
B2	PN40 / 300 lbs material: 1.7335 (13 CrMo 4 4) DN32 1 1/2"
B3	PN63 / 300 lbs material: 1.7335 (13 CrMo 4 4) DN40 1 1/2"
B4	PN100 / 600 lbs material: 1.7335 (13 CrMo 4 4) DN40 1 1/2"
B5	PN160 /1500 lbs material: 1.7335 (13 CrMo 4 4) DN40 1 1/2"
B6	PN250 / 1500 lbs material: 1.7335 (13 CrMo 4 4) DN40 1 1/2"
B7	PN320 / 2500 lbs material: 1.7335 (13 CrMo 4 4) DN40 1 1/2"
B8	PN400 / 2500 lbs material: 1.7335 (13 CrMo 4 4) DN40 1 1/2"
C1	PN16 / 150 lbs material: 1.7380 (10 CrMo 9 10) DN32 1 1/2"
C2	PN40 / 300 lbs material: 1.7380 (10 CrMo 9 10) DN32 1 1/2"
C3	PN63 / 300 lbs material: 1.7380 (10 CrMo 9 10) DN40 1 1/2"
C4	PN100 / 600 lbs material: 1.7380 (10 CrMo 9 10) DN40 1 1/2"
C5	PN160 /1500 lbs material: 1.7380 (10 CrMo 9 10) DN40 1 1/2"
C6	PN250 / 1500 lbs material: 1.7380 (10 CrMo 9 10) DN40 1 1/2"
C7	PN320 / 2500 lbs material: 1.7380 (10 CrMo 9 10) DN40 1 1/2"
C8	PN400 / 2500 lbs material: 1.7380 (10 CrMo 9 10) DN40 1 1/2"
D1	PN16 / 150 lbs material: 1.4903 (10 CrMoVNb 91) DN32 1 1/2"
D2	PN40 / 300 lbs material: 1.4903 (10 CrMoVNb 91) DN32 1 1/2"
D3	PN63 / 300 lbs material: 1.4903 (10 CrMoVNb 91) DN40 1 1/2"
D4	PN100 / 600 lbs material: 1.4903 (10 CrMoVNb 91) DN40 1 1/2"
D5	PN160 /1500 lbs material: 1.4903 (10 CrMoVNb 91) DN40 1 1/2"
D6	PN250 / 1500 lbs material: 1.4903 (10 CrMoVNb 91) DN40 1 1/2"
D7	PN320 / 2500 lbs material: 1.4903 (10 CrMoVNb 91) DN40 1 1/2"
D8	PN400 / 2500 lbs material: 1.4903 (10 CrMoVNb 91) DN40 1 1/2"
7. design assembly connecting pieces	
R	assembly connecting pieces with flange (standard)
W	Weldolet-assembly connecting pieces and flange

1. Order specification ITABAR-FLOW-Sensor, series IBFD-36-HT

8. assembly connecting piece with flange, identically to sensor flange.				
0	without flange			
M	flange according DIN, gasket strip form C			
A	flange according ANSI, gasket strip RF			
F	flange according ANSI, gasket strip SF (smooth finish)			
T	flange according ANSI, gasket strip RTJ			
9. material connecting piece, with flange (max. press. rat.)				
always identically to sensor flange.			DIN	ANSI
S15	1.5415 (15 Mo 3)	PN16 / 150 lbs	DN50	2"
S44	1.7335 (13 CrMo 4 4)	PN16 / 150 lbs	DN50	2"
S91	1.7380 (10 CrMo 9 10)	PN16 / 150 lbs	DN50	2"
S30	1.4903 (10 CrMoVNb 91)	PN16 / 150 lbs	DN50	2"
(not weld together with material 1.7335)				
S16	1.5415 (15 Mo 3)	PN40 / 300 lbs	DN50	2"
S45	1.7335 (13 CrMo 4 4)	PN40 / 300 lbs	DN50	2"
S92	1.7380 (10 CrMo 9 10)	PN40 / 300 lbs	DN50	2"
S31	1.4903 (10 CrMoVNb 91)	PN40 / 300 lbs	DN50	2"
(not weld together with material 1.7335)				
S17	1.5415 (15 Mo 3)	PN63 / 300 lbs	DN50	2"
S46	1.7335 (13 CrMo 4 4)	PN63 / 300 lbs	DN50	2"
S93	1.7380 (10 CrMo 9 10)	PN63 / 300 lbs	DN50	2"
S32	1.4903 (10 CrMoVNb 91)	PN63 / 300 lbs	DN50	2"
(not weld together with material 1.7335)				
S18	1.5415 (15 Mo 3)	PN100 / 600 lbs	DN50	2"
S47	1.7335 (13 CrMo 4 4)	PN100 / 600 lbs	DN50	2"
S94	1.7380 (10 CrMo 9 10)	PN100 / 600 lbs	DN50	2"
S33	1.4903 (10 CrMoVNb 91)	PN100 / 600 lbs	DN50	2"
(not weld together with material 1.7335)				
S19	1.5415 (15 Mo 3)	PN160 / 1500 lbs	DN50	2"
S48	1.7335 (13 CrMo 4 4)	PN160 / 1500 lbs	DN50	2"
S95	1.7380 (10 CrMo 9 10)	PN160 / 1500 lbs	DN50	2"
S34	1.4903 (10 CrMoVNb 91)	PN160 / 1500 lbs	DN50	2"
(not weld together with material 1.7335)				
S20	1.5415 (15 Mo 3)	PN250 / 1500 lbs	DN50	2"
S49	1.7335 (13 CrMo 4 4)	PN250 / 1500 lbs	DN50	2"
S96	1.7380 (10 CrMo 9 10)	PN250 / 1500 lbs	DN50	2"
S35	1.4903 (10 CrMoVNb 91)	PN250 / 1500 lbs	DN50	2"
(not weld together with material 1.7335)				
S21	1.5415 (15 Mo 3)	PN320 / 2500 lbs	DN50	2"
S50	1.7335 (13 CrMo 4 4)	PN320 / 2500 lbs	DN50	2"
S97	1.7380 (10 CrMo 9 10)	PN320 / 2500 lbs	DN50	2"
S36	1.4903 (10 CrMoVNb 91)	PN320 / 2500 lbs	DN50	2"
(not weld together with material 1.7335)				
S22	1.5415 (15 Mo 3)	PN400 / 2500 lbs	DN50	2"
S51	1.7335 (13 CrMo 4 4)	PN400 / 2500 lbs	DN50	2"
S97	1.7380 (10 CrMo 9 10)	PN400 / 2500 lbs	DN50	2"
S37	1.4903 (10 CrMoVNb 91)	PN400 / 2500 lbs	DN50	2"
(not weld together with material 1.7335)				
10. end support				
0	without end support (if build-laterally available.)			
P	material: 1.5415 (15 Mo 3)			
V	material: 1.7335 (13 CrMo 4 4)			
R	material: 1.7380 (10 CrMo 9 10)			
C	material: 1.4903 (10 CrMoVNb 91)			
11. condensate vessel with connection				
s. page 153				

1. Bestellaangaben ITABAR-DURCHFLUSS-Sonde, Baureihe IBFD-36-HT

IBFD-	36-HT																	
		type of sensor	Innendurchmesser / Wandstärke in mm	sensor material	sensor flange	gasket	PN, material and DN of Sensor flange	design assembly connecting pieces	assembly connecting piece with flange	material connecting piece, with flange	end support	condesate vessel with connection	process connection					

12. process connection

s. page 153

13. thermal isolation

KI without

X.. thermal isolation in inches or mm,

please specify

14. piping run

HL horizontal

VL vertikal

11.1 Sensor Series IBFD-HTG for Superheated Steam to 5880 PSI

Description

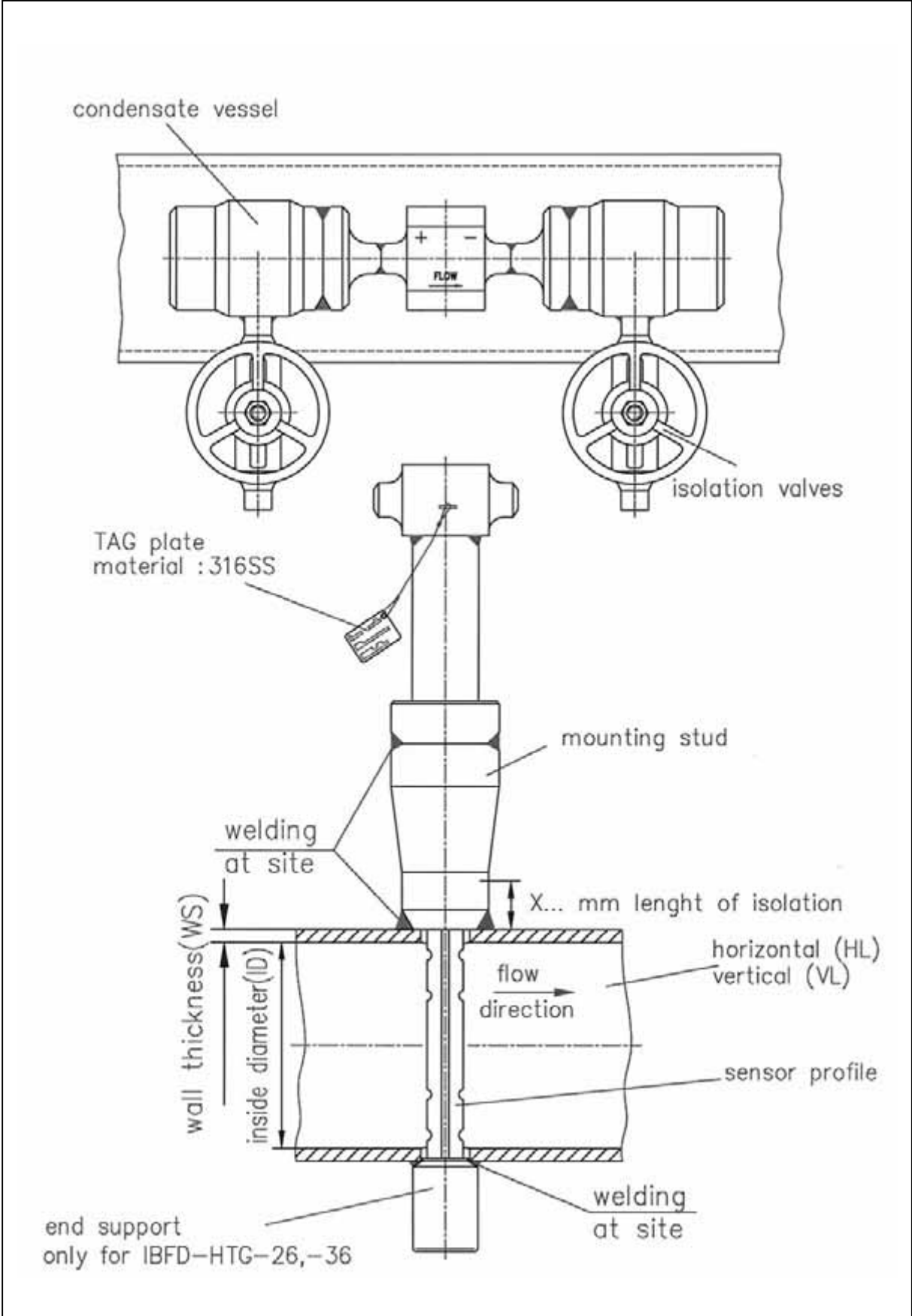
Sensor series IBFD-HTG is designed to measure volumetric / mass flow of superheated steam. Because of high safety related requirements the sensor is only manufactured in a welded construction, which afterwards is stress-free annealing. A (German) VdTÜV component test is done for certain types of IBFD-26 HTG.

Materials	Max. steam temperature
1.5415 (15 Mo 3)	1802 °F
1.7335 (10 CrMo 4 4)	1870 °F
1.7380 (10 CrMo 9 10)	1938°F
1.4903 (10 CrMoVNB 91)	2210°F



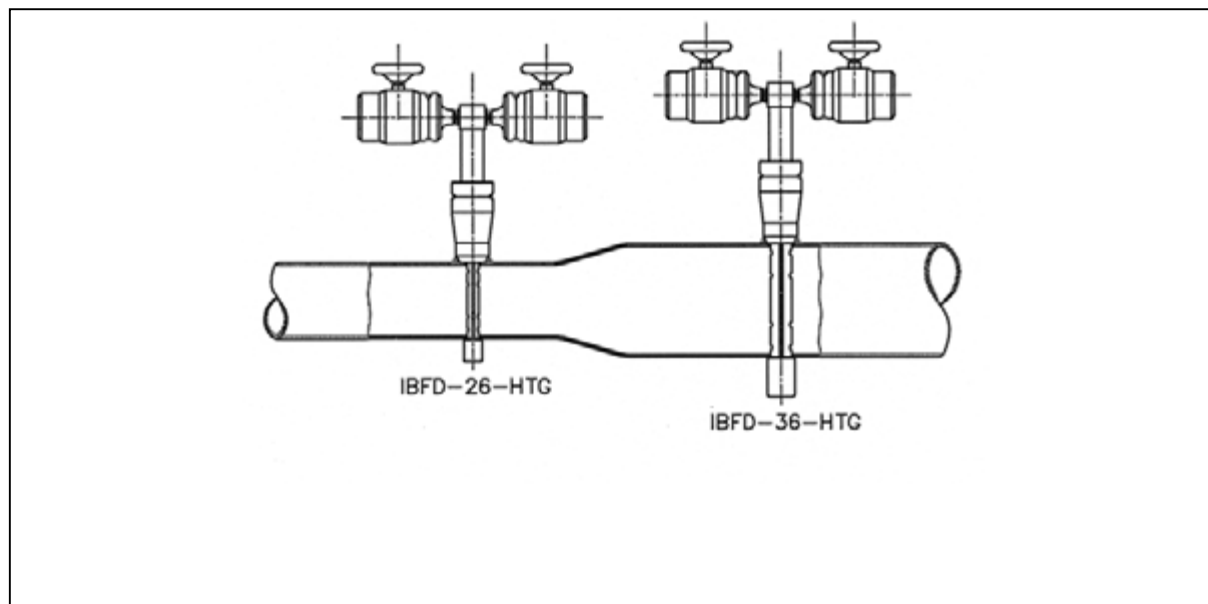
Fig. 8.5: ITABAR IBFD-HTG for superheated steam

Drawings for ITABAR Series IBFD-HTG



Oder Data for ITABAR Series IBFD-HTG

1. Sensor Type



Pipe Size	Maximum flow volume Q_v in GPM	
	IBFD -26-HTG	IBFD -36-HTG
4	4857	---
5	6415	---
6	7972	---
8	11083	---
10	14476	---
12	18145	19826
14	21696	23786
16	25137	27755
20	32340	35323
24	39419	42803

These values are for water of 0.999 SGU and at a temperature $T = 68$ °F. To calculate volumetric or mass flow of fluids with other densities see chapter 6 „Specifications of DP Sensors with WINFLOW“.

1. Order specification ITABAR-FLOW-Sensor, series IBFD-HTG-26

1. type of sensor	
26-HTG	IBFD-26-HTG
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
	max. op. temperature
P	1.5415 (15 Mo 3) 530°C
V	1.7335 (13 CrMo 4 4) 550°C
R	1.7380 (10 CrMo 9 10) 570°C
C	1.4903 (10 CrMoVNb 91) 650°C
4. condensate vessel with connection	
	s. page 152
5. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
6. piping run	
HL	horizontal
VL	vertikal
	12. process connection, s page 155

IBFD-	26-HTG	/							
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1. Order specification ITABAR-FLOW-Sensor, series IBFD-HTG-36

1. type of sensor	
36-HTG	IBFD-36-HTG
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
	max. op. temperature
P	1.5415 (15 Mo 3) 530°C
V	1.7335 (13 CrMo 4 4) 550°C
R	1.7380 (10 CrMo 9 10) 570°C
C	1.4903 (10 CrMoVNb 91) 650°C
4. condensate vessel with connection	
	s. page 152
5. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
6. piping run	
HL	horizontal
VL	vertikal
	12. process connection, s page 155

IBFD-	36-HTG	/							
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Pressure Rating Assembly Flange

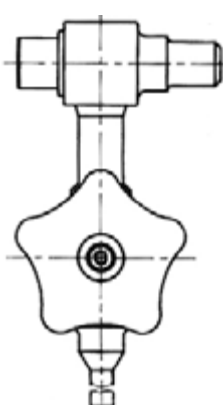
Code	Material	Pressure rating	Operating temperature (°F)														
			Max Operating Pressure PSI														
			1020	1190	1360	1530	1700	1734	1768	1802	1836	1870	1904	1938	1972	2040	2108
C1	C22.8	PN16 / 150 lbs	139	88													
S1	1.4571		169	161	161	147											
P1	1.5415		161	147	139	132	117										
R1	1.7335		176	161	174	139	139	117	102	88.2	73	59					
S1	1.7380																
V1	1.4903																
C1	C22.8	PN40 / 300 lbs	352	147													
S1	1.4571		382	382	367	352											
P1	1.5415		397	367	338	323	308										
R1	1.7335		441	396	382	352	352	294	250	220	191	147					
S1	1.7380																
V1	1.4903																
C1	C22.8	PN63 / 300 lbs															
S1	1.4571																
P1	1.5415																
R1	1.7335																
S1	1.7380																
V1	1.4903																
C1	C22.8	PN100 / 600 lbs	882	808													
S1	1.4571		1014	970	940	882											
P1	1.5415		970	926	867	837	808										
R1	1.7335		1073	999	940	896	867	735	646	543	455	382					
S1	1.7380																
V1	1.4903																
C1	C22.8	PN160 / 1500 lbs	1411	1323													
S1	1.4571		1617	1543	1381	1396											
P1	1.5415		1558	1470	1381	1337	1293										
R1	1.7335		1705	1587	1514	1425	1381	1176	1029	882	735	602					
S1	1.7380																
V1	1.4903																
C1	C22.8	PN250 / 1500 lbs	2822	2058													
S1	1.4571		3101	2425	2352	2205											
P1	1.5415		3131	2205	2175	2102	2028										
R1	1.7335		3425	2499	2366	2234	2175	1764	1411	1264	1102	940					
S1	1.7380		3469	2616	2499	2381	2249	1778	1440	1308	1131	999	867	779			
V1	1.4903																
C1	C22.8	PN320 / 2500 lbs	2822	2646													
S1	1.4571		3101	3087	2940	2675											
P1	1.5415		3131	2954	1778	2690	2601										
R1	1.7335		3425	3189	3028	2866	2793	2175	1764	1558	1396	1205					
S1	1.7380		3586	3351	3204	3057	2881	2263	1852	1675	1470	1293	1117	999			
V1	1.4903																
R1	1.7335	PN400 / 2500 lbs	4454	4160	3983	3792	3513	2793	2175	1999	1690	1543					
S1	1.7380		4483	4189	3998	3822	3601	2866	2307	2087	1837	1617	1396	1249			
V1	1.4903																

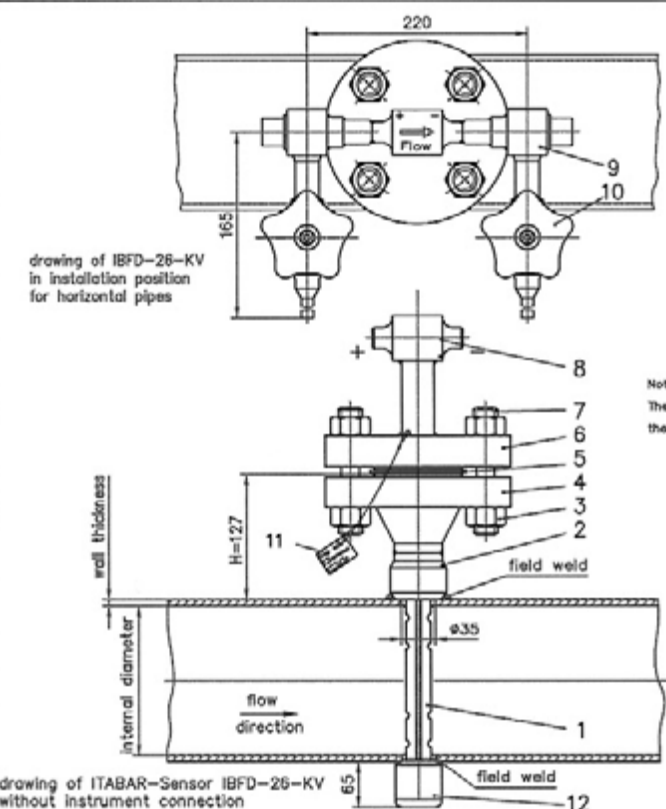
Combination Condensate Pots / Shut-Off Valves

Basically it is possible to use a combination of condensate pots and shut-off valves for sensor types IBFD-/IBFD21 and IBFD -25/26. Such combinations are welded directly onto the sensor head. Preferably such a construction is used in applications with high differential pressures.

Advantages are:

- low weight
- smaller dimensions
- quick local installation

Schematic drawing	Description	Material	Code	Max. Operating Data	
				p PSI	At T (°F)
	Combination of condensate pot and shut-off valve process connection: welding boss 21 mm with graphite packing	15 Mo 3	KV02	3675	408
		1.5415		1764	1700
	13 CrMo 4 4	1.7335	KV03	3675	408
				1837	1870
	10 CrMo 910	1.7380	KV04	2940	3230



drawing of IBFD-26-KV in installation position for horizontal pipes

drawing of ITABAR-Sensor IBFD-26-KV without instrument connection

client	
quotation/order	
TAG no.	
internal pipe diameter	
wall thickness	
medium	
pressure	
temperature	
density	

pipe line

horizontal	vertical
<input type="checkbox"/>	<input type="checkbox"/>

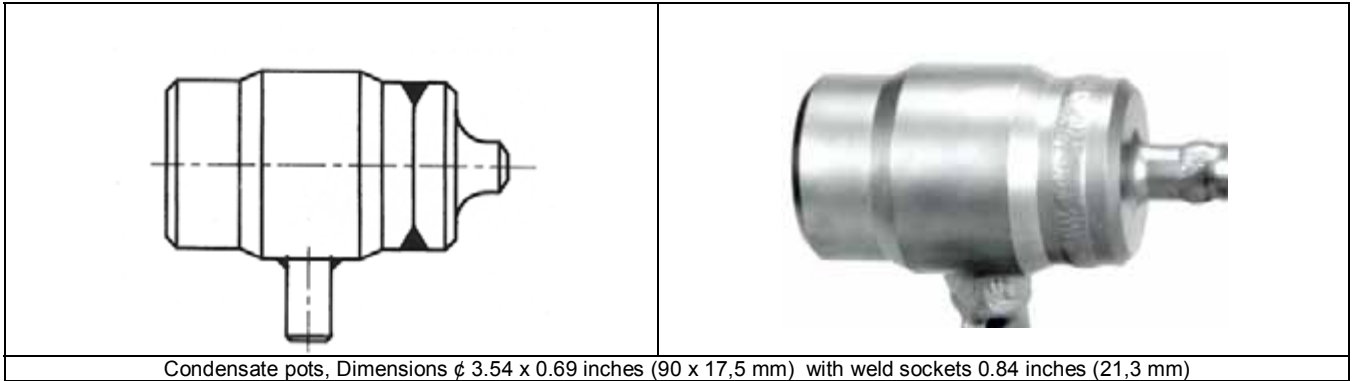
Note:
The area of application of the arrangement depends on the used materials, the pressure rating, the flanges and the combination of alignment vessel and stop valve.

12 closed end support	1	1.3CrMo44
11 TAG plate	1	316SS
10 shut-off valve	2	1.3CrMo44
9 condensation vessel	2	1.3CrMo44
8 sensor head with weld ends	1	1.3CrMo44
7 bolts M24	4	A1-630 Mo S7
6 Sensor flange DN40 PN250	1	1.3CrMo44
5 gasket spiral wound	1	1.3CrMo44/Graphit
4 IN-flange DN40 PN250	1	DN 2828 1.3CrMo44
3 nuts M24	8	DN 2810 A1-630 S7
2 mounting stud	1	1.3CrMo44
1 Sensor profile #25	1	1.3CrMo44

Benennung		ITABAR-Flow-Sensor for steam	
type		IBFD-26-KV	
Objekt	Projekt	Material	1.3CrMo44
Objekt	Projekt	Material	1.3CrMo44
Zustimmung/Prüfung			
Zeichnung/Prüfung	Zeichner	Prüfer	0 1/1
Interaktion	dateiname	ZSON/KZIBFD/PS049e00	
Änderung	Prüfung		

Interpretation Condensate vessel

One important requirement for a trouble-free functioning of the ITABAR steam sensors is that the transition process from steam to condensate only takes place inside the condensate pots designed for this purpose. With this in mind different style condensate pots are offered for various operating conditions.



The following table gives the pressure rating of the condensate pots

Material st steel	Wall thickne ss mm	Operating temperature (°F)															
		Max Operating pressure / PSI															
		1020	1190	1360	1530	1700	1734	1768	1802	1836	1870	1904	1938	1972	2040	2108	2210
1.5415	4	1705	1499	1411	1323	1278	1264	1264									
1.7335	4	1911	1793	1675	1587	1528	1514	1514	1499	1484	1470	1176	1029				
1.7335	12,5				7350	6409	5350	4233	3454	2778	2175	1778	1440				
1.7380	15				7350	6556	5733	4968	4307	3719	3160	2734	2352	2013	1749		
1.4903	15																

Pressure- Temperature Table for Shut-Off Valves

Code	Description	Pressure Psi	Enclosure material abbrev name / DIN		Connections Inches	Packing	Used for
A13	Shut-off valves	5880	15 Mo 3	1.5415	0.85 x 0.13	graphite	IBFD-HT, IBFD-HTG
A14		5880	13 CrMo 4 4	1.7335	0.85 x 0.13	graphite	
A15		5880	10 CrMo 9 10	1.7380	0.85 x 0.13	graphite	
A16	Shut-off valve (component pest to TRD 110, TRB 801 Nr. 45)	4704	15 Mo 3	1.5415	0.85 x 0.13	graphite	IBFD-HT, IBFD-HTG
A17		4704	13 CrMo 44	1.7335	0.85 x 0.13	graphite	
A18		4704	10 CrMo 9 10	1.7380	0.85 x 0.13	graphite	
A19		5880	15 Mo 3	1.5415	1.06 x 0.2	graphite	
A20		5880	13 CrMo 44	1.7335	1.06 x 0.2	graphite	
A21		5880	10 CrMo 9 10	1.7380	1.06 x 0.2	graphite	
A22		5880	X10 CrMoVNb9-1	1.4903	1.06 x 0.2	graphite	

Code	Maximum operating pressure (PSI) at operating temperature °F																
	510	680	850	1030	1190	1360	1445	1530	1615	1700	1734	1768	1802	1836	1870	1904	1938
A13	5424	4983	4527	4086	3630	3189	2969	2734	2513	2278	2190	2102	2013	1925	1837	-	-
A14	5424	4983	4527	4086	3630	3189	2969	2734	2513	2278	2190	2102	2013	1925	1837	-	-
A15	5880	5880	5880	5880	5512	5145	4777	4410	4042	3675	3528	3381	3234	3087	2940	-	-

Code	Maximum operating pressure (PSI) at operating temperature °F																						
	1020	1190	1360	1445	1530	1615	1700	1734	1768	1802	1836	1870	1904	1938	1972	2006	2040	2074	2108	2142	2176	2210	
A16	4704	4674	4380	4307	4233	4160	2631	1999	1572	1264	-	-	-	-	-	-	-	-	-	-	-	-	
A17	4704	4704	4704	4704	4704	4630	4027	3366	2660	2175	1749	1367	-	-	-	-	-	-	-	-	-	-	
A18	4704	4704	4704	4704	4704	4704	4204	3675	3189	2763	2381	2028	2028	1499	1293	-	-	-	-	-	-	-	
A19	8085	7114	6659	6541	6423	6306	4263	3395	2704	2146	-	-	-	-	-	-	-	-	-	-	-	-	
A20	8085	8085	7805	7570	7350	7247	6291	5321	4307	3572	2793	2249	-	-	-	-	-	-	-	-	-	-	
A21	8085	8085	8085	8085	8026	7805	6188	5409	4718	4130	3572	3116	2660	2337	2013	-	-	-	-	-	-	-	
A22	8085	8085	8085	8085	8085	8085	8085	8085	8085	8085	8085	8085	7438	6659	4968	5277	4674	4130	3572	3116	2660	2337	2013



Fig. 8.14: Design of shut-off valves, materials:
15 Mo 3
13 CrMo 44
10 CrMo 910



Fig. 8.15: Design of shut-off valves, materials:
15 Mo 3
13 CrMo 44
10 CrMo 910
X10 CrMoVNb9-1

Order specification condensate vessel**IBFD-HT/HTG 26, 36**

condensate vessel		material case	
		short name	material no.
K0	without condensate vessel		
K5	condensate vessel with welding stud 21,3mm size: ø 90 x 17,5 mm	15 Mo 3	1.5415
K6	condensate vessel with welding stud 21,3mm size: ø 90 x 17,5 mm	13 CrMo 4 4	1.7335
K7	condensate vessel with welding stud 21,3mm size: ø 80 x 12,5 mm	10 CrMo 9 10	1.7380
K8	condensate vessel with welding stud 21,3mm size: ø 80 x 12,5 mm	10 CrMoVNb 91	1.4903, not weld together with A14, A20

The material of the condensate vessel should correspond with the material of the stop valve.

Order specification connection and shut-off device**type IBFD-HT/HTG 26, 36**

shut-off device for effect pressure pipe		material case		connection	packing
		short name	material no.		
A00	without shut-off valve				
A13	shut-off valve, nominal pressure: PN400	15 Mo 3	1.5415	21,3 x 3,2 mm	graphite
A14	shut-off valve, nominal pressure: PN400	13 CrMo 4 4	1.7335	21,3 x 3,2 mm	graphite
A15	shut-off valve, nominal pressure: PN400	10 CrMo 9 10	1.7380	21,3 x 3,2 mm	graphite

high-pressure shut-off valve acc. VdTÜV

A16	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 Nr.45	15 Mo 3	1.5415	21,3 x 3,2 mm	graphite
A17	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 Nr.45	13 CrMo 4 4	1.7335	21,3 x 3,2 mm	graphite
A18	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 Nr.45	10 CrMo 9 10	1.7380	21,3 x 3,2 mm	graphite
A19	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 Nr.45	15 Mo 3	1.5415	21,3 x 3,2 mm	graphite
A20	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 Nr.45	13 CrMo 4 4	1.7335	21,3 x 3,2 mm	graphite
A21	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 Nr.45	10 CrMo 9 10	1.7380	21,3 x 3,2 mm	graphite
A22	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 Nr.45	10 CrMoVNb 91	1.4903	21,3 x 3,2 mm	graphite

If double stop valves are required please to code, for example: A13-A13

Combination condensate vessel and shut-off valve**IBFD-HT/HTG 26, 36**

shut-off device for effect pressure pipe		material case		packing
		short name	DIN material no.	
KV02	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	15 Mo 3	1.5415	graphite
KV03	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	13 CrMo 4 4	1.7335	graphite
KV04	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	10 CrMo 9 10	1.7380	graphite

12.0 Model Series FTMD to 235 psi (16 bar)

Description

The ITABAR-Sensor series FTMD is designed to measure volumetric flow of saturated steam up to an operating pressure of $p_{\max} = 235$ psi (16 bar) and a operating temperature of $T_{\max} = 300$ °C. The sensor construction features a welding boss between the pipe and the sensor-related parts, a compression fitting to seal the sensor and a gate valve to insert the sensor profile into the pipe. The insertion or removal of the sensor is made easy by two guide-rod spindles or (as an option) via a hand wheel driven gearbox.

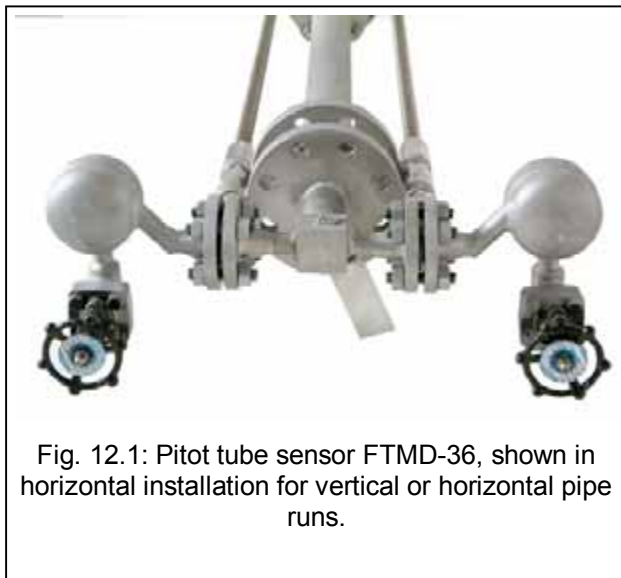
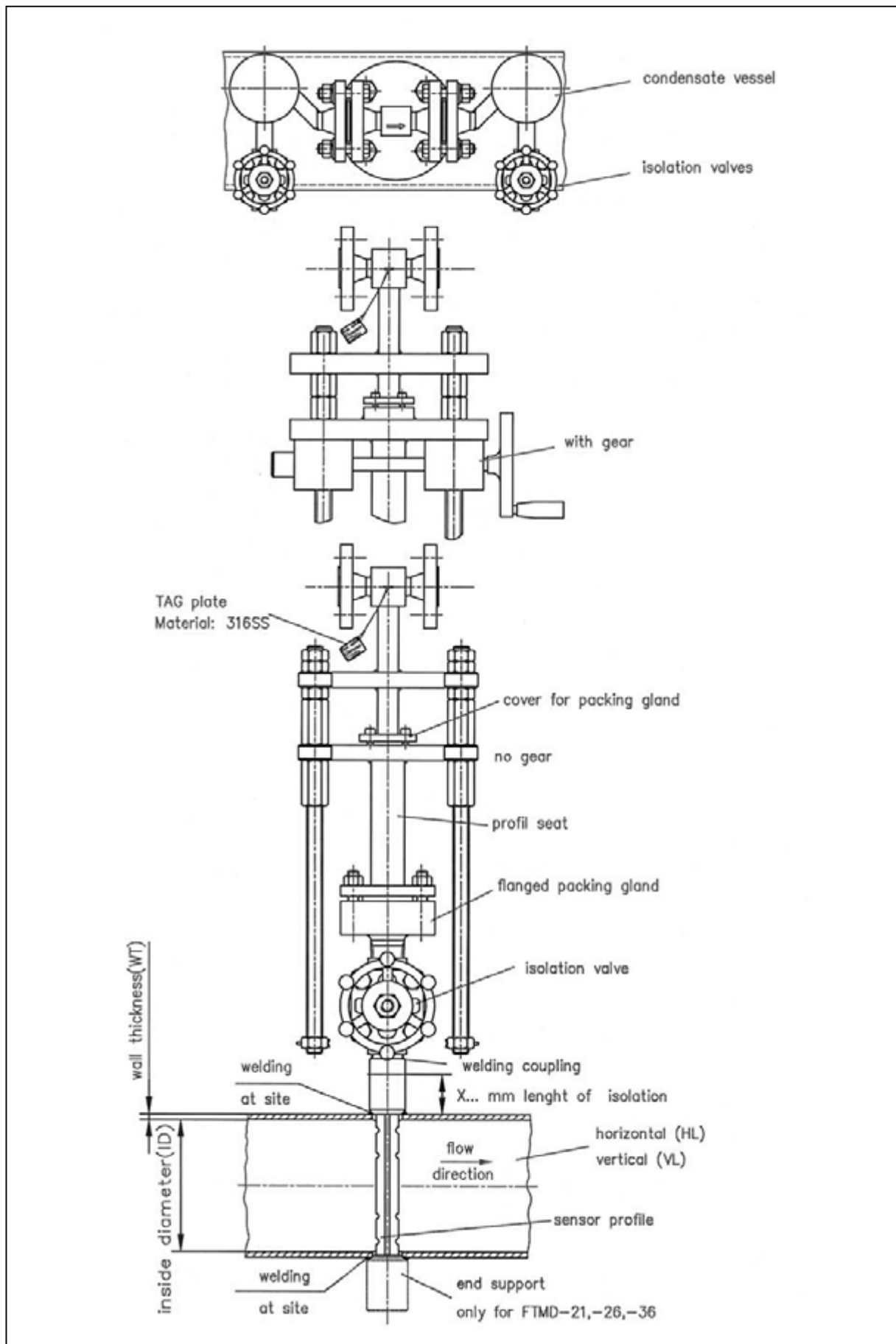


Fig. 12.1: Pitot tube sensor FTMD-36, shown in horizontal installation for vertical or horizontal pipe runs.



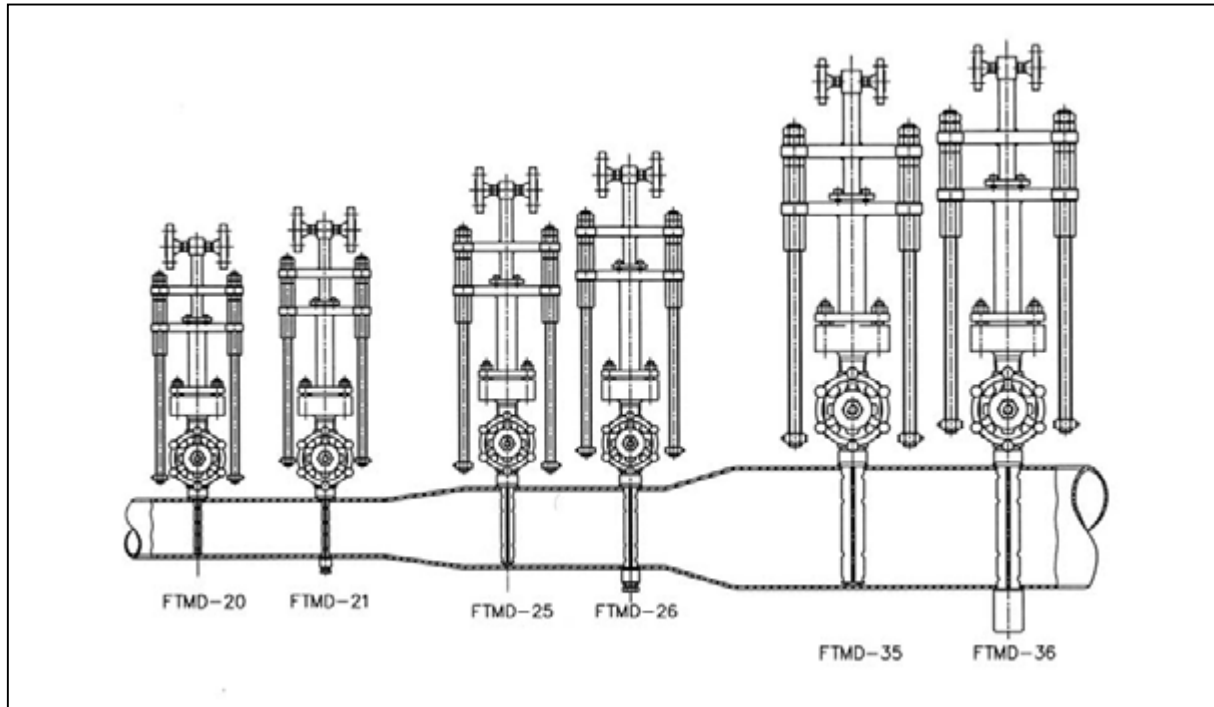
Fig.12.2: Pitot tube sensor FTMD-36 made of st. steel for pipe size ID= 336.5 mm

Drawings of ITABAR Series FTMD



Ordering Data for ITABAR Series FTMD-20/21/25/35/36

1. Sensor Type



Pipe size (inches)	Maxium allowable volumetric flow in GPM					
	Sensor type					
	FTMD -20	FTMD -21	FTMD -25	FTMD -26	FTMD -35	FTMD -36
1 1/2	175	502	---	---	---	---
2	260	708	---	---	---	---
2 1/4	409	1069	---	---	---	---
3	572	1443	---	---	---	---
4	787	1936	902	2398	---	---
5	1047	2512	1240	3168	---	---
6	---	---	1579	3938	---	---
8	---	---	2270	5473	---	---
10	---	---	3027	7150	---	---
12	---	---	3841	8962	7739	18519
14	---	---	4637	10718	9438	22321
16	---	---	5403	12460	11154	26158
20	---	---	7013	15976	14462	33528
24	---	---	8588	19483	17850	41087
28	---	---	10212	23069	21370	48923
32	---	---	11910	26870	24965	56962
36	---	---	---	30839	---	65155
40	---	---	---	34896	---	73189
48	---	---	---	43010	---	90090

These values are valid for water with a density of $\rho = 0,9982 \text{ kg/l}$ and a temperature $T = 20 \text{ }^\circ\text{C}$. To calculate volumetric flow or mass flow for fluids of another density ρ_1 see chapter 6 „Specifications of pitot tubes with WINFLOW“.

1. Order specification ITABAR-FLOW-Sensor, series FTMD-20 / 21

1. type of sensor

20	without end support
21	with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S 316 SS

4. welding coupling

00	without
07	material: C.S.
08	material: 316 SS

5. end support (only FTMD-21)

Y	without end support
C	end support material: C.S.
S	end support material: 316 SS

6. isolation valve for the sensor profile

AS1	gate valve 1", material: C.S.	PN16 / 150 lbs
AS2	gate valve 1", material: 1.4401	PN16 / 150 lbs

7. flanged packing gland

S material: 316 SS

8. cage nipple

PC	material: C.S.
PS	material: 316 SS

9. packing material for the flanged and welded packing gland

2 packing material: graphite, max 400°C

10. condensate vessel

s. page 162

11. thermal isolation

KI	without
X..	thermal isolation in inches or mm, please specify

12. piping run

HL	horizontal
VL	vertikal

13. gears

0	without gears
1	with gears

14. process connect., s page 162

FTMD-		/	S				S		2					
-------	--	---	---	--	--	--	---	--	---	--	--	--	--	--

1. Order specification ITABAR-FLOW-Sensor, series FTMD-25 / 26

1. type of sensor	
25	without end support
26	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
00	without
07	material: C.S.
08	material: 316 SS
5. end support (only FTMD-26)	
Y	without end support
C	end support material: C.S.
S	end support material: 316 SS
6. isolation valve for the sensor profile	
AS3	gate valve 1 1/2", material: C.S. PN16 / 150 lbs
AS4	gate valve 1 1/2", material: 1.4401 PN16 / 150 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS
9. packing material for the flanged and welded packing gland	
2	packing material: graphite, max 400°C
10. Condensate vessel	
	s. page 162
11. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
12. piping run	
HL	horizontal
VL	vertikal
13. gears	
0	without gears
1	with gears
14. integ. RTD resit. thermocouple	
TO	without
TA	3-wire
TB	3-wire, with ex-proofness
	15. process con., s page 162

FTMD- / S S 2

1. Order specification ITABAR-FLOW-Sensor, series FTMD-35 / 36

1. type of sensor	
35	without end support
36	with end support
2. inside diameter and wall thickness.	
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify
3. sensor material	
S	316 SS
4. welding coupling	
00	without
07	material: C.S.
08	material: 316 SS
5. end support (only FTMD-36)	
Y	without end support
C	end support material: C.S.
S	end support material: 316 SS
6. isolation valve for the sensor profile	
AS3	gate valve 2", material: C.S. PN16 / 150 lbs
AS4	gate valve 2", material: 1.4401 PN16 / 150 lbs
7. flanged packing gland	
S	material: 316 SS
8. cage nipple	
PC	material: C.S.
PS	material: 316 SS
9. packing material for the flanged and welded packing gland	
2	packing material: graphite, max 400°C
10. condensate vessel	
	s. page 162
11. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify
12. piping run	
HL	horizontal
VL	vertikal
13. gears	
0	without gears
1	with gears
14. integ. RTD resit. thermocouple	
TO	without
TA	3-wire
TB	3-wire, with ex-proofness
	15. process con., s page 162

FTMD- / S S 2

Order specification condensate vessel**type FTMD 20, 21, 25, 26, 35, 36****flanged joint at sensor head**

K0	without condensate vessel
K1	condensate vessel, welding stud 21,3mm, edge form 21 acc. DIN 2559

material and size condensate vessel

H	Kesselbach H11	size Ø 88,9 x 5 mm
S	material: 316 SS	size Ø 88,9 x 3,2 mm

**Order specification connection and shut-off device****type FTMD- 20, 21, 25, 26, 35, 36****shut-off device for effect pressure pipe, standard with welding condensate vessel**

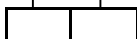
A00	without gate valve
A81	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material case: A105, packing: graphite glas-fibre
A82	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material case: 316L, pcking: graphite glas-fibre

**Order specification condensate vessel (only compact construction)****type FTMD 20, 21, 25, 26, 35, 36****flanged joint at sensor head**

A1	condensate vessel with sensor head, effect pressure pipe and direct welding flange
----	--

material and size condensate vessel

H	Kesselbach H11	size: Ø 88,9 x 5 mm
S	material: 316 SS	size: Ø 88,9 x 3,2 mm

**Order specification connection, only with A1****type FTMD- 20, 21, 25, 26, 35, 36****connections**

A06	flanged joint for 3-way manifold
A07	flanged joint for 5-way manifold

**Order specification shut-off device, only with A1****type FTMD- 20, 21, 25, 26, 35, 36****shut-off device for effect pressure pipe**

A00	without shut-off device
A66	mounted 3-way manifold, PN400, 1.4401 / packing: graphite
A71	mounted 5-way manifold, PN400, 1.4401 / packing: graphite



12.1 Model Series FTHD to 588 psi (PN 40)

Description

The ITABAR-sensor series FTHD is designed to measure volumetric flow of saturated and super heated steam.

The sensor construction features a flanged connection between the pipe and the sensor-related parts, a compression fitting to seal the sensor and a gate valve to insert the sensor profile into the pipe.

The sensor can be used at an operating pressure of up to 588 psi (40 bar) and an operating temperature of up to 400°C.

The insertion or removal of the sensor is made easy by two guide-rod spindles or (as an option) via a hand wheel driven gearbox.

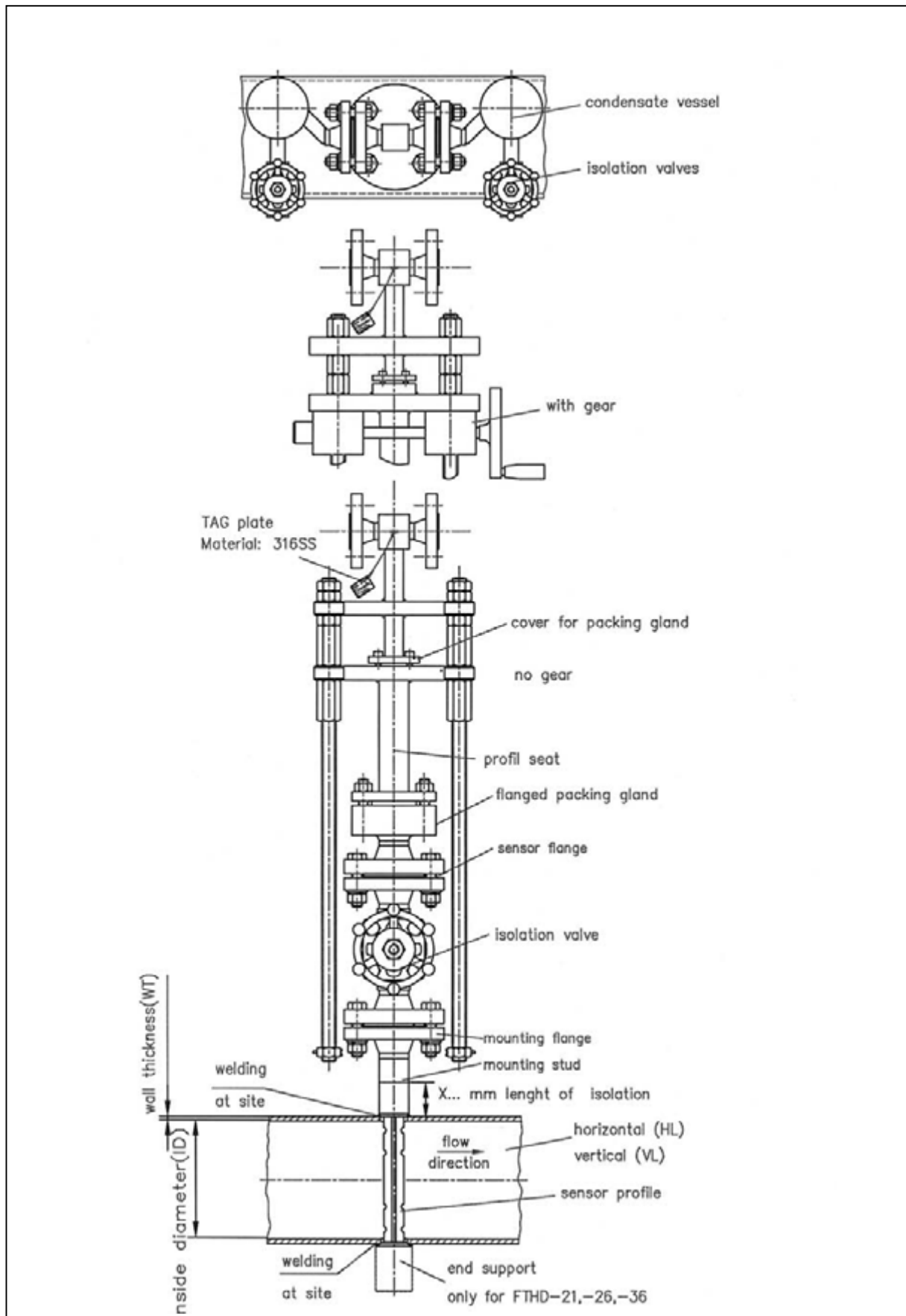


Fig. 12.3: : Pitot tube sensor FTHD-36 made of st. steel for a pipe with ID = 336.5 mm



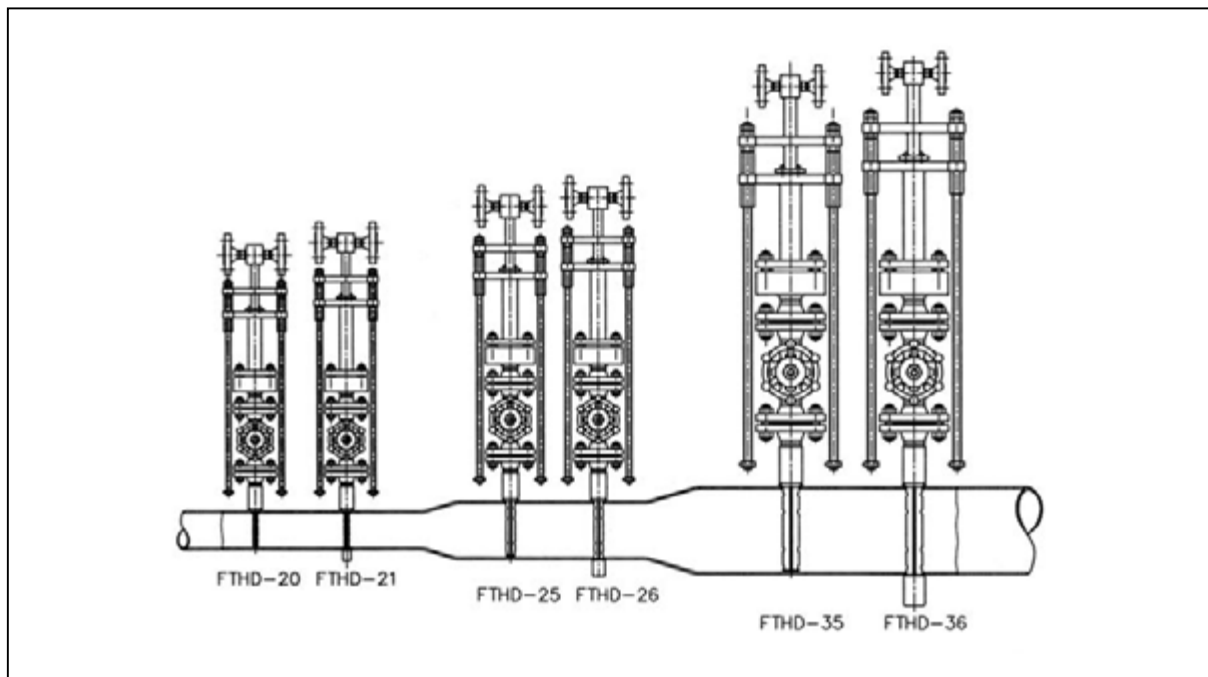
Fig. 12.4: Pitot tube sensor FTHD-36, shown in a horizontal installation for horizontal or vertical pipe runs.

Drawings für ITABAR Series FTHD



Order Data for ITABAR Series FTHD-20/21/25/26/35/36

1. Sensor Type



Pipe diameter (inches)	Maximum allowable volumetric flow in GPM					
	Sensor type					
	FTHD -20	FTHD -21	FTHD -25	FTHD -26	FTHD -35	FTHD -36
1 1/2	175	502	---	---	---	---
2	260	708	---	---	---	---
2 1/4	409	1069	---	---	---	---
3	572	1443	---	---	---	---
4	787	1936	902	2398	---	---
5	1047	2512	1240	3168	---	---
6	---	---	1579	3938	---	---
8	---	---	2270	5473	---	---
10	---	---	3027	7150	---	---
12	---	---	3841	8962	7739	18519
14	---	---	4637	10718	9438	22321
16	---	---	5403	12460	11154	26158
20	---	---	7013	15976	14462	33528
24	---	---	8588	19483	17850	41087
28	---	---	10212	23069	21370	48923
32	---	---	11910	26870	24965	56962
36	---	---	---	30839	---	65155
40	---	---	---	34896	---	73189
48	---	---	---	43010	---	90090
56	---	---	---	50965	---	106695
64	---	---	---	58656	---	123292
72	---	---	---	66255	---	139264
80	---	---	---	---	---	---

1. Order specification ITABAR-FLOW-Sensor, series FTHD-20 / 21

1. type of sensor

- 20 without end support
- 21 with end support

2. inside diameter and wall thickness.

ID / W.-thickn inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

- S 316 SS (standard)

4. sensor flange, always identically to sensor material.

- SM flange according DIN
- SA flange according ANSI

5. gasket

- 1 gasket strip according DIN
- 2 ANSI RF
- 3 ANSI RF SF (smooth finish)
- 4 RTJ

6. PN, material and DN of Sensor flange

		DIN	ANSI
1	PN16 / 150 lbs	DN25	1"
2	PN40 / 300 lbs	DN25	1"

7. design assembly connecting pieces

- R assembly connecting pieces with flange (standard)
- W Weldolet-assembly connecting pieces and flange

8. assembly connecting piece with flange, identically to sensor flange.

- 0 without flange
- M flange according DIN, gasket strip form C
- A flange according ANSI, gasket strip RF
- F flange according ANSI, gasket strip SF (smooth finish)
- T flange according ANSI, gasket strip RTJ

9. material connecting piece, with flange (max. pressure rating)

		always identically to sensor flange.		DIN	ANSI
C1	C.S.	PN16 / 150 lbs	DN25	1"	
S1	316 SS	PN16 / 150 lbs	DN25	1"	
C2	C.S.	PN40 / 300 lbs	DN25	1"	
S2	316 SS	PN40 / 300 lbs	DN25	1"	

10. end support (only FTHD-21)

- Y without end support
- C end support, material:C.S.
- S end support, material 316 SS

11. isolation valve for the sensor profile identically to sensor flange.

s. page 167

12. flanged packing gland

- S material: 316 SS

13. cage nipple

- PC material: C.S.
- PS material: 316 SS

14. packing material for the flanged and welded packing gland

- 1 packing material: PTFE, max 200°C
- 2 packing material: Graphit, max 400°C

15. gears

- 0 without gears
- 1 with gears

16. condensate vessel

s. page 174

17. thermal isolation

- KI without
- X.. thermal isolation in inches or mm, please specify

18. piping run

- HL horizontal
- VL vertikal

19. shut-off device

s. page 174

FTHD- / S

2. Order specification ITABAR-FLOW-Sensor - Flo-Tap-version**shut-off device for type FTHD-20/21****isolation valve for the sensor profile, DIN**

MF01 ball valve, DN25 / PN16, material: C.S.

MF02 ball valve DN25 / PN16, material: 1.4401

MF03 ball valve DN25 / PN40, material: C.S.

MF04 ball valve DN25 / PN40, material: 1.4401

MS01 gate valve DN25 / PN100, material: C.S.

MS02 gate valve DN25 / PN100, material: 1.4401

**isolation valve for the sensor profile, ANSI**

AF01 ball valve, 1" ANSI 150 lbs, material: C.S.

AF02 ball valve, 1" ANSI 150 lbs, material: 1.4401

AF03 ball valve, 1" ANSI 300 lbs, material: C.S.

AF04 ball valve, 1" ANSI 300 lbs, material: 1.4401

AS01 gate valve, 1" ANSI / 600lbs, material: C.S.

AS02 gate valve, 1" ANSI / 600lbs, material: 1.4401



1. Order specification ITABAR-FLOW-Sensor, series FTHD-25 / 26

1. type of sensor

25	without end support
26	with end support

2. inside diameter and wall thickness.

ID / W.-thickn. inside diameter and wall thickness in inches (or mm), please specify

3. sensor material

S	316 SS (standard)
---	-------------------

4. sensor flange, always identically to sensor material.

SM	flange according DIN
SA	flange according ANSI

5. gasket

1	gasket strip according DIN
2	ANSI RF
3	ANSI RF SF (smooth finish)
4	RTJ

6. PN, material and DN of Sensor flange

		DIN	ANSI
1	PN16 / 150 lbs	DN50	2"
2	PN40 / 300 lbs	DN50	2"

7. design assembly connecting pieces

R	assembly connecting pieces with flange (standard)
W	Weldolet-assembly connecting pieces and flange

8. assembly connecting piece with flange, identically to sensor flange.

0	without flange
M	flange according DIN, gasket strip form C
A	flange according ANSI, gasket strip RF
F	flange according ANSI, gasket strip SF (smooth finish)
T	flange according ANSI, gasket strip RTJ

9. material connecting piece, with flange (max. pressure rating)

always identically to sensor flange.			DIN	ANSI
C1	C.S.	PN16 / 150 lbs	DN50	2"
S1	316 SS	PN16 / 150 lbs	DN50	2"
C2	C.S.	PN40 / 300 lbs	DN50	2"
S2	316 SS	PN40 / 300 lbs	DN50	2"

10. end support (only FTHD-26)

Y	without end support
C	end support, material:C.S.

11. isolation valve for the sensor profile

s. page 170

12. flanged packing gland

S	material: 316 SS
---	------------------

13. cage nipple

PC	material: C.S.
PS	material: 316 SS

14. packing material for the flanged and welded packing gland

1	packing material: PTFE, max 200°C
2	packing material: Graphit, max 400°C

15. gears

0	without gears
1	with gears

16. thermal isolation

KI	without
X..	thermal isolation in inches or mm, please specify

17. condensate vessel

s. page 174

18. piping run

HL	horizontal
VL	vertikal

19. integ. RTD resit. thermocouple

T0	without
TA	3-wire
TB	3-wire, with ex-proofness

1. Bestellangaben ITABAR-DURCHFLUSS-Sonde, Baureihe FTGD-25 / 26

FTGD-																																					
	type of sensor		inside diameter and wall thickness.		sensor material		sensor flange		gasket		PN, material and DN of Sensor		design assembly connecting pieces		assembly connecting piece with flange		material connecting piece,		end support		isolation valve for the sensor profile		flanged packing gland		cage nipple		packing material for the flanged		gears		isolation		condensate vessel		pipng run		integ. RTD resist. thermocouple

	20. shut-off device
	s. page 174

2. Order specification ITABAR-FLOW-Sensor - Flo-Tap-version

shut-off device for type FT HD-25/26

isolation valve for the sensor profile, DIN

MF08	ball valve, DN32 / PN16, material: C.S.
MF09	ball valve, DN32 / PN16, material: 1.4401
MF13	ball valve, DN32 / PN40, material: C.S.-Stahl
MF14	ball valve, DN32 / PN40, material: 1.4401
MF18	ball valve, DN40 / PN63, material C.S.
MF19	ball valve, DN40 / PN63, material: 1.4401
MS10	gate valve DN40 / PN100, material: C.S.
MS11	gate valve DN40 / PN100, material: 1.4401



isolation valve for the sensor profile, ANSI

AF05	ball valve, 1 1/2" ANSI 150 lbs, material: C.S.
AF06	ball valve, 1 1/2" ANSI 150 lbs, material: 1.4401
AF10	ball valve, 1 1/2" ANSI 300 lbs, material: C.S.
AF11	ball valve, 1 1/2" ANSI 300 lbs, material: 1.4401
AS10	gate valve 1 1/2" ANSI 600 lbs, material: C.S.
AS11	gate valve, 1 1/2" ANSI 600 lbs, material: 1.4401



1. Order specification ITABAR-FLOW-Sensor, series FTHD-35 / 36

1. type of sensor			
35	without end support		
36	with end support		
2. inside diameter and wall thickness.			
ID / W.-thickn.	inside diameter and wall thickness in inches (or mm), please specify		
3. sensor material			
S	316 SS (standard)		
4. sensor flange, always identically to sensor material.			
SM	flange according DIN		
SA	flange according ANSI		
5. gasket			
1	gasket strip according DIN		
2	ANSI RF		
3	ANSI RF SF (smooth finish)		
4	RTJ		
6. PN, material and DN of Sensor flange			
		DIN	ANSI
1	PN16 / 150 lbs	DN50	2"
2	PN40 / 300 lbs	DN50	2"
7. design assembly connecting pieces			
R	assembly connecting pieces with flange (standard)		
W	Weldolet-assembly connecting pieces and flange		
8. assembly connecting piece with flange, identically to sensor flange.			
0	without flange		
M	flange according DIN, gasket strip form C		
A	flange according ANSI, gasket strip RF		
F	flange according ANSI, gasket strip SF (smooth finish)		
T	flange according ANSI, gasket strip RTJ		
9. material connecting piece, with flange (max. pressure rating)			
always identically to sensor flange.			
		DIN	ANSI
C1	C.S.	PN16 / 150 lbs	DN25 2"
S1	316 SS	PN16 / 150 lbs	DN25 2"
C2	C.S.	PN40 / 300 lbs	DN25 2"
S2	316 SS	PN40 / 300 lbs	DN25 2"
10. end support (only FTHD-36)			
Y	without end support		
C	end support, material:C.S.		
11. isolation valve for the sensor profile			
	s. page 173		
12. flanged packing gland			
S	material: 316 SS		
13. cage nipple			
PC	material; C.S.		
PS	material: 316 SS		
14. packing material for the flanged and welded packing gland			
1	packing material: PTFE, max 200°C		
2	packing material: Graphit, max 400°C		
15. gears			
0	without gears		
1	with gears		
16. thermal isolation			
KI	without		
X..	thermal isolation in inches or mm, please specify		
17. condensate vessel			
	s. page 174		
18. piping run			
HL	horizontal		
VL	vertikal		
19. integ. RTD resit. thermocouple			
T0	without		
TA	3-wire		

1. Order specification ITABAR-FLOW-Sensor, series FTGD-35 / 36

FTGD-	type of sensor																					
	inside diameter and wall thickness.																					
	sensor material																					
	sensor flange																					
	gasket																					
	PN, material and DN of Sensor																					
	design assembly connecting pieces																					
	assembly connecting piece with flange																					
	material connecting piece,																					
	end support																					
	isolation valve for the sensor profile																					
	flanged packing gland																					
	cage nipple																					
	packing material for the																					
	gears																					
	isolation																					
	condensate vessel																					
	pipng run																					
	integ. RTD resit. thermocouple																					

	20. shut-off device
	s. page 174

2. Order specification ITABAR-FLOW-Sensor - Flo-Tap-version

shut-off device for FTHD-35/36	
isolation valve for the sensor profile, DIN	
MF30	ball valve DN50 / PN16, material: C.S.
MF31	ball valve DN50 / PN16, material: 1.4401
MF35	ball valve DN50 / PN40, material: C.S.
MF36	ball valve DN50 / PN40, material: 1.4401
MF40	ball valve DN50 / PN63, material: C.S.
MF41	ball valve DN50 / PN63, material: 1.4401
MS20	gate valve, DN50 / PN100, material: C.S.
MS21	gate valve DN50 / PN100, material: 1.4401



isolation valve for the sensor profile, ANSI	
AF30	ball valve 2" ANSI 150 lbs, material: C.S.
AF31	ball valve 2" ANSI 150 lbs, material: 1.4401
AF35	ball valve 2" ANSI 300 lbs, material: C.S.
AF36	ball valve, 2" ANSI 300 lbs, Werkstoff: 1.4401
AS20	gate valve 2" ANSI 600 lbs, material: C.S.
AS21	gate valve 2" ANSI 600 lbs, material: 1.4401



Order specification condensate vessel**type FTHD 20, 21, 25, 26, 35, 36****flanged joint at sensor head**

K0	without condensate vessel
K1	condensate vessel, weld sockets 21,3mm, edge form 21 according DIN 2559
K3	condensate vessel with R 1/2" screw neck for screwed flange acc. DIN 19207
K4	condensate vessel with 1/2" NPT- screw neck
K5	condensate vessel with Ermeto coupling for 12 mm pipe (DIN 2353)

material and size condensate vessel

H	Kesselbach H11	size Ø 88,9 x 5 mm
S	material: 316 SS	size Ø 88,9 x 3,2 mm

**Order specification connection and shut-off device****type FTHD- 20, 21, 25, 26, 35, 36****shut-off device for effect pressure pipe, standard with welding condensate vessel**

A00	without gate valve
A81	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material case: A105, packing: graphite glas-fibre
A82	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material case: 316L, pcking: graphite glas-fibre

**Order specification condensate vessel (only compact construction)****type FTHD 20, 21, 25, 26, 35, 36****flanged joint at sensor head**

A1	condensate vessel with sensor head, effect pressure pipe and direct welding flange
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material and size condensate vessel

H	Kesselbach H11	size: Ø 88,9 x 5 mm
S	material: 316 SS	size: Ø 88,9 x 3,2 mm

**Order specification connection, only with A1****type FTHD- 20, 21, 25, 26, 35, 36****connections**

A06	flanged joint for 3-way manifold
A07	flanged joint for 5-way manifold

**Order specification shut-off device, only with A1****type FTMD- 20, 21, 25, 26, 35, 36****shut-off device for effect pressure pipe**

A00	without shut-off device
A66	mounted 3-way manifold, PN400, 1.4401 / packing: graphite
A71	mounted 5-way manifold, PN400, 1.4401 / packing: graphite



13. Documentation

Code	Description
D00	None

General Documentation :

Code	Description
D01	Certificate of Compliance
D04	Certificate of Origin
D05	Notarized Certificate of Origin
D07	Inspection Certificate

Manufacturing Process Documentation :

Code	Description
P12	Welding Methods Specifications (WPS, PQR), for standard materials
P13	Welding Methods Specifications (WPS, PQR), for special materials

Instrument Testing Documentation:

Code	Description
Y14	Materials Certificate (EN 10204 2.2)
Y15	Materials Certificate (EN 10204 3.1 B) for Models IBF and IBR
Y17	Materials Certificate (EN 10204 3.1 A)
Y18	Materials Certificate (EN 10204 3.1 C)
Y19	Hydraulic Pressure Test incl. test report
Y20	Construction- and Pressure Test according to Pressure Vessel Guidelines by TÜV, incl. Materials Certificate (EN 10204 3.1B)
Y21	Construction- and Pressure Test according AD-Procedure, TRB und TRD by TÜV, incl. Materials Certificate (EN 10204 3.1B AD-W2)
Y22	X-ray Testing of Welding Seams per DIN 54 111 or ASME Sec. VIII
Y23	Dye Tests of Welding Seams per DIN 54152 or ASME Sec.VIII
Y24	Hardness Test to NACE MR01-75, incl. NACE-Certificate of Conformance
Y25	Weight Certificate (for all instruments of an order)
Y26	Error check (PMI-check)
Y27	Certificate about ferrite particles in welding seam

Order code sample:	D01-P12-Y25
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14. Mass-Flow Signal Transmitter

Signal transmitters for mass flow measurement – also known as multivariable differential pressure transmitters – serve to measure the density compensated flow of gases, steam and liquids. Such transmitters (see Fig.1) allow a compact modular construction with pitot tubes as the flow sensing element (see Fig 2).

In conditions of changing operating temperatures and pressures the resulting operating density of a process fluid can vary over a wide range. As an example : a pressure and temperature change of only 2% can result in a 1% change of the mass flow value.

While direct fluid density measurement is possible in principle, it is often too cumbersome to accomplish.

Mostly it is easier to measure the operating temperature and pressure and include these values in mass flow calculations. With information about volumetric flow, operating temperature and operating pressure mass flow can be calculated as follows:

- Information about the volumetric flow value is derived from a pressure differential generated at the pitot tube flow sensor. This differential pressure (dp) is measured with a differential pressure sensor, which is built into the transmitter.
- Information about the fluid operating pressure is measured by a separate absolute-pressure sensor inside the same transmitter. There is an electrical connection between the dp and absolute-pressure sensors inside the transmitter. No cabling is required.
- The fluid operating temperature can be measured by means of either of a thermal element built into the flow sensor or a separately mounted temperature sensor. In both cases the temperature sensor is to be connected to the transmitter.

Mass flow is then calculated from volumetric flow and fluid density. The aggregate condition of a fluid is important :

- To calculate the densities of liquids a polynomial is used with operating temperature as its process variable.
- To calculate steam density a formula with operating temperature as its process variable is applied.
- To calculate the density of gases, gas laws are applied, taking into consideration both operating temperature as well as operating pressure.



Fig. 1: Transmitter for volumetric flow measurement, fluid temperature and pressure as well as the calculation of mass flow



Fig. 2: Compact sensor with multivariable transmitter

For a number of commonly measured fluids the functional relationships between density and operating temperature as well as operating pressure are stored in the transmitter's memory. Mass flow of other fluids can be measured by programming the appropriate density-temperature-pressure relationships into the transmitter.

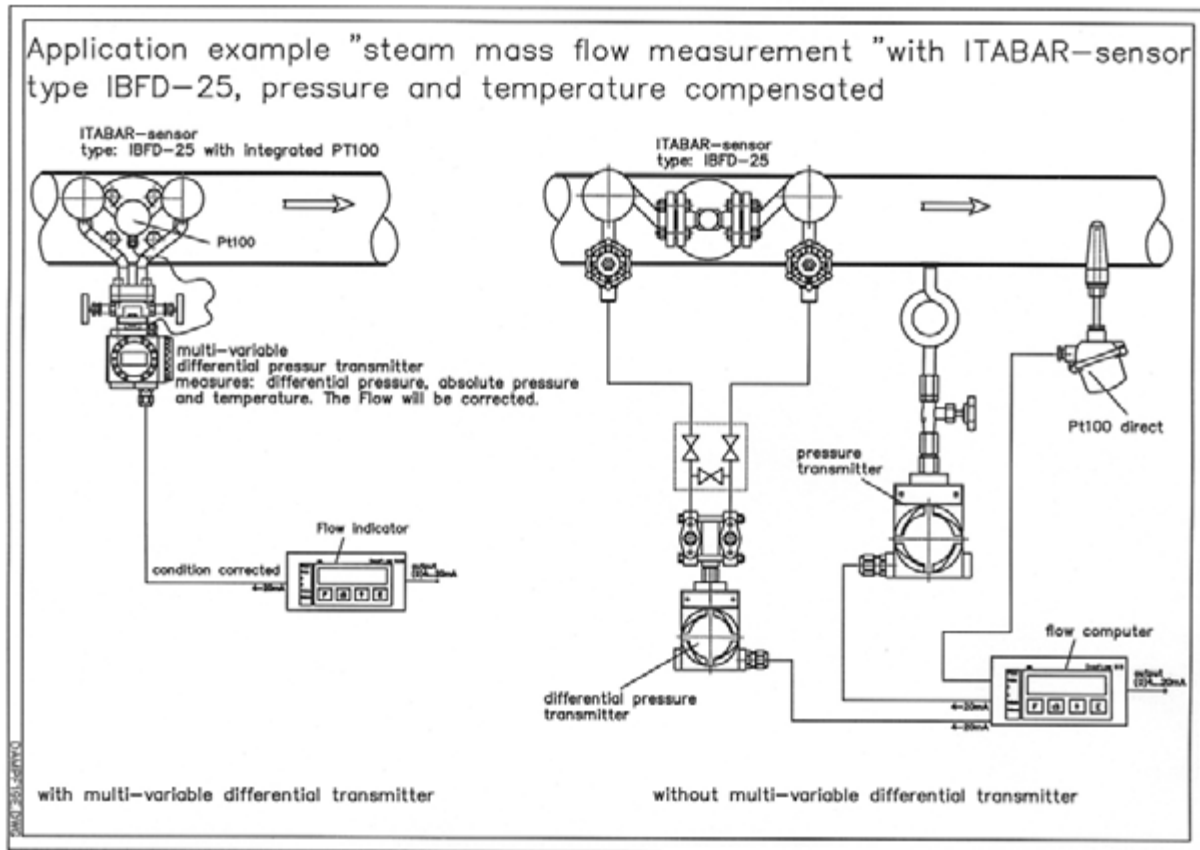


Fig. 3: Mass flow instrumentation of conventional transmitters vs multivariable transmitters

Fig. 3 illustrates two possible instrumentation arrangements for steam mass flow measurement. The advantages of the multivariable transmitter arrangement are :

- Simple and cost saving installation
- Pipeline only has to be tapped in one place
- Quick installation and removal from process
- No need to cut the pipe
- Replacement of thermal element is possible under pressure
- No additional installation and wiring procedures for pressure- or temperature sensors
- No need for additional corrective temperature/pressure calculators

Order Codes for Multi-Variable Signal Converter 2010 TC

1. Communication

V15714-P	Profibus PA
V15714-F	Foundation Fieldbus
V15714-H	HART, 4...20 mA

2. Differential Pressure Measuring Range

A	10 mbar (1 kPa / 5 inch H ₂ O) max. PN 6 (88 psi)
B	60 mbar (6 kPa / 25 inch H ₂ O)
C	400 mbar (40 kPa / 160 inch H ₂ O)
D	2.5 bar (250 kPa / 100 inch H ₂ O)

3. Static Pressure Measuring Range

5	6 bar (88 psi) only for measuring range 10 mbar (Code A)
4	20 bar (294 psi)
3	100 bar (1479 psi)
2	400 bar (5880 psi)

4. Version of Pressure Sensor

A	Membrane: Hastelloy C	Fluid : fluor carbon
B	Membrane: Hastelloy C	Fluid: silicone oil
F	Membrane: 1.4435 (316 st.steel)	Fluid: silicone oil
J	Membrane: Tantalum	Fluid : fluor carbon
P	Membrane: Monel	Fluid: silicone oil
U	Membrane: Gold coating	Fluid: silicone oil

5. Flanged Process Connections (plus- and minus sides identical)

J	316 st.steel (1.4404)
L	Hastelloy C
M	Monel

6. Process Connections (only plugs, no valves)

A	7/16 UNF and ¼" NPTF	Threaded holes for vent- or drain valves on process axis
B	7/16 UNF and ¼" NPTF	Side oriented holes for vent- or drain valves (only w/code 395/396)
C	M10/M12 and ¼"-18 NPTF	Threaded holes for vent- or drain valves on process axis
D	M10/M12 und ¼"-18 NPT (F)	Side oriented holes for vent- or drain valves (only w/code 395/396)

6. O-ring Materials for Process Flanges (screws always made of 316 st.steel)

6	Viton (-20 to +120°C)
7	Buna N
8	PTFE
9	EPDM for NACE applications

7. Enclosure of Signal Converter (data tag always synthetic)

	Enclosure Type	Enclosure Material	Electrical connections
D	Barrel-Type	Aluminum	½" NPTF
E	Barrel-Type	Aluminum	1 threaded M20x1,5

F	Barrel-Type	Aluminum	plug HAN 8U
J	Barrel-Type	stainless steel	½" NPTF
K	Barrel-Type	stainless steel	1 threaded M20x1,5
L	DIN-Type	Aluminum	½" NPTF
M	DIN-Type	Aluminum	1 threaded M20x1,5
N	DIN-Type	Aluminum	plug HAN 8U

8. Function

00	Without
5C9	Customer specific calibration

9. Signal Converter Accessories

5C2	On-board push buttons (not with enclosure Code J and K)
5C4	LC-Display
5C5	Backlit LC-Display (only with HART-Protocol)

10. Type of Ex-Protection

5A1	Pressure tight enclosure EEx d IIC T6 (no cable glands)
5A2	Explosion Proof and Intrinsically Safe to FM / CSA
5A3	Intrinsically Safe version EEx ia IIC T6 (also Zone 0)
5A4	Intrinsically Safe to FM / CSA

11. Mounting Brackets

142	For wall- or pipe mount, carb steel
144	For wall- or pipe mount, stainless steel

12. Vent- and Drain Valves (2 pieces)

395	Stainless steel
396	Hastelloy

13. Flange Adaptors

377	Oval flange ½-14 NPT and stainless steel screws
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14. Instrument Tag Numbering

5C8	On stainless steel tag
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15. User Manual

Z2D	German
Z2E	English

Ordering Sample: 2010TC-V15714-H-C-4-B-J-A-7-E-5C1-5C4-5A3-142-5C8

The measurement accuracy of the ITABAR sensors can be verified per customer request in external independent calibration facilities or with the manufacturer's calibration test rig. Calibrations at the manufacturer's site are done per customer specifications and are documented with a manufacturer's test certificate.



Fig. 4: Water calibration test stand for pipe sizes DN 15 (1/2") to DN 300 (12"). Volumetric flow: 0 to 360 m³/h (1600 GPM). Temperature: 15 bis 25 °C. Druck: 0.2 – 1.,0 bar.

Selected Application Examples

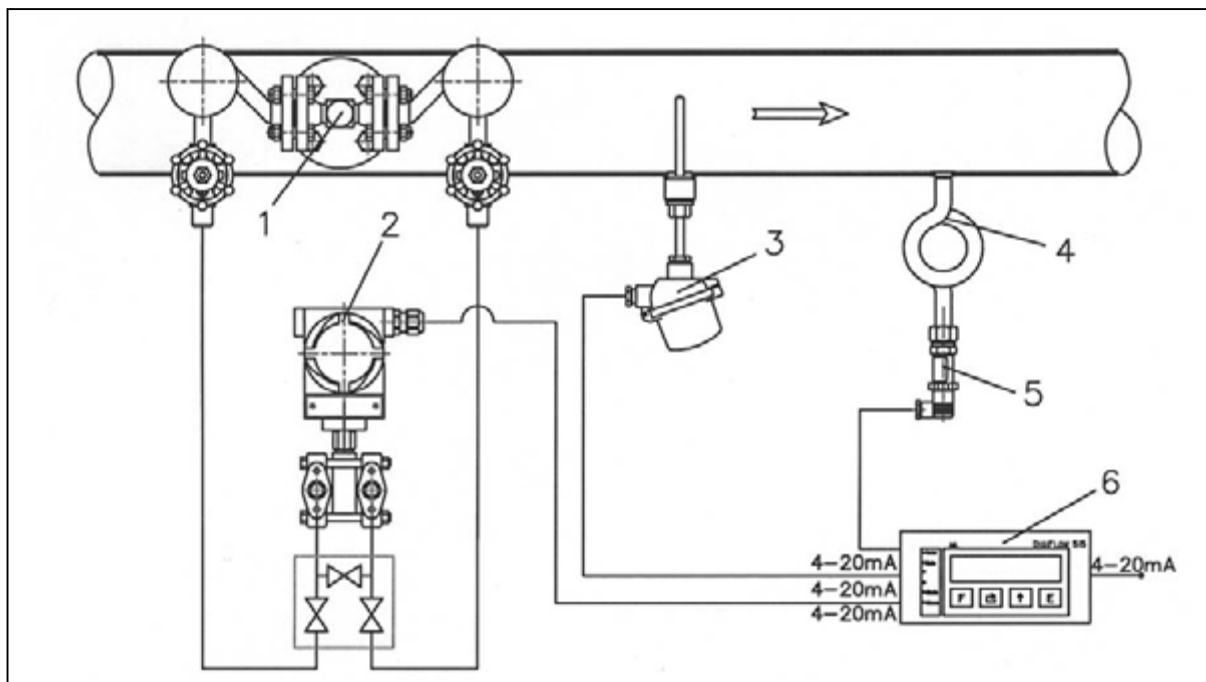


Fig. 5: Mass flow and heat measurement of steam with DP sensor type IBRD-26 (1), DP transmitter (2), PT100 temperature sensor (3) with integrated signal converter, contained (4) protected pressure sensor (5) and flow computer (6) type DigiFlow 515.

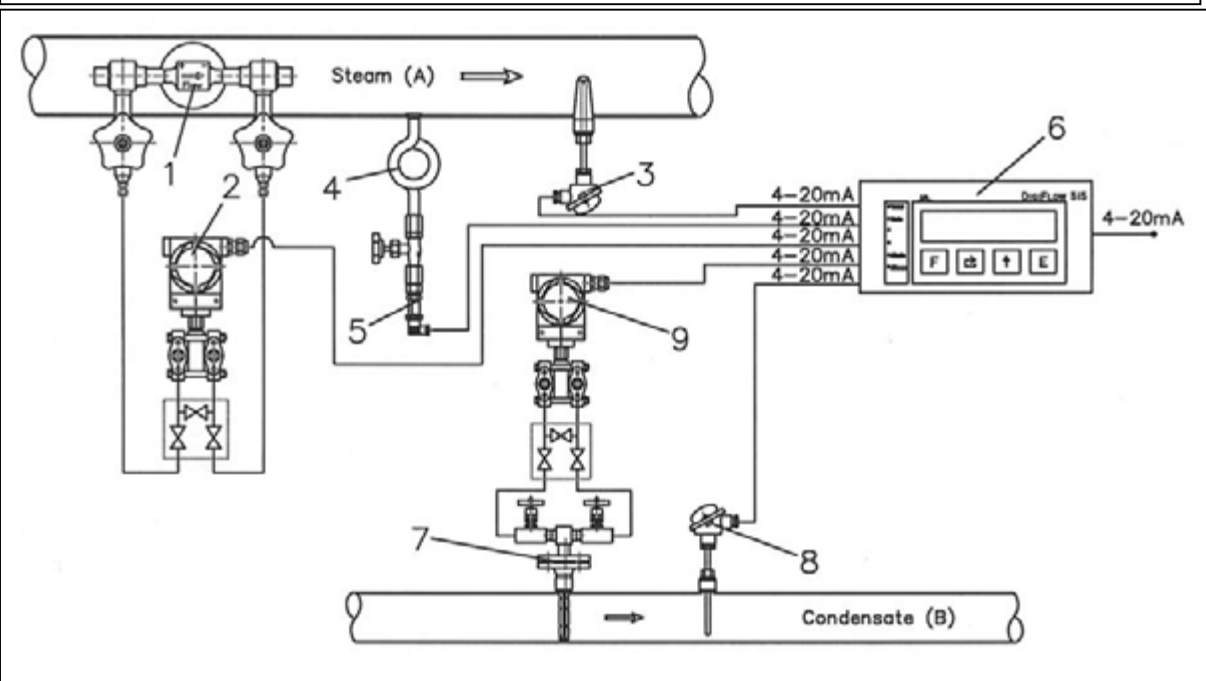


Fig. 6: Measurement of expended heat by calculating difference between heat in steam (A) and condensate (B). Components : DP sensor type IBFD-26 (1), DP transmitter (2 and 9), PT100 temperature sensor (3 and 8) with integrated signal converter, water loop (4), pressure sensor (5), DP sensor type IBF-25 (7) and flow computer (6) type DigiFlow 515.

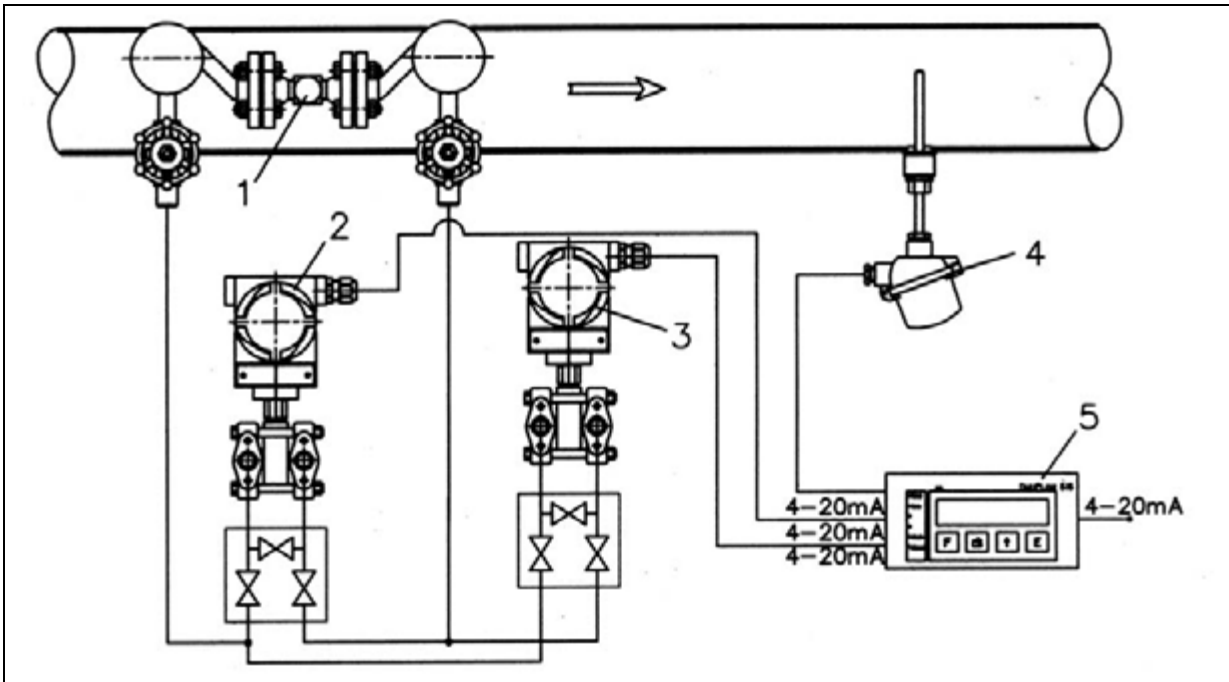


Fig. 7: Mass flow measurement of steam with expanded measuring range. The DP flow signal from sensor IBRD-26 (1) is the input to two separate DP transmitters (2 and 3) with different range settings (split range). Other components : PT100 temperature sensor (4) with integrated signal converter and flow computer type DigiFlow 515 (5).

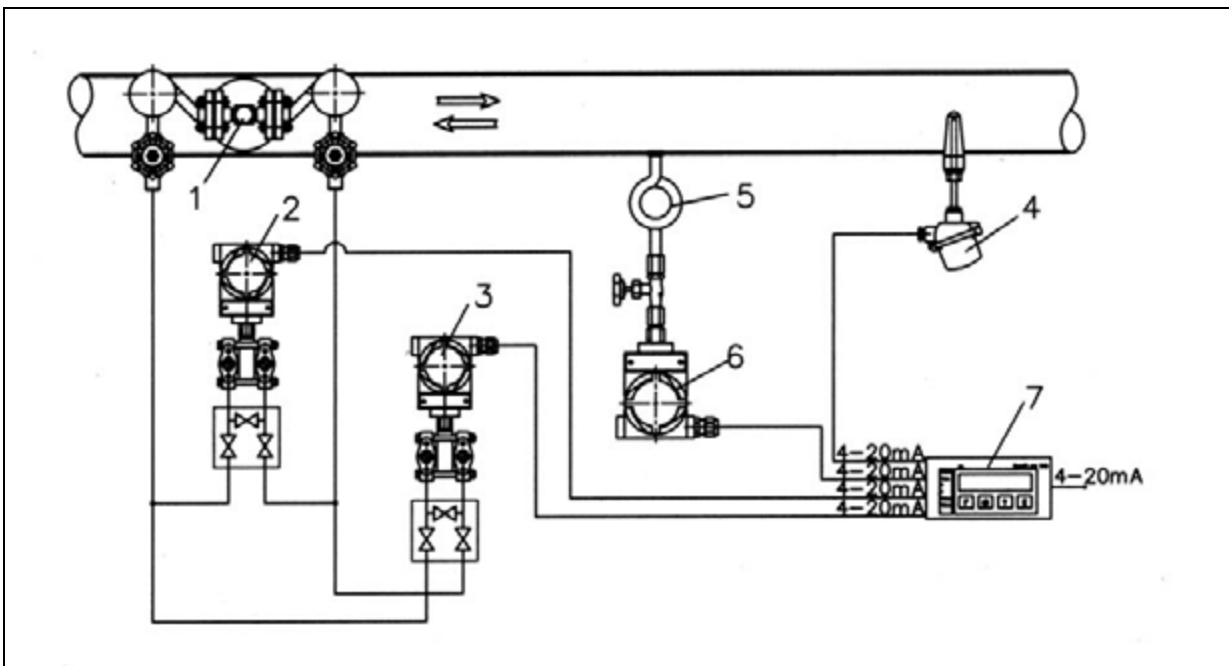
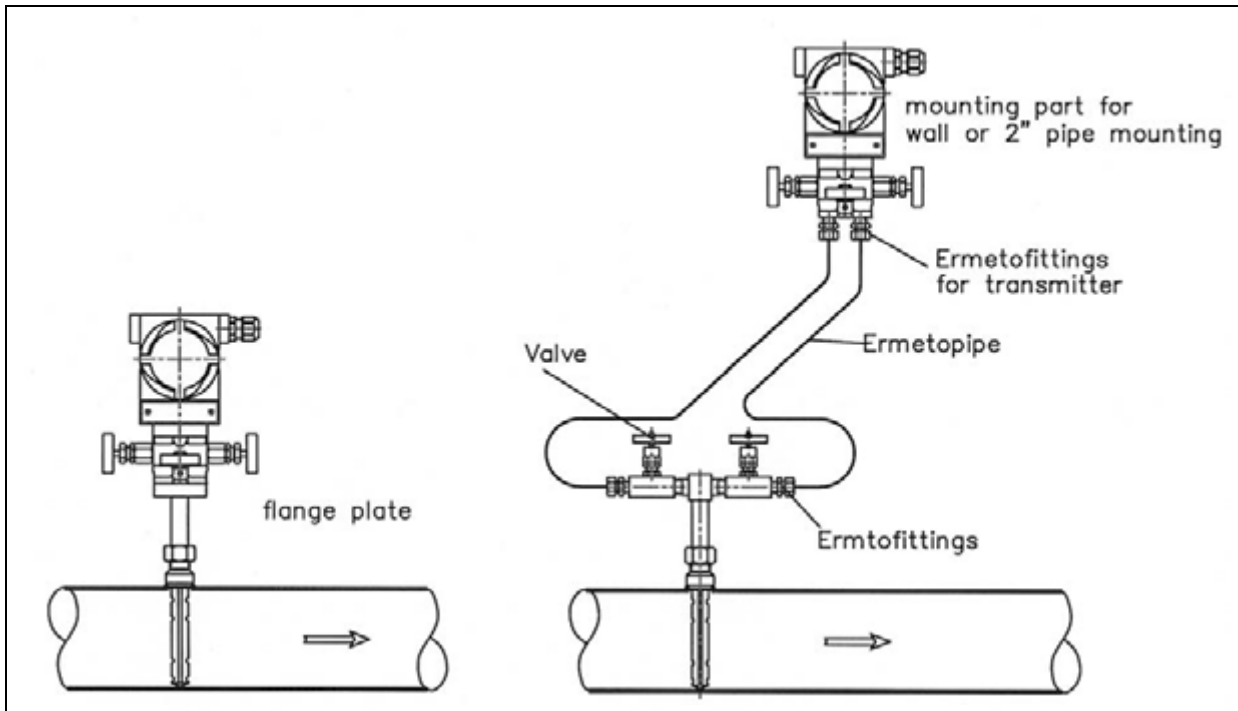


Fig. 8: Bi-directional mass flow measurement of steam with increased accuracy. Components: DP flow sensor type IBRD-25 (1), DP transmitter for forward flow (2) and reverse flow (3), PT100 temperature sensor with integrated signal converter (4), water loop (5), pressure sensor (6) and flow calculator (7) type DigiFlow 515.



The temperature limits of compact sensors (w/integrally mounted DP transmitter) are given by the temperature limits T_{FL} of the transmitter's process connections (as listed by the manufacturer). It is necessary to calculate in each instance whether or not the maximum allowable temperature at the transmitter's process connection might be exceeded or not. Such calculations are a function of a number of variables, requiring case by case computations for reliable results.

If the operating temperature of the fluid far exceeds the specified transmitter temperature limits it is recommended to install heat or cold insulation layers or – as a further step – to increase the distance between transmitter flange plate and sensor pipe mounting.

The following example for the use of a compact version sensor (w/integral transmitter) illustrates the issue (see Fig 9.5): The differential pressure is measured by a standard DP transmitter with a maximum allowed temperature of $T_{FL} = 85\text{ }^{\circ}\text{C}$ at the process flanges.

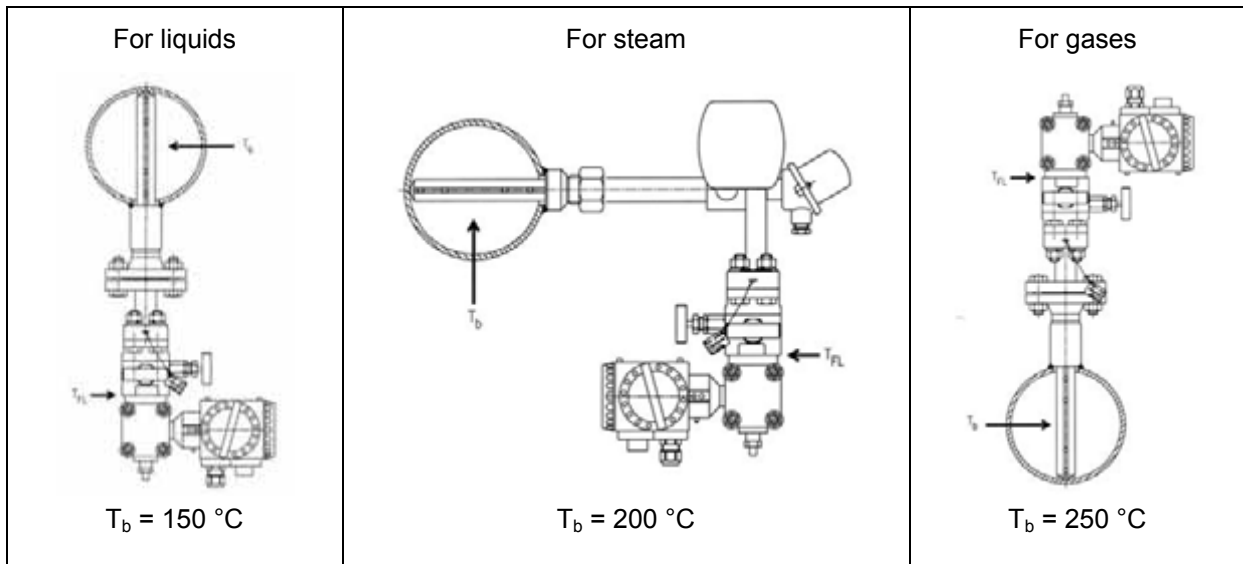


Fig. 9: Maximum allowable operating temperature T_b and recommended installation for compact version DP flow sensors: For liquids (steam, gases) the maximum allowable temperature $T_b = 150\text{ }^{\circ}\text{C}$ ($200\text{ }^{\circ}\text{C}$, $250\text{ }^{\circ}\text{C}$). Experience shows that with these temperature limits the specified max temperature of $T_{FL} = 85\text{ }^{\circ}\text{C}$ at the process flanges will not be exceeded.

15 Engineering Unit Conversion Tables

15.1 Conversion Table for Pressure

In commerce and governmental business the older pressure units - at, atü, ata, kg/cm², kp/cm², atm, mmWS, kp/m², Torr, mmHG, mmQS - are only allowed for exports. The new pressure unit is PASCAL [Pa] = Newton per square meter [N/m²]. Because this unit is not very handy „Bar“ is used as a multiple.

Pa N / m²	kPa	MPa	bar	mbar	inch H₂O	inch HG	PSI lbf/in²
1	10 ⁻³	10 ⁻⁶	10 ⁻⁵	10 ⁻²	4,016·10 ⁻³	2,953·10 ⁻⁴	145,05·10 ⁻⁶
10 ³	1	10 ⁻³	10 ⁻²	10	4,016	0,2953	0,14505
10 ⁶	10 ³	1	10	10 ⁴	4016	295,3	145,05
10 ⁵	100	0,1	1	10 ³	401,6	29,53	14,505
100	0,1	10 ⁻⁴	10 ⁻³	1	0,4016	29,53·10 ⁻³	14,505·10 ⁻³
249,1	0,2491	0,2491·10 ⁻³	2,491·10 ⁻³	2,491	1	7,355·10 ⁻²	36,126·10 ⁻³
3386	3,386	3,386·10 ⁻³	3,386·10 ⁻²	33,86	13,6	1	0,4912
6894,8	6,8948	6,8948·10 ⁻³	6,8948·10 ⁻²	68,948	27,68	2,036	1

Pressure conversion tables for older units:

Pa N / m²	kPa	bar	mbar	mmWS mmH₂O	Torr mmHg	at kp / cm²	atm
1	10 ⁻³	10 ⁻⁵	10 ⁻²	0,102	7,501·10 ⁻³	10,2·10 ⁻⁶	9,869·10 ⁻⁶
10 ³	1	10 ⁻²	10	102	7,501	10,2·10 ⁻³	9,869·10 ⁻³
10 ⁶	10 ³	10	10 ⁴	102·10 ³	7501	10,2	9,869
10 ⁵	100	1	10 ³	10,2·10 ³	750,1	1,02	0,9869
100	0,1	10 ⁻³	1	10,2	0,7501	1,02·10 ⁻³	0,9869·10 ⁻³
9807	9,807	98,07·10 ⁻³	98,07	10 ³	73,56	0,1	96,78·10 ⁻³
9,807	9,807·10 ⁻³	98,07·10 ⁻⁶	98,07·10 ⁻³	1	73,56·10 ⁻³	10 ⁻⁴	96,78·10 ⁻⁶
133,32	0,13332	1,333·10 ⁻³	1,333	13,59	1	1,359·10 ⁻³	1,316·10 ⁻³
98,07·10 ³	98,07	0,9807	980,7	10 ⁴	735,6	1	0,9678
1,013·10 ⁵	101,3	1,013	1013	10,33·10 ³	760	1,033	1

15.1 Conversion Table for Viscosity

There are two types of viscosity: dynamic viscosity and kinematic viscosity .

Dynamic viscosity is independent of fluid density. The SI units for dynamic viscosity is the pascal-second [Pa·s]. A dynamic viscosity of one pascal-second is equal to the dynamic viscosity of a laminar flowing homogenous fluid, in which the tension between two in parallel flowing streams with an in-between distance of 1 meter and at a velocity difference of 1 m/s is 1 pascal. Older units for dynamic viscosity are Poise [P] or [kp s/m²].

Conversion Table for Dynamic Viscosity Units

Pa s	mPa s cP	dPa s P	kp s / m ²	kp h / m ²	lb-mass/ ft s	lb-force s/ ft ²
1	1000	10	0,10197	2,833 x 10 ⁻⁵	0,6721	2,0885 x 10 ⁻²
0,001	1	0,01	0,10197 x 10 ⁻³	2,833 x 10 ⁻⁸	0,6721 x 10 ⁻³	2,0885 x 10 ⁻⁵
0,1	100	1	0,010197	2,833 x 10 ⁻⁶	0,06721	2,0885 x 10 ⁻³
9,807	9807	98,07	1	2,778 x 10 ⁻⁴	6,5919	0,20482
0,35304 x 10 ⁵	0,35304 x 10 ⁸	0,35304 x 10 ⁶	3600	1	2,3730 x 10 ⁴	0,73728 x 10 ³
1,488	1448,2	14,882	0,1518	4,214 x 10 ⁻⁵	1	0,03108
47,88	47880	478,8	4,882	1,3558 x 10 ⁻³	32,174	1

Kinematic Viscosity is density dependent and therefore always related to the density of a fluid. The unit of measure is square meter per second [m²/s]. A kinematic viscosity of one m²/s is equal to the kinematic viscosity of a homogenous fluid with a dynamic viscosity of one pascal-second and a density of 1 kg/cubicmeter. The unit Stokes (St) is no longer valid.

The Engler-Degree [E] is not a unit in the meaning of the „laws of mass unit measurements“. To convert Engler-Degree into kinematic viscosity ν the following formular can be used:

$$\nu = \left(7,32 E - \frac{6,31}{E} \right) 10^{-6} \text{ m}^2 / \text{s} \quad (\text{Gl. 14.1})$$

Conversion Table for Kinematic Viscosity Units

m ² /s	cm ² /s	mm ² /s	m ² /h	St	cSt	ft ² /s	ft ² /h
1	10 ⁵	10 ⁶	3600	10 ⁵	10 ⁶	10,764	3,875 x 10 ⁴
10 ⁻⁴	1	100	0,36	1	100	1,0764 x 10 ⁻³	3,875
10 ⁻⁶	10 ⁻²	1	0,0036	0,01	1	1,0764 x 10 ⁻⁵	0,03875
2,778 x 10 ⁻⁴	2,778	277,8	1	2,778	277,8	29,9 x 10 ⁻⁴	10,764
10 ⁻⁴	1	100	0,36	1	100	1,0764 x 10 ⁻³	3,875
10 ⁻⁶	10 ⁻²	1	0,0036	0,01	1	1,0764 x 10 ⁻⁵	0,03875
9,2903 x 10 ⁻²	929,03	92903	334,45	929,03	92903	1	3600
0,25806 x 10 ⁻⁴	0,25806	25,806	9,2903 x 10 ⁻²	0,25806	24,806	2,778 x 10 ⁻⁴	1