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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 Annex.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) (sound engineering practice) and may not be marked with a CE symbol (see Art. 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 267CS 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 267CS 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

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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 1/2" 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-on 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

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

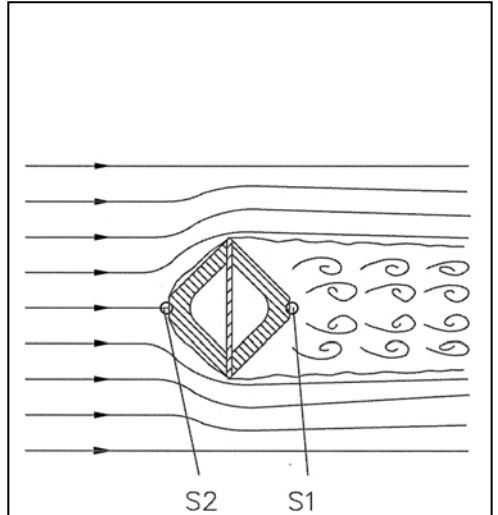


Fig. 2.1: Schematic representation of fluid flow pattern at location of ITABAR profile

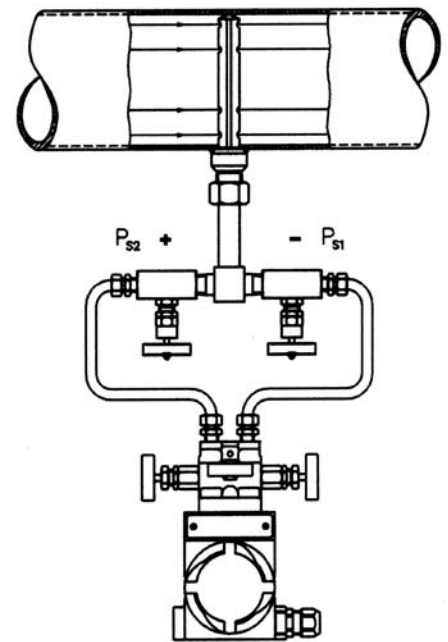


Fig. 2.2: Schematic representation of generating a differential pressure Δp

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

Volumetric flow for gases under standard conditions	$Q_{vn} = k * 1,0159 * A \varepsilon \sqrt{\frac{2 \Delta p P_b Z_n T_n}{\rho_n T_b Z_b P_n}}$	2.7
Volumetric flow for gases under operating conditions	$Q_v = k * 1,0159 * A \varepsilon \sqrt{\frac{2 \Delta p}{\rho_b}}$	2.8
Mass flow for gases and steam	$Q_m = k * 1,0159 * A \varepsilon \sqrt{2 \Delta p \rho_b}$	2.9
Mass flow for liquids	$Q_m = k * 1,0159 * A \sqrt{2 \Delta p \rho_b}$	2.10
Volumetric flow for liquids	$Q_v = k * 1,0159 * A \sqrt{\frac{2 \Delta p}{\rho_b}}$	2.11

The following definitions apply :

		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 :

$$\varepsilon = 1 - \frac{\Delta p}{k(\dots) P_b} \left\{ \left(1 - \frac{2 b}{\sqrt{\pi F}} \right)^2 0,31424 - 0,09484 \right\} \quad (\text{Gl. 2.11})$$

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 Rohren 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

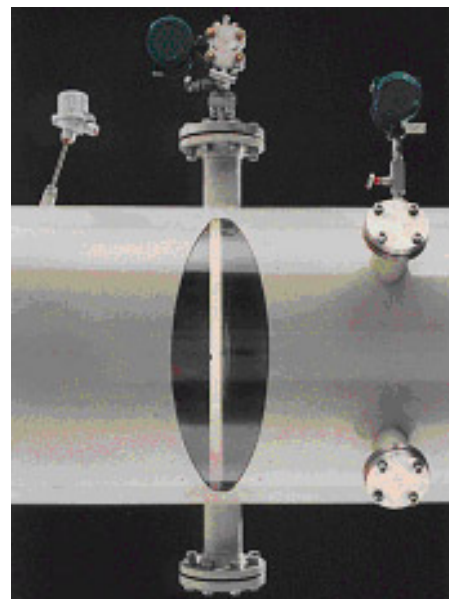


Fig. 3.2: Foto of sensor version IBF-100, developed specifically for flue gas measurement, installed in a (for demo purposes) transparent pipe. The sensor is accessible from both ends and allows mechanical cleaning without having to be taken out of the line.

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.

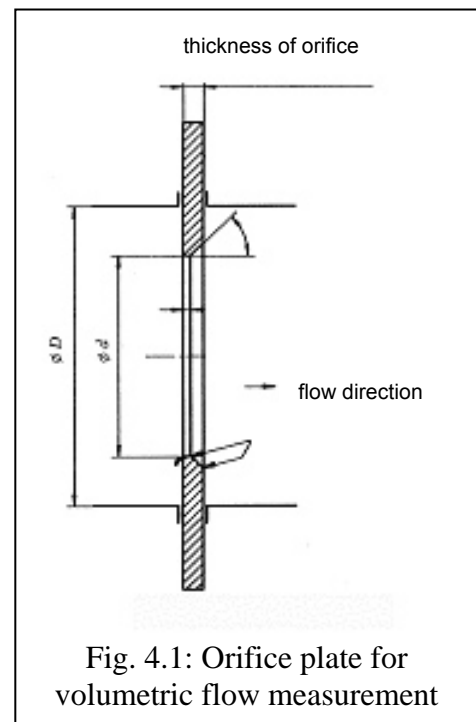
The total savings in material- and labor costs which can be realized by using an ITABAR-sensor are at least 25% in a 4" pipe installation and at least 70% in a 20" pipe installation.

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.



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 $T = 68\text{ }^{\circ}\text{F}$ ($20\text{ }^{\circ}\text{C}$); operating pressure $p = 29.01\text{ psia}$ (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 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. .

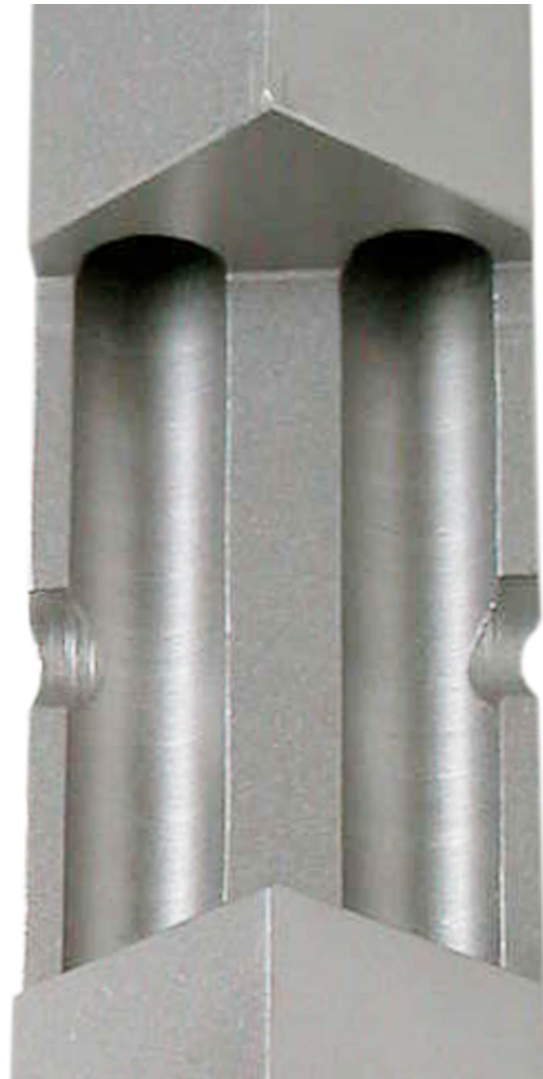


Fig.4.2: Sensor profile of pitot tube model 35/36 in a cut-away view to illustrate the two pressure channels near the pressure apertures.

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.

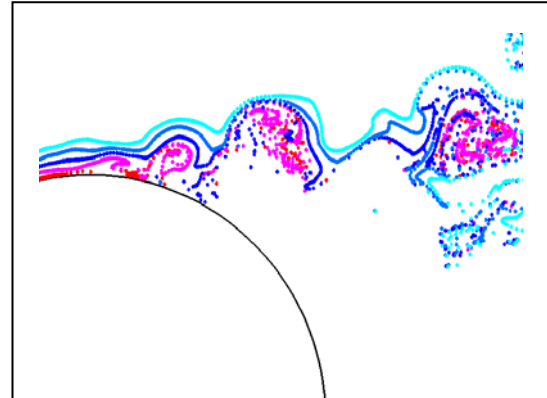


Fig. 4.3: Stream lines illustration at the separation area of a cylindrical shaped pitot tube sensor. Using a finite-element-method calculation, this computer graphic shows the fluid conditions at a Reynolds number $Re = 20.000$

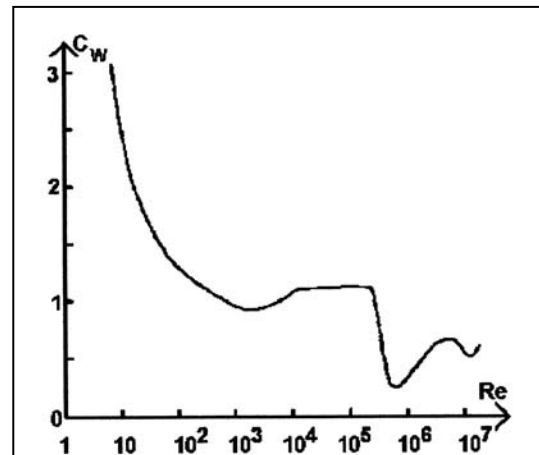


Fig. 4.4: Resistance value c_w of a cylindrical pitot tube sensor as a function of Reynolds number

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 (-148°F to +842 °F).

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

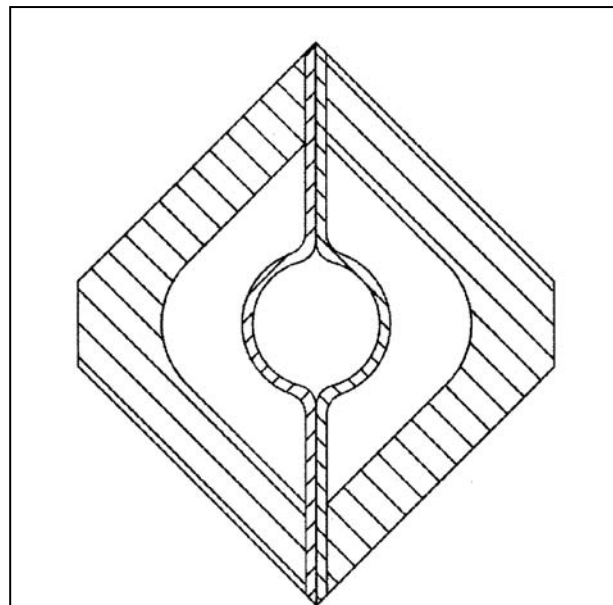


Fig. 4.6: Cross-sectional view of a type 25/26/35/36/65/66/100 sensor profile for insertion of a resistance thermocouple

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	± 0.5 % 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	± 1 % of rate	medium	low
Electro-magnetic sensors (insertion type)	Liquids with conductivity > 5 μS	Localized measurement in vicinity of sensor electrodes	$\pm 2-3$ % of rate	low	medium

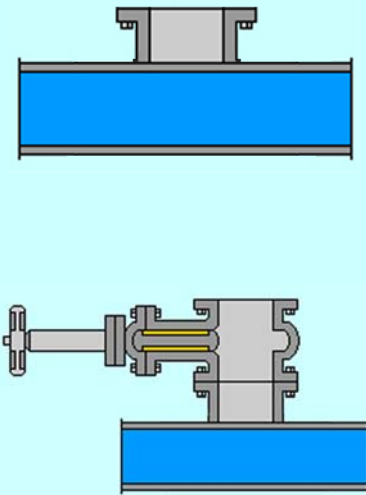
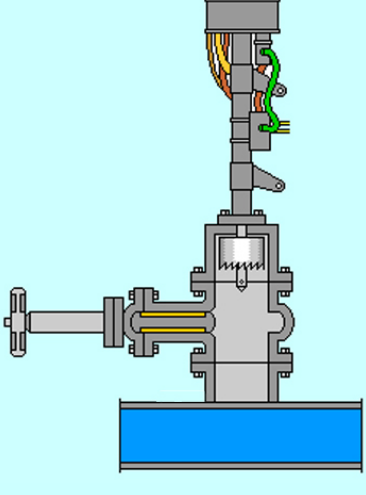
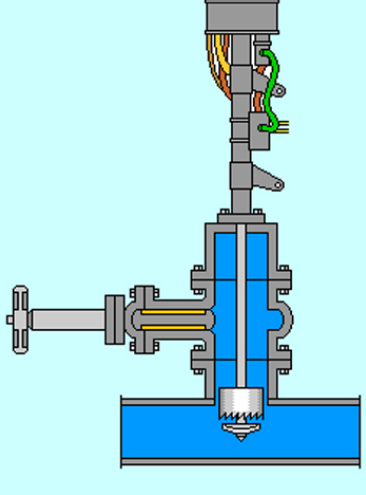
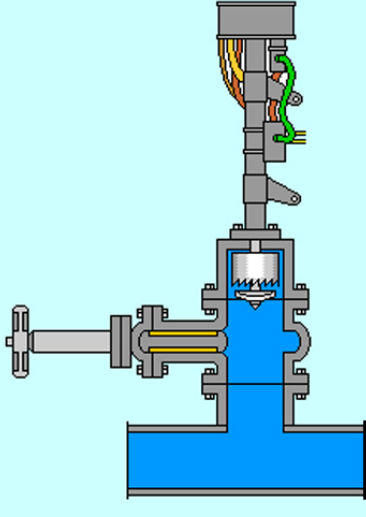
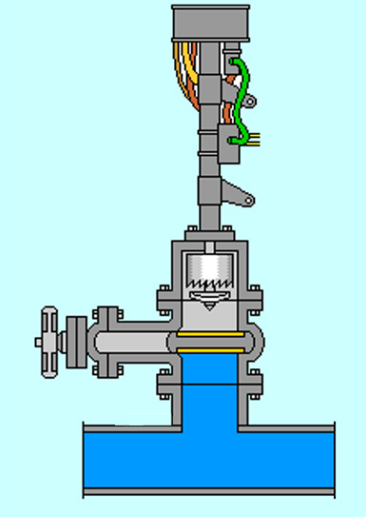
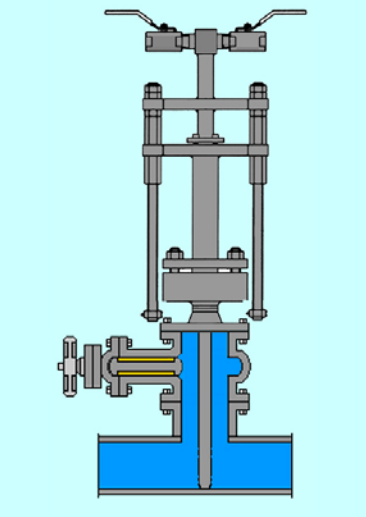
For many applications, which require an under-pressure installation, the ITABAR pitot tube series Flo-Tap is the first choice. A retroactive Flo-Tap-sensor installation under pressure is done in the following steps:

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 vale 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 FTHD 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.

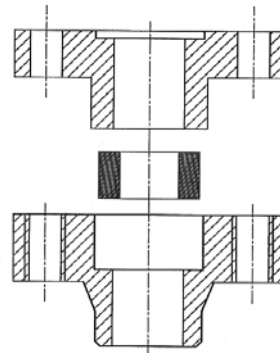


Fig. 4.8: ITABAR® Flo-Tap-sensor with second packing gland

Construction of Wet-Tap Pitot Tubes

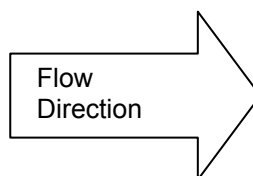
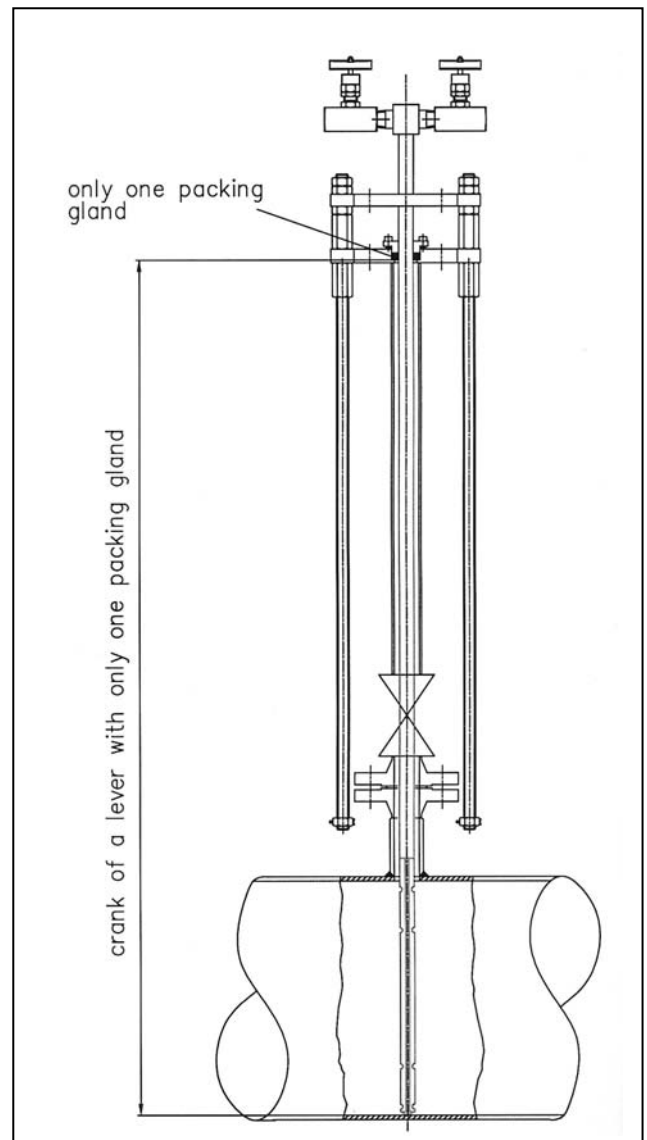
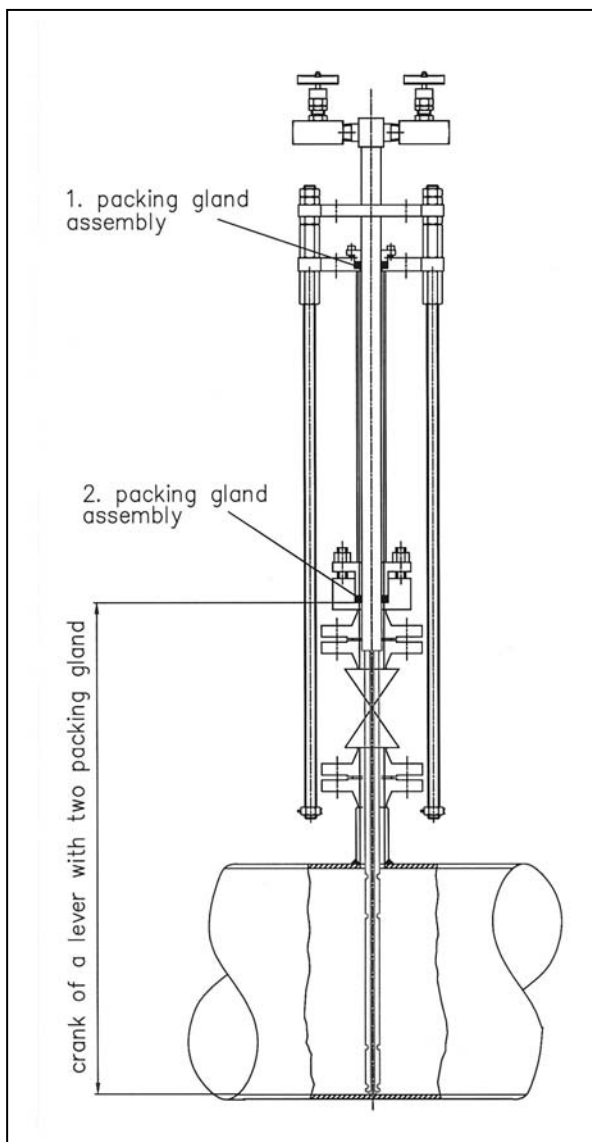


Fig. 4.9: ITABAR pitot tube with two packing glands. The short leverage practically eliminates the danger of the sensor breaking.

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.

The screenshot shows the 'WinFlow 2.5 vom 16.02.99' window. It has a menu bar with 'Datei', 'Bearbeiten', 'Kopfdaten', and 'Parameter'. The main area contains several input fields and dropdown menus. The 'Berechnungsart' is set to 'Volumenstrom Gase (Betriebsbedingung)'. 'Medium' is 'Luft'. 'Druck' is '5,00' bar (abs). 'Temperatur' is '45,00' °C. 'Dichte' is '0,0000' kg/Nm3. 'Viskosität' is '0,0000' mPa s. 'QMax' is '12.500,00' m3/h. 'QNorm' is '10.000,00'. 'QMin' is '2.500,00'. 'Rohrinnendurchmesser' is '354,000' mm. 'Wandstärke' is '6,4' mm. 'Kanalforn' is 'rund'. 'Rohrleitungsverlauf' is 'vertikal'. 'Typ' is '25'. 'Sensor' is 'IBR'. 'Material' is '1.4571 / X6 CrNiMoTi 17 12 2'. There is a 'D/E' button at the bottom right.

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
<p>Installation / Removal with Process Shut Down</p>			
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 (87, 232 psig)	x	x	x
40 bar, 63 bar (580, 914 psig)	x	x	---
100, 160, 250, 320, 400 bar (1450, 2321, 3626, 4641, 5801 psig)		x	---
Max. operating temperature			
200° Celsius / 25 bar (392 °F / 363 psig)	x		
1175° Celsius (2147 °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, Inconel 600, PVDF	---	x	x
3.7035 (Titanium Gr.2)	---	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
<p>Installation / Removal Under Pressure (Wet-Tap)</p>   			
Measurement task:			
Measurement of liquids, gases and gas mixtures	x	x	x
Measurement of flue gas	x	x	x
Possible operating pressures			
6 bar / 87 psig	x	x	x
16 bar, 40 bar (232, 580 psig)	---	x	x
63 and 100 bar (914 and 1450 psig)	---	---	x
Max. operating temperature:			
200° Celsius (392 °F)	x		
300° Celsius (572 °F)	---	x	x
400° Celsius (752 °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
3.7035 (Titanium Gr.2)	x	x	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 (914 psig) and temp_{max} = 200 °C (392°F), liquids to pressure_{max} = 63 bar (914 psig) and temp_{max} = 150°C (302°F)



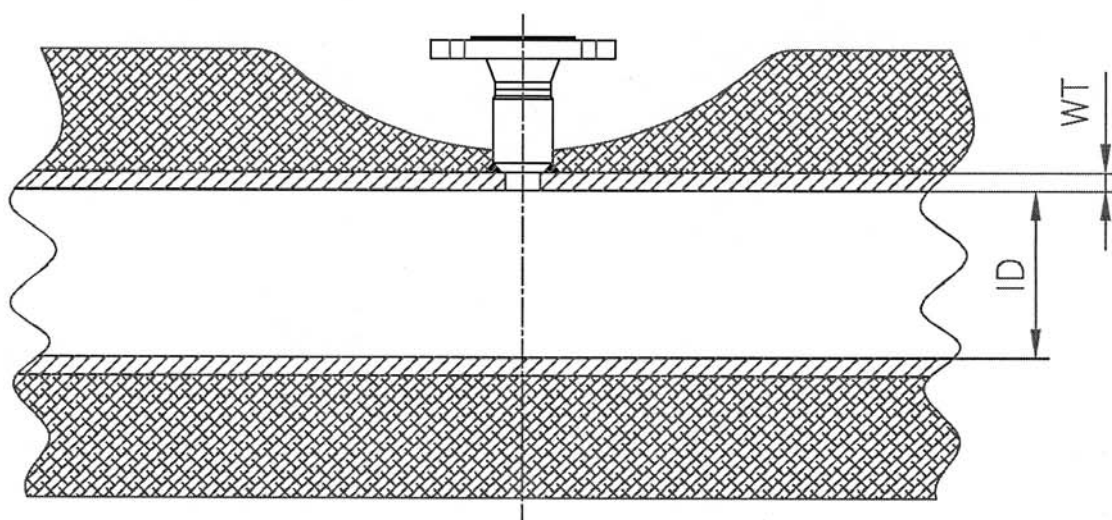
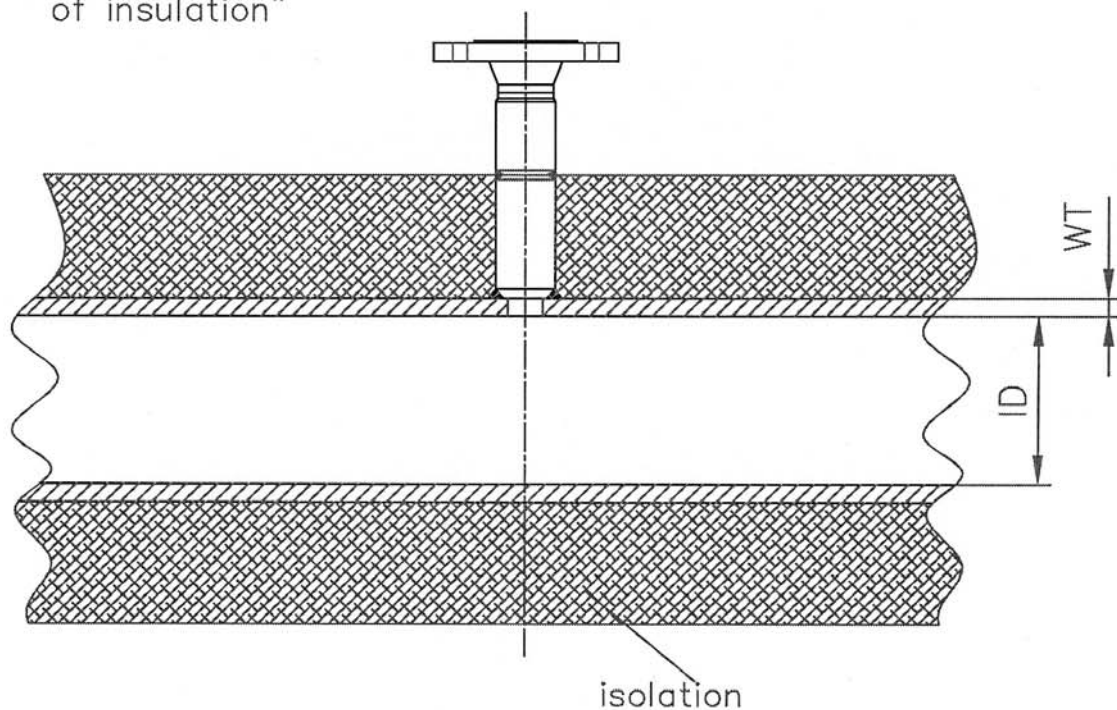
Fig. 7.3: Threaded weld boss for IBR-25/26 mat. Carbon steel, 316 SS



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"

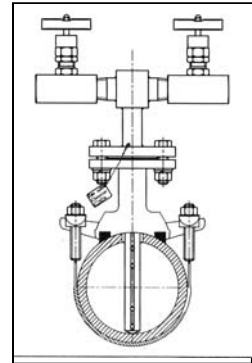


"If an extension is not included, the isolation must be reduced – increased insulation effort"

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 / 58.0 psig (gas) / PN 16 / 232.1 psig (water) and at least one saddle clamp.



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

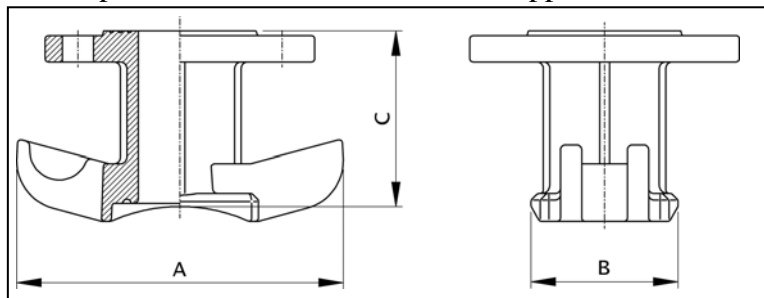


Fig 7.6: Universal drill-clamp with flange pipe size 2" DN 40/50 PN 4 / 58.0 psig (gas) / PN 16 / 232.1 psig (water)

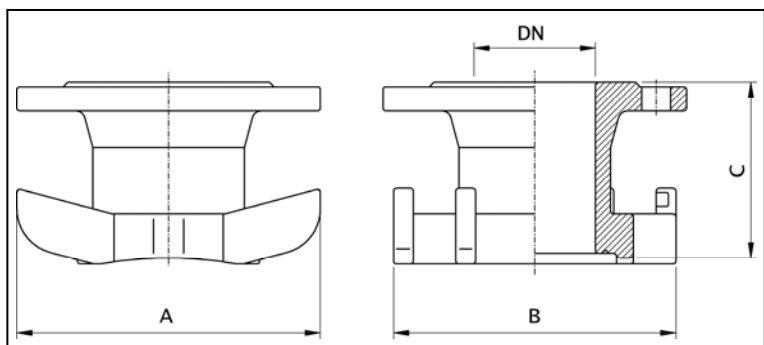


Fig 7.7: Double saddle clamp-drill-clamp with flange pipe size 3" DN 80 PN 4 / 58.0 psig (gas) / PN 16 / 232.1 psig (water)



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 (145 psig)	---	---	x
- Asbestos-cement pipe 12.5 bar (181.3 psig)	---	---	x
- Asbestos-cement pipe 16 bar (232.1 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.	Temperature range	Use	Use
316 SS (Standard)	800°C 1472°F (for pressure retaining parts: 450°C 842°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	500°C 932°F	Sea water desalination plants, petro-chem 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 842-1472°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 1202-1904°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 1652°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 2147°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.
3.7035 Ti-50° B 348 Gr.2 Titan Gr.2	300°C 572°F (for pressure retaining parts: -10 - +250°C 14 - +482°F)	Sea water desalination plants, petro-chem industry, food industry, evaporators, extraction facilities, distilleries, dryers	Good mechanical properties combined with high resistance against general corrosion, tear- and oscillation corrosion. Low density and excellent to be welded.

Materials Overview

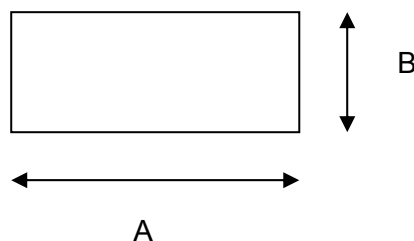
Material Nr.	Temperature range	Use	Use
2.4360 NiCu2Ofe Monel	425-550°C 797-1020°F	Extraction facilities, dryers, mixing – and batching plants, evaporators distilleries, sea water desalination plants	The Cr-Ni-Mo alloyed material is very resistant against reducing organic and inorganic acids, as well 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 -40°F to +248°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 16 Mo 3	530°C 986°F	High pressure steam applications	
1.7335	570°C 1058°F	High pressure steam applications	
1.7380 10 CrMo 4 4	600°C 1112°F	High pressure steam applications	
1.4903 10 CrMoVNB 91	650°C 1202°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		-
	3.7035	Titan Gr. 2	B 348 Gr.2	-

Pipe inside diameter	1 ½" – 480" (DN 20 - DN 12000)
Max. operating pressure	PN 400 / 5801 psig (depending on sensor type)
Max. operating temperature	1200°C (2192°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/Gerrnany. 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



Substitute diameter

$$D_{ER} = 2 * \sqrt{\frac{A * B}{\pi}}$$

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.

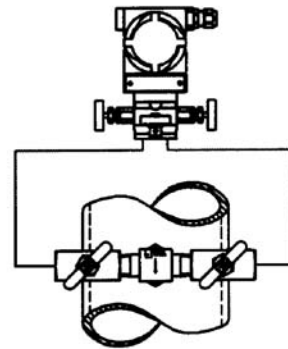
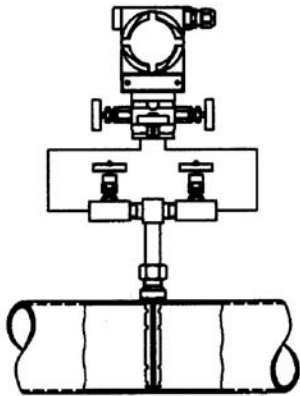


Fig. 7.10: Recommended orientation for measurement of gases

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.

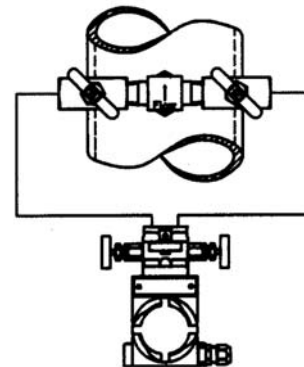
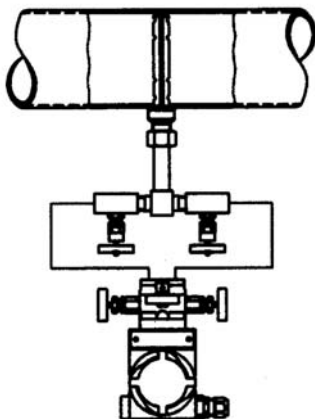
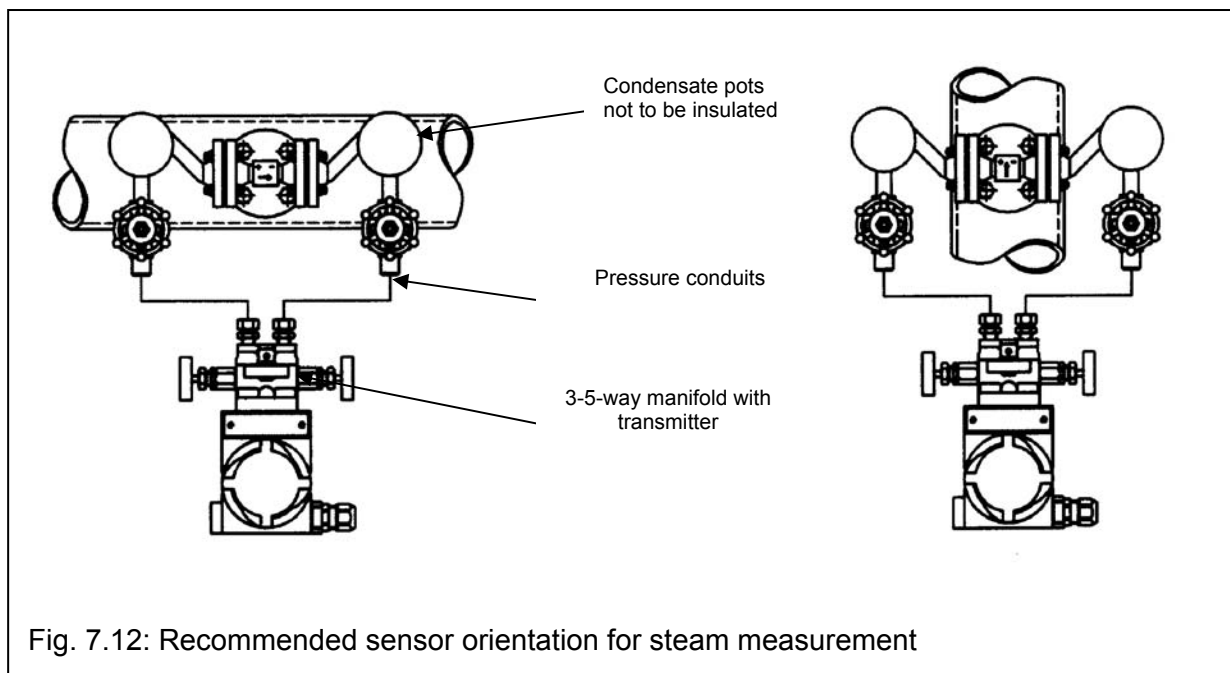


Fig. 7.11 Recommended sensor orientation for liquid measurement

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.



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

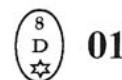
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Ort und Datum der Prüfung
Place and date of inspection

Göttingen, 20. September 2001

Gültigkeit der Prüfung bis 31. Dezember 2002
This inspection is valid until

Stempelzeichen
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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
m³/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



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 Norm 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	$\pm 0,5\%$ of rate for all measured values	NMI Nederlands Meetinstituut	NL-Dordrecht	24.3.2000
IBF-25	Measurement accuracy	$\pm 0,68\%$ of rate for all measured values	PIGSAR Ruhrgas AG (national authorized)	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

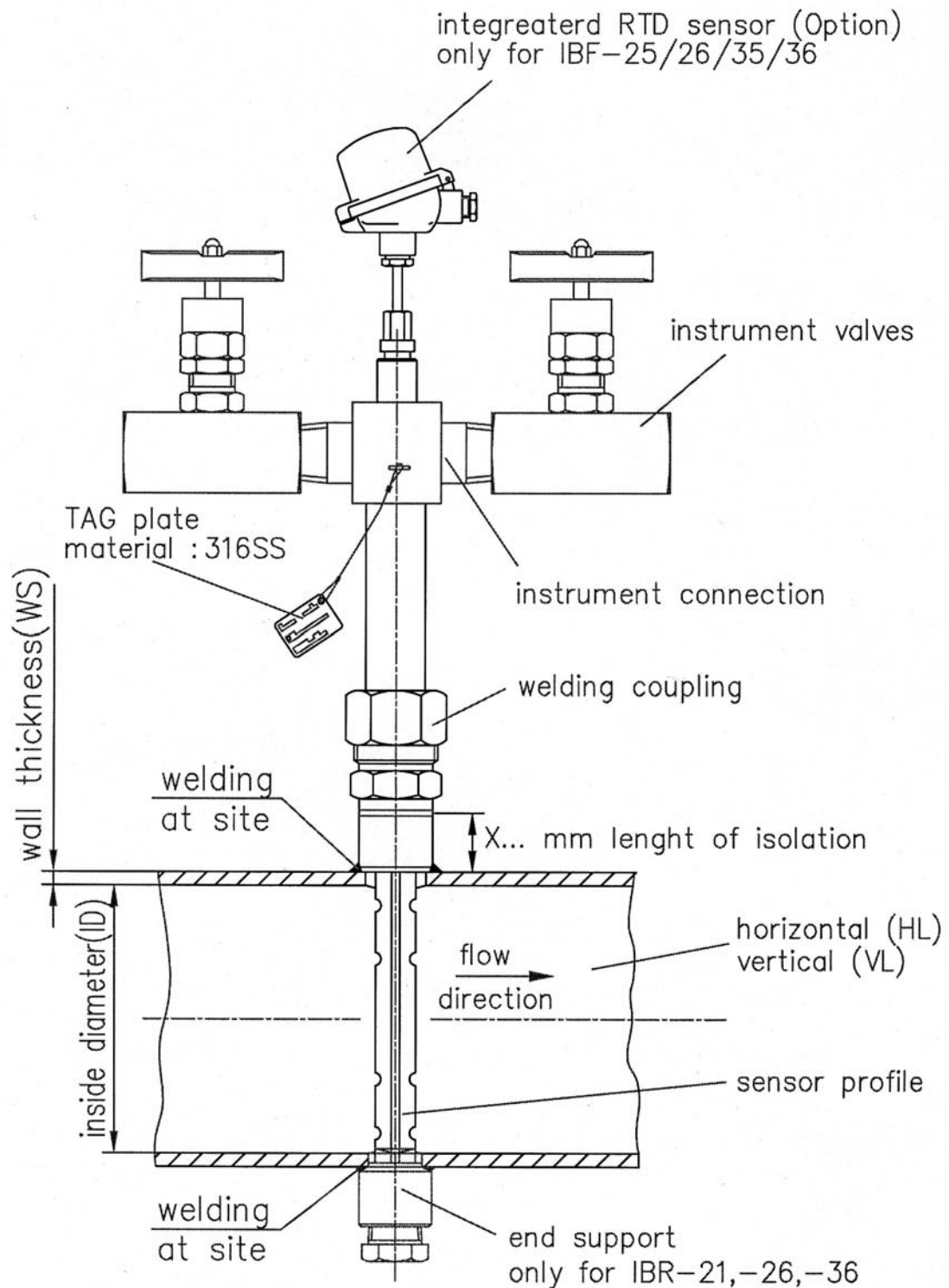
Description

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

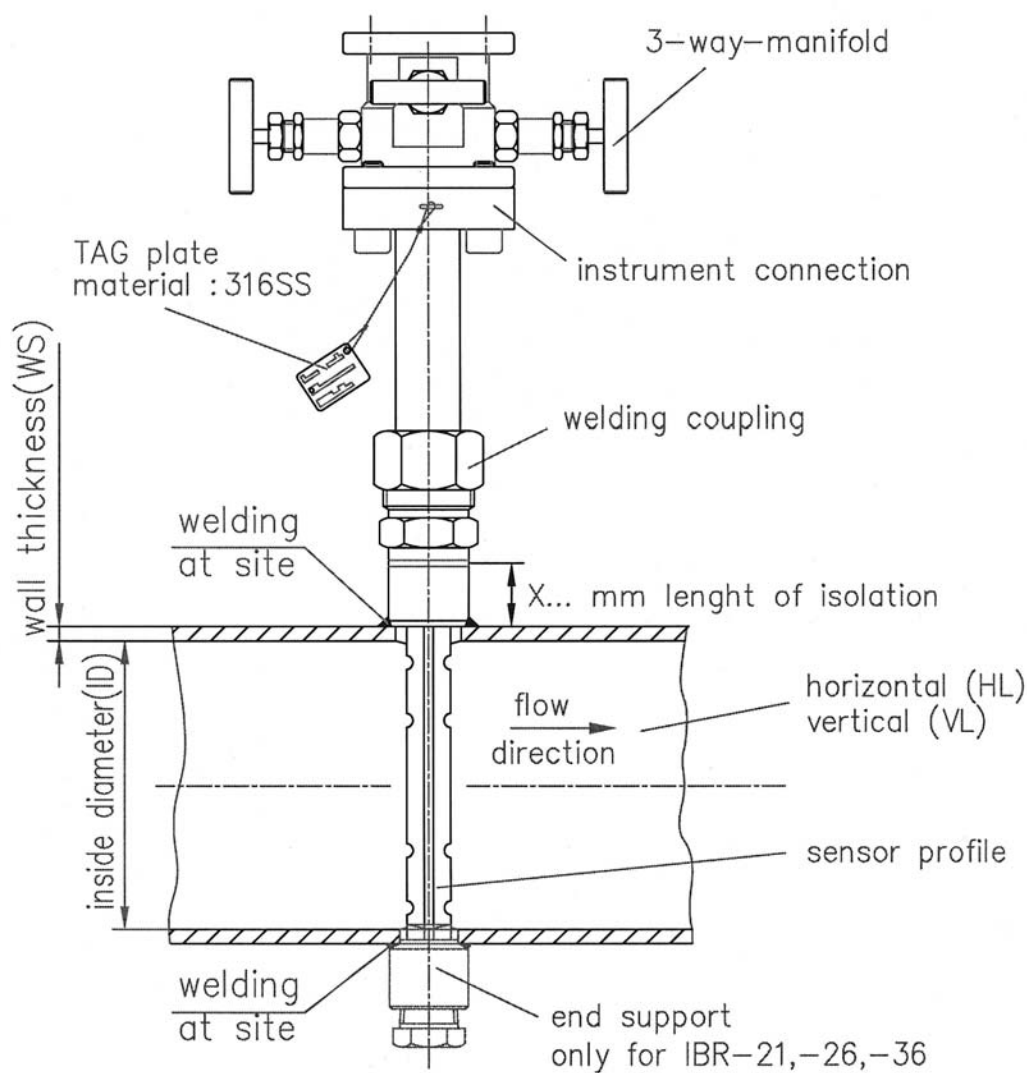


Fig.7.1: ITABAR IBR-25 for pipe size ID = 5.76 inches

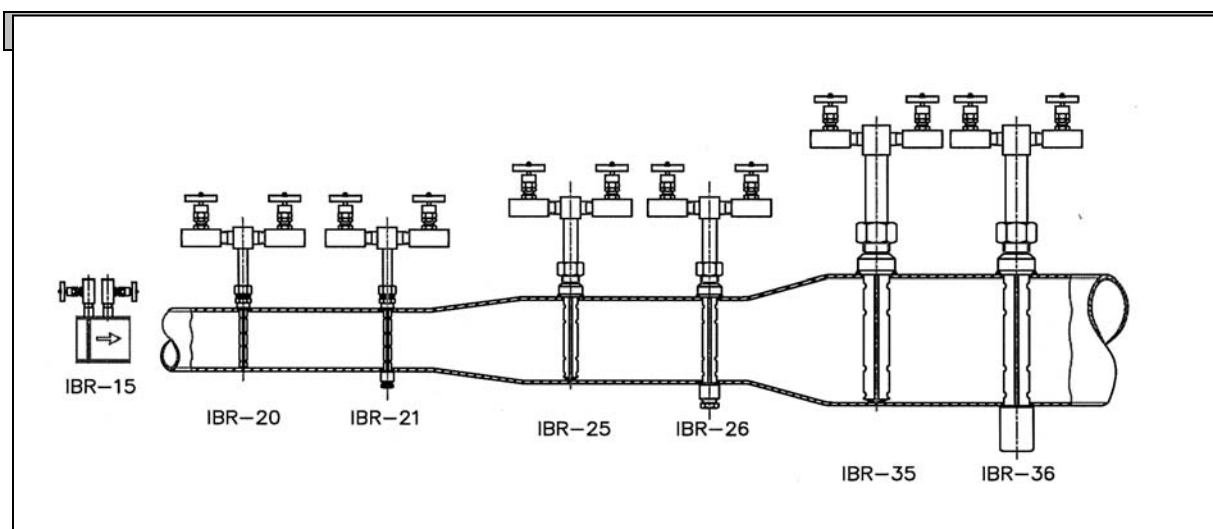
seperate installation of sensor and transmitter



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



	Max. volumetric flow GPM <small>(water see below)</small>						
	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	---	---	---	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	316Ti (1.4571)								
5. piping run									
HL	horizontal								
VL	vertical (only for dry gases)								
6. process connection									
7. instrument valves									

IBR-	15	/	S						
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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	316Ti (1.4571)								
4. welding coupling									
00	without								
07	material: C.S.								
07.1	material: copper incl. Adapter <i>- only for pipe made from copper-</i>								
08	material: 316Ti (1.4571)								
5. material end support (IBR-21)									
Y	without end support								
C	end support, material: C.S.								
S	end support, material: 316Ti (1.4571)								
K	end support, material: copper								
6. isolation									
KI	without								
X..	isolation in inches (or mm), please specify								
7. piping run									
HL	horizontal								
VL	vertical								
8. process connection									
9. instrument valves									

IBR-		/	S						
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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	316Ti													
4. welding coupling														
0	without													
1	material: C.S.													
1.1	material: copper incl. adapter - only for pipe made from copper-													
2	material: 316Ti													
5. material end support (IBR-26)														
Y	without end support													
C	end support: material C.S.													
S	end support, material: 316Ti													
K	end support, material: copper													
6. isolation														
KI	without													
X..	isolation in inches (or mm), please specify													
7. piping run														
HL	horizontal													
VL	vertical													
8. integrated RTD resistance thermocouple														
T0	without													
TA	3-wire													
TB	3-wire, with ex-approval													
9. headtransmitter for thermocouple														
10. process connection														
11. instrument valves														
12. accessories -only with A03,A04-														
0	without													
SPA	1/8"-NPT cleaning ports													
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	316Ti													
4. welding coupling														
0	without													
1	material: C.S.													
1.1	material: copper incl. adapter - only for pipe made from copper-													
2	material: 316Ti (1.4571)													
5. material end support (IBR-36)														
Y	without end support													
C	end support, material: C.S.													
S	end support, material: 316Ti (1.4571)													
K	end support, material: copper													
6. isolation														
KI	without													
X..	isolation in inches (or mm), please specify													
7. piping run														
HL	horizontal													
VL	vertical													
8.integrated RTD resistance thermocouple														
T0	without													
TA	3-wire													
TB	2-wire, with ex-approval													
9. headtransmitter for thermocouple														
10. process connection														
11. instrument valves														
12. accessories -only with A03,A04-														
0	without													
SPA	1/8"-NPT cleaning ports													
IBR- / S														

8.1 Series IBF to 5801 PSI

Description

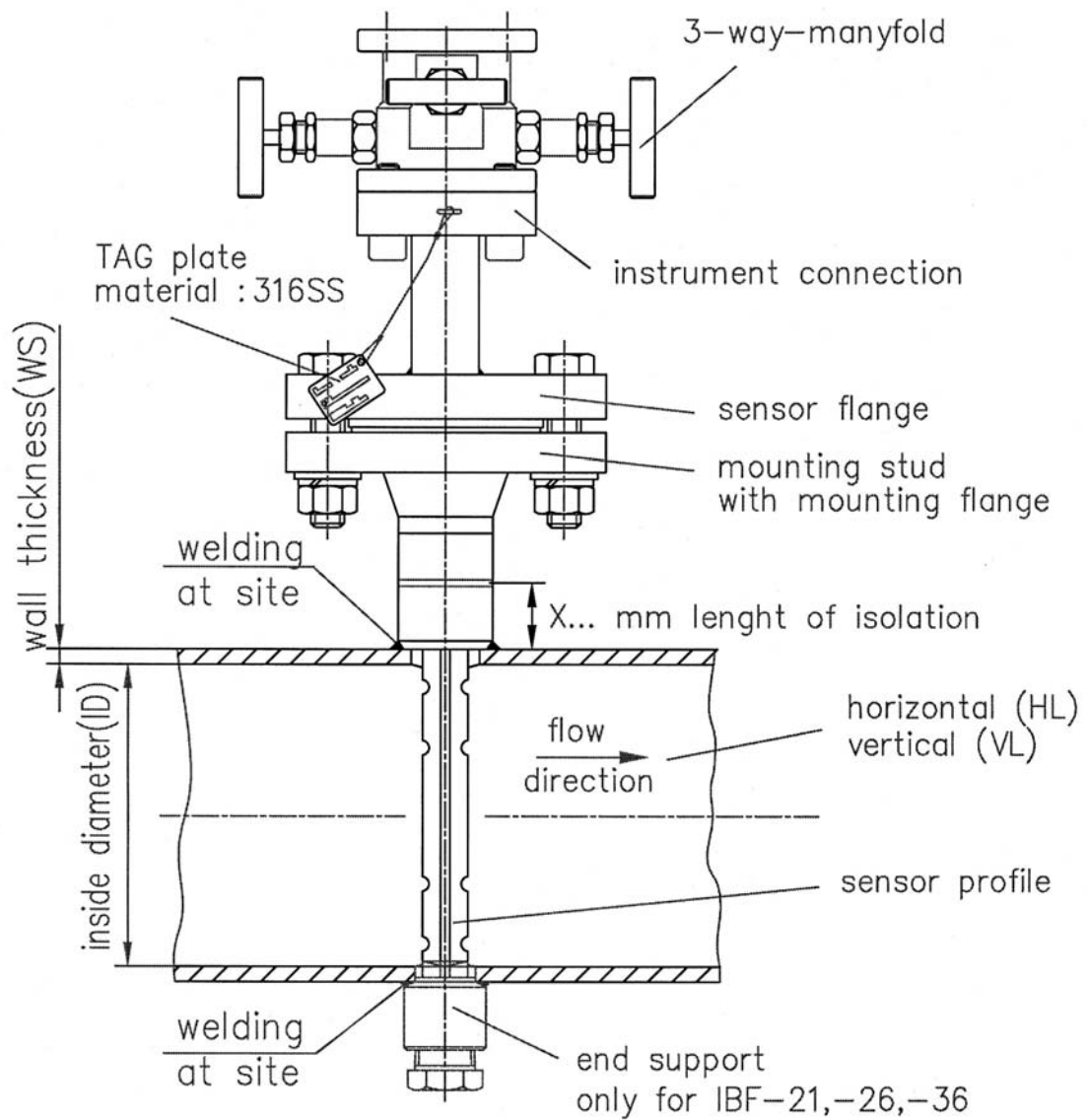
The ITABAR-sensor series IBF is designed to measure the volumetric flow of liquids and gases. The sensor flange is threaded to a pipe mount welding boss, which makes the use in max 5801 psi applications possible. The maximum pressure is a function of the flange rating.

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

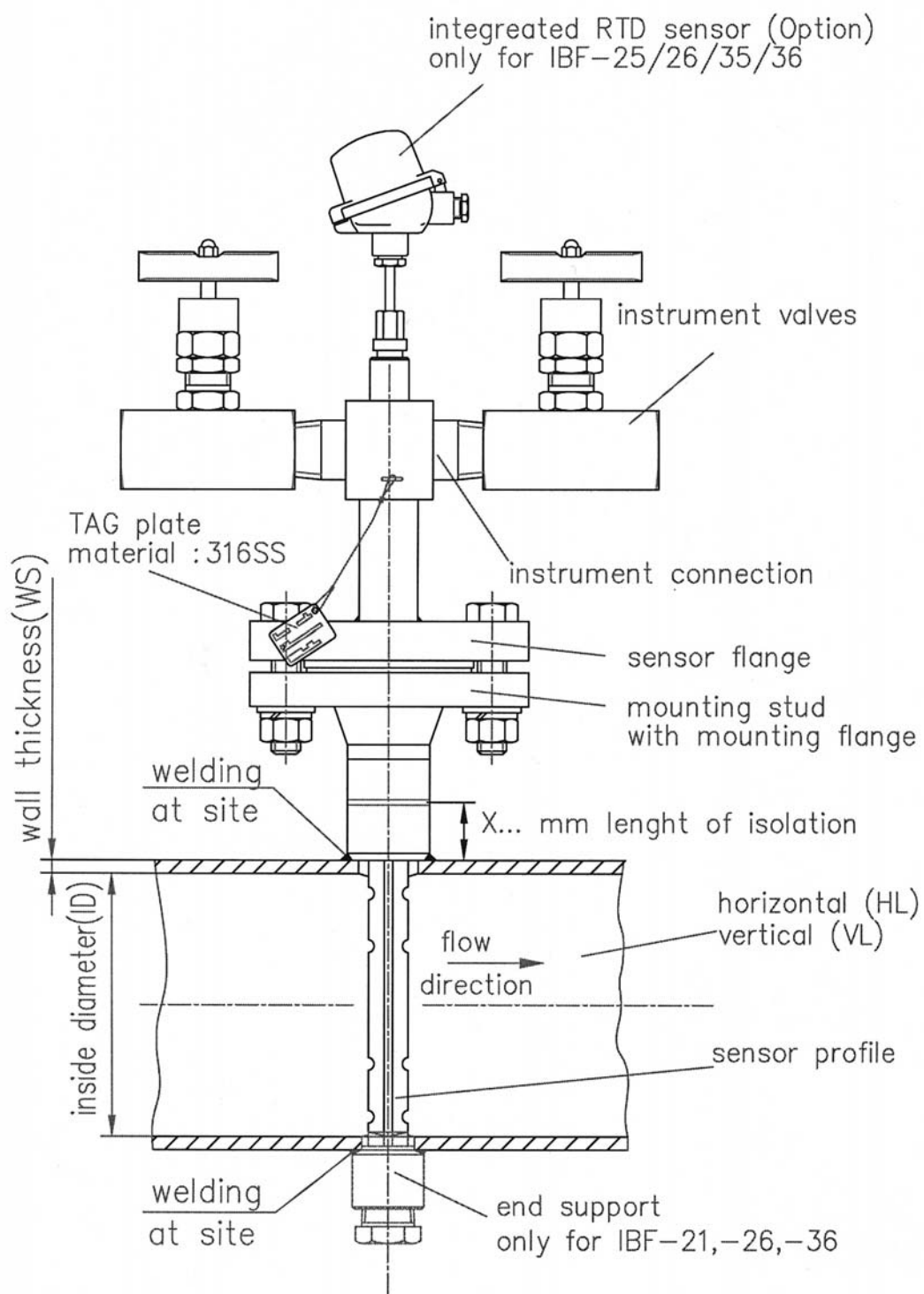


Fig.: 7.2: DP sensor IBF-25 for a pipe with ID 146,3 mm. The DP transmitter is remotely mounted and is connected to the sensor through Ermeto- pipe

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

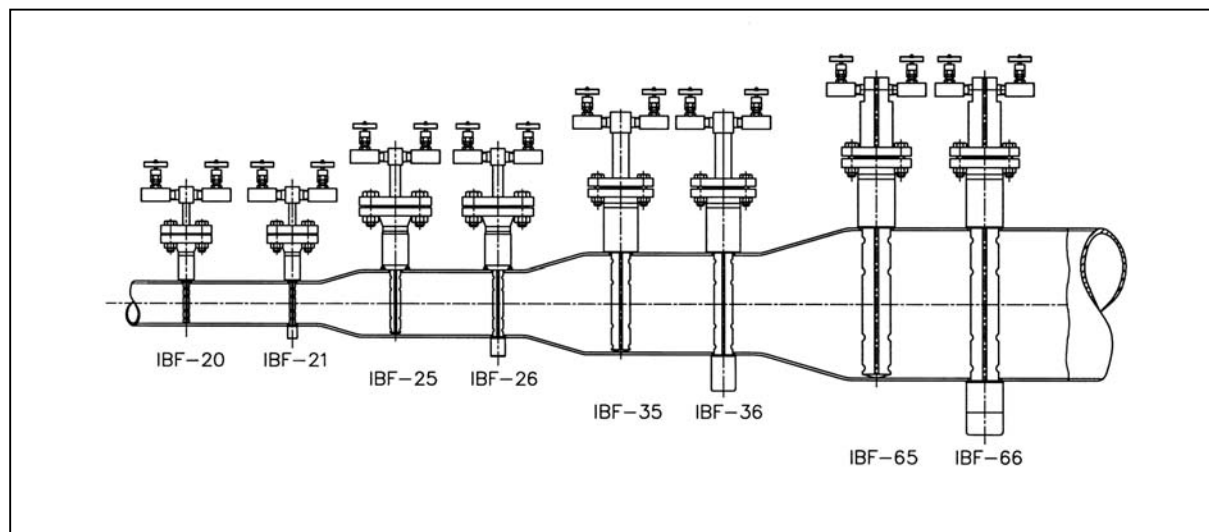


seperate installation of sensor and transmitter



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 316Ti (1.4571)
X A 182 F51 (1.4462) "Duplex"
K 904L (1.4539)
H Hastelloy C4 (2.4610)
Y Incoloy 800 (1.4876)
L Inconel 600 (2.4816)
M Monel 400 (2.4360)
T B 348 Grade 2 (3.7035) "Titanium Grade 2"

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: 316Ti (1.4571)	DN25	1"
A02	PN40	material: 316Ti (1.4571)	DN25	1"
A03	PN63 / 300 lbs	material: 316Ti (1.4571)	DN25	1"
A04	PN100 / 600 lbs	material: 316Ti (1.4571)	DN25	1"
A05	PN160	material: 316Ti (1.4571)	DN25	1"
A06	PN250 / 1500 lbs	material: 316Ti (1.4571)	DN25	1"
A07	PN320	material: 316Ti (1.4571)	DN25	1"
A08	PN400 / 2500 lbs	material: 316Ti (1.4571)	DN25	1"

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

A20	PN16 / 150 lbs	material: 904L (1.4539)	DN25	1"
A21	PN40	material: 904L (1.4539)	DN25	1"
A22	PN63 / 300 lbs	material: 904L (1.4539)	DN25	1"
A23	PN100 / 600 lbs	material: 904L (1.4539)	DN25	1"
A24	PN160	material: 904L (1.4539)	DN25	1"
A25	PN250 / 1500 lbs	material: 904L (1.4539)	DN25	1"
A26	PN320	material: 904L (1.4539)	DN25	1"
A27	PN400 / 2500 lbs	material: 904L (1.4539)	DN25	1"

A30	PN16 / 150 lbs	material: Hastelloy C4	DN25	1"
A31	PN40	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	material: Hastelloy C4	DN25	1"
A35	PN250 / 1500 lbs	material: Hastelloy C4	DN25	1"
A36	PN320	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	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	material: Incoloy 800	DN25	1"	
A45	PN250 / 1500 lbs	material: Incoloy 800	DN25	1"	
A46	PN320	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	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	material: Inconel 600	DN25	1"	
A55	PN250 / 1500 lbs	material: Inconel 600	DN25	1"	
A56	PN320	material: Inconel 600	DN25	1"	
A57	PN400 / 2500 lbs	material: Inconel 600	DN25	1"	
A60	PN16 / 150 lbs	material: Monel 400	DN25	1"	
A61	PN40	material: Monel 400	DN25	1"	
A62	PN63 / 300 lbs	material: Monel 400	DN25	1"	
A63	PN100 / 600 lbs	material: Monel 400	DN25	1"	
A64	PN160	material: Monel 400	DN25	1"	
A65	PN250 / 1500 lbs	material: Monel 400	DN25	1"	
A66	PN320	material: Monel 400	DN25	1"	
A67	PN400 / 2500 lbs	material: Monel 400	DN25	1"	
A70	PN16 / 150 lbs	material: Titanium Grade 2	DN25	1"	
A71	PN40	material: Titanium Grade 2	DN25	1"	
A72	PN63 / 300 lbs	material: Titanium Grade 2	DN25	1"	
A73	PN100 / 600 lbs	material: Titanium Grade 2	DN25	1"	
A74	PN160	material: Titanium Grade 2	DN25	1"	
A75	PN250 / 1500 lbs	material: Titanium Grade 2	DN25	1"	
A76	PN320	material: Titanium Grade 2	DN25	1"	
A77	PN400 / 2500 lbs	material: Titanium Grade 2	DN25	1"	
7. design assembly connecting pieces	0	without			
	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			
	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)				
	0	without			
	C1	C.S.	PN16 / 150 lbs	DN25	1"
	S1	316Ti (1.4571)	PN16 / 150 lbs	DN25	1"
	X1	Duplex	PN16 / 150 lbs	DN25	1"
	K1	904L (1.4539)	PN16 / 150 lbs	DN25	1"
	H1	Hastelloy C4	PN16 / 150 lbs	DN25	1"
	D1	Incoloy 800	PN16 / 150 lbs	DN25	1"
	L1	Inconel 600	PN16 / 150 lbs	DN25	1"
	M1	Monel 400	PN16 / 150 lbs	DN25	1"
	T1	Titanium Grade 2	PN16 / 150 lbs	DN25	1"
	C2	C.S.	PN40	DN25	1"
	S2	316Ti (1.4571)	PN40	DN25	1"
	X2	Duplex	PN40	DN25	1"
	K2	904L (1.4539)	PN40	DN25	1"
	H2	Hastelloy C4	PN40	DN25	1"
	D2	Incoloy 800	PN40	DN25	1"
	L2	Inconel 600	PN40	DN25	1"
	M2	Monel 400	PN40	DN25	1"
	T2	Titanium Grade 2	PN40	DN25	1"
	C3	C.S.	PN63 / 300 lbs	DN25	1"
	S3	316Ti (1.4571)	PN63 / 300 lbs	DN25	1"
	X3	Duplex	PN63 / 300 lbs	DN25	1"
	K3	904L (1.4539)	PN63 / 300 lbs	DN25	1"
	H3	Hastelloy C4	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 400	PN63 / 300 lbs	DN25	1"
T3	Titanium Grade 2	PN63 / 300 lbs	DN25	1"
C4	C.S.	PN100 / 600 lbs	DN25	1"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN25	1"
X4	Duplex	PN100 / 600 lbs	DN25	1"
K4	904L (1.4539)	PN100 / 600 lbs	DN25	1"
H4	Hastelloy C4	PN100 / 600 lbs	DN25	1"
D4	Incoloy 800	PN100 / 600 lbs	DN25	1"
L4	Inconel 600	PN100 / 600 lbs	DN25	1"
M4	Monel 400	PN100 / 600 lbs	DN25	1"
T4	Titanium Grade 2	PN100 / 600 lbs	DN25	1"
C5	C.S.	PN160	DN25	1"
S5	316Ti (1.4571)	PN160	DN25	1"
X5	Duplex	PN160	DN25	1"
K5	904L (1.4539)	PN160	DN25	1"
H5	Hastelloy C4	PN160	DN25	1"
D5	Incoloy 800	PN160	DN25	1"
L5	Inconel 600	PN160	DN25	1"
M5	Monel 400	PN160	DN25	1"
T5	Titanium Grade 2	PN160	DN25	1"
C6	C.S.	PN250 / 1500 lbs	DN25	1"
S6	316Ti (1.4571)	PN250 / 1500 lbs	DN25	1"
X6	Duplex	PN250 / 1500 lbs	DN25	1"
K6	904L (1.4539)	PN250 / 1500 lbs	DN25	1"
H6	Hastelloy C4	PN250 / 1500 lbs	DN25	1"
D6	Incoloy 800	PN250 / 1500 lbs	DN25	1"
L6	Inconel 600	PN250 / 1500 lbs	DN25	1"
M6	Monel 400	PN250 / 1500 lbs	DN25	1"
T6	Titanium Grade 2	PN250 / 1500 lbs	DN25	1"
C7	C.S.	PN320	DN25	1"
S7	316Ti (1.4571)	PN320	DN25	1"
X7	Duplex	PN320	DN25	1"
K7	904L (1.4539)	PN320	DN25	1"
H7	Hastelloy C4	PN320	DN25	1"
D7	Incoloy 800	PN320	DN25	1"
L7	Inconel 600	PN320	DN25	1"
M7	Monel 400	PN320	DN25	1"
T7	Titanium Grade 2	PN320	DN25	1"
C8	C.S.	PN400 / 2500 lbs	DN25	1"
S8	316Ti (1.4571)	PN400 / 2500 lbs	DN25	1"
X8	Duplex	PN400 / 2500 lbs	DN25	1"
K8	904L (1.4539)	PN400 / 2500 lbs	DN25	1"
H8	Hastelloy C4	PN400 / 2500 lbs	DN25	1"
D8	Incoloy 800	PN400 / 2500 lbs	DN25	1"
L8	Inconel 600	PN400 / 2500 lbs	DN25	1"
M8	Monel 400	PN400 / 2500 lbs	DN25	1"
T8	Titanium Grade 2	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: 316Ti (1.4571)
X	end support, material: Duplex (1.4462)
K	end support, material: 904L (1.4539)
M	end support, material: Monel 400
H	end support, material: Hastelloy C4
D	end support, material: Incoloy 800
L	end support, material: Inconel 600
T	end support, material: Titanium Grade 2

1. Order specification ITABAR-FLOW-Sensor, series IBF-20/21													
IBF-	type of sensor	inside diameter and wall thickness	material sensor	sensor flange	gasket strip	PN, material and DN of Sensor flange	design assembly connecting pieces	Assembly connecting piece with flange	material connecting piece, with flange	end support (only IBF-21)	11. isolation		
											KI	without	
											X..	thermal isolation, each 10mm; 316Ti (1.4571)	
												thermal isolation, each 10mm; Duplex (1.4462)	
												thermal isolation, each 10mm; 904L (1.4539)	
												thermal isolation, each 10mm; Hast. C4 (2.4610)	
												thermal isolation, each 10mm; Incoloy 800	
												thermal isolation, each 10mm; Inconel 600	
												thermal isolation, each 10mm; Monel 400	
												thermal isolation, each 10mm; Titanium Grade 2	
											12. piping run		
											HL	horizontal	
											VL	vertical	
											14. process connection		
15. instrument valves													

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	316Ti (1.4571)			
X	A 182 F51 (1.4462) "Duplex"			
K	904L (1.4539)			
H	Hastelloy C4 (2.4610)			
Y	Incoloy 800 (1.4876)			
L	Inconel 600 (2.4816)			
M	Monel 400 (2.4360)			
D	PVDF, max. pressure 6 bar, DN100 up to DN1200			
T	B 348 Grade 2 (3.7035) "Titanium Grade 2"			
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: 316Ti	DN32	1 1/2"
B02	PN40	material: 316Ti	DN32	1 1/2"
B03	PN63 / 300 lbs	material: 316Ti	DN40	1 1/2"
B04	PN100 / 600 lbs	material: 316Ti	DN40	1 1/2"
B05	PN160	material: 316Ti	DN40	1 1/2"
B06	PN250 / 1500 lbs	material: 316Ti	DN40	1 1/2"
B07	PN320	material: 316Ti	DN40	1 1/2"
B08	PN400 / 2500 lbs	material: 316Ti	DN40	1 1/2"
B10	PN16 / 150 lbs	material: Duplex (1.4462)	DN32	1 1/2"
B11	PN40	material: Duplex (1.4462)	DN32	1 1/2"
B12	PN63 / 300 lbs	material: Duplex (1.4462)	DN40	1 1/2"
B13	PN100 / 600 lbs	material: Duplex (1.4462)	DN40	1 1/2"
B14	PN160	material: Duplex (1.4462)	DN40	1 1/2"
B15	PN250 / 1500 lbs	material: Duplex (1.4462)	DN40	1 1/2"
B16	PN320	material: Duplex (1.4462)	DN40	1 1/2"
B17	PN400 / 2500 lbs	material: Duplex (1.4462)	DN40	1 1/2"
B20	PN16 / 150 lbs	material: 904L (1.4539)	DN32	1 1/2"
B21	PN40	material: 904L (1.4539)	DN32	1 1/2"
B22	PN63 / 300 lbs	material: 904L (1.4539)	DN40	1 1/2"
B23	PN100 / 600 lbs	material: 904L (1.4539)	DN40	1 1/2"
B24	PN160	material: 904L (1.4539)	DN40	1 1/2"
B25	PN250 / 1500 lbs	material: 904L (1.4539)	DN40	1 1/2"
B26	PN320	material: 904L (1.4539)	DN40	1 1/2"
B27	PN400 / 2500 lbs	material: 904L (1.4539)	DN40	1 1/2"
B30	PN16 / 150 lbs	material: Hastelloy C4	DN32	1 1/2"
B31	PN40	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	material: Hastelloy C4	DN40	1 1/2"
B35	PN250 / 1500 lbs	material: Hastelloy C4	DN40	1 1/2"
B36	PN320	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	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	material: Incoloy 800	DN40	1 1/2"	
B45	PN250 / 1500 lbs	material: Incoloy 800	DN40	1 1/2"	
B46	PN320	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	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	material: Inconel 600	DN40	1 1/2"	
B55	PN250 / 1500 lbs	material: Inconel 600	DN40	1 1/2"	
B56	PN320	material: Inconel 600	DN40	1 1/2"	
B57	PN400 / 2500 lbs	material: Inconel 600	DN40	1 1/2"	
B60	PN16 / 150 lbs	material: Monel 400	DN32	1 1/2"	
B61	PN40	material: Monel 400	DN32	1 1/2"	
B62	PN63 / 300 lbs	material: Monel 400	DN40	1 1/2"	
B63	PN100 / 600 lbs	material: Monel 400	DN40	1 1/2"	
B64	PN160	material: Monel 400	DN40	1 1/2"	
B65	PN250 / 1500 lbs	material: Monel 400	DN40	1 1/2"	
B66	PN320	material: Monel 400	DN40	1 1/2"	
B67	PN400 / 2500 lbs	material: Monel 400	DN40	1 1/2"	
B70	PN16 / 150 lbs	material: PVDF, <i>max. pressure 6 bar</i>	DN32	1 1/2"	
B80	PN16 / 150 lbs	material: Titanium Grade 2	DN32	1 1/2"	
B81	PN40	material: Titanium Grade 2	DN32	1 1/2"	
B82	PN63 / 300 lbs	material: Titanium Grade 2	DN40	1 1/2"	
B83	PN100 / 600 lbs	material: Titanium Grade 2	DN40	1 1/2"	
B84	PN160	material: Titanium Grade 2	DN40	1 1/2"	
B85	PN250 / 1500 lbs	material: Titanium Grade 2	DN40	1 1/2"	
B86	PN320	material: Titanium Grade 2	DN40	1 1/2"	
B87	PN400 / 2500 lbs	material: Titanium Grade 2	DN40	1 1/2"	
	7. design assembly connecting pieces				
	0	without			
	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			
	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)			
	0	without			
	C1	C.S.	PN16 / 150 lbs	DN32	1 1/2"
	S1	316Ti (1.4571)	PN16 / 150 lbs	DN32	1 1/2"
	X1	Duplex	PN16 / 150 lbs	DN32	1 1/2"
	K1	904L (1.4539)	PN16 / 150 lbs	DN32	1 1/2"
	H1	Hastelloy C4	PN16 / 150 lbs	DN32	1 1/2"
	D1	Incoloy 800	PN16 / 150 lbs	DN32	1 1/2"
	L1	Inconel 600	PN16 / 150 lbs	DN32	1 1/2"
	M1	Monel 400	PN16 / 150 lbs	DN32	1 1/2"
V1	PVDF (<i>max. PN6</i>)	PN16 / 150 lbs	DN32	1 1/2"	

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

T1	Titanium Grade 2	PN16 / 150 lbs	DN32	1 1/2"
C2	C.S.	PN40	DN32	1 1/2"
S2	316Ti (1.4571)	PN40	DN32	1 1/2"
X2	Duplex	PN40	DN32	1 1/2"
K2	904L (1.4539)	PN40	DN32	1 1/2"
H2	Hastelloy C4	PN40	DN32	1 1/2"
D2	Incoloy 800	PN40	DN32	1 1/2"
L2	Inconel 600	PN40	DN32	1 1/2"
M2	Monel 400	PN40	DN32	1 1/2"
T2	Titanium Grade 2	PN40	DN32	1 1/2"
C3	C.S.	PN63 / 300 lbs	DN40	1 1/2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN40	1 1/2"
X3	Duplex	PN63 / 300 lbs	DN40	1 1/2"
K3	904L (1.4539)	PN63 / 300 lbs	DN40	1 1/2"
H3	Hastelloy C4	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 400	PN63 / 300 lbs	DN40	1 1/2"
T3	Titanium Grade 2	PN63 / 300 lbs	DN40	1 1/2"
C4	C.S.	PN100 / 600 lbs	DN40	1 1/2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN40	1 1/2"
X4	Duplex	PN100 / 600 lbs	DN40	1 1/2"
K4	904L (1.4539)	PN100 / 600 lbs	DN40	1 1/2"
H4	Hastelloy C4	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 400	PN100 / 600 lbs	DN40	1 1/2"
T4	Titanium Grade 2	PN100 / 600 lbs	DN40	1 1/2"
C5	C.S.	PN160	DN40	1 1/2"
S5	316Ti (1.4571)	PN160	DN40	1 1/2"
X5	Duplex	PN160	DN40	1 1/2"
K5	904L (1.4539)	PN160	DN40	1 1/2"
H5	Hastelloy C4	PN160	DN40	1 1/2"
D5	Incoloy 800	PN160	DN40	1 1/2"
L5	Inconel 600	PN160	DN40	1 1/2"
M5	Monel 400	PN160	DN40	1 1/2"
T5	Titanium Grade 2	PN160	DN40	1 1/2"
C6	C.S.	PN250 / 1500 lbs	DN40	1 1/2"
S6	316Ti (1.4571)	PN250 / 1500 lbs	DN40	1 1/2"
X6	Duplex	PN250 / 1500 lbs	DN40	1 1/2"
K6	904L (1.4539)	PN250 / 1500 lbs	DN40	1 1/2"
H6	Hastelloy C4	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 400	PN250 / 1500 lbs	DN40	1 1/2"
T6	Titanium Grade 2	PN250 / 1500 lbs	DN40	1 1/2"
C7	C.S.	PN320	DN40	1 1/2"
S7	316Ti (1.4571)	PN321	DN40	1 1/2"
X7	Duplex	PN322	DN40	1 1/2"
K7	904L (1.4539)	PN323	DN40	1 1/2"
H7	Hastelloy C4	PN324	DN40	1 1/2"
D7	Incoloy 800	PN325	DN40	1 1/2"
L7	Inconel 600	PN326	DN40	1 1/2"
M7	Monel 400	PN327	DN40	1 1/2"
T7	Titanium Grade 2	PN328	DN40	1 1/2"
C8	C.S.	PN400 / 2500 lbs	DN40	1 1/2"
S8	316Ti (1.4571)	PN400 / 2500 lbs	DN40	1 1/2"
X8	Duplex	PN400 / 2500 lbs	DN40	1 1/2"
K8	904L (1.4539)	PN400 / 2500 lbs	DN40	1 1/2"
H8	Hastelloy C4	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 400	PN400 / 2500 lbs	DN40	1 1/2"										
T8	Titanium Grade 2	PN400 / 2500 lbs	DN40	1 1/2"										
10. end support (only IBF-26)														
O	without end support													
C	end support, material C.S.													
S	end support, material: 316Ti (1.4571)													
X	end support, material: Duplex (1.4462)													
K	end support, material: 904L (1.4539)													
M	end support, material: Monel 400													
H	end support, material: Hastelloy C4													
D	end support, material: Incoloy 800													
L	end support, material: Inconel 600													
V	end support, material: PVDF (max. PN6)													
T	end support, material: Titanium Grade 2													
11. isolation														
KI	without													
X..	thermal isolation, each 10mm; 316Ti (1.4571)													
	thermal isolation, each 10mm; Duplex (1.4462)													
	thermal isolation, each 10mm; 904L (1.4539)													
	thermal isolation, each 10mm; Hast. C4 (2.4610)													
	thermal isolation, each 10mm; Incoloy 800													
	thermal isolation, each 10mm; Inconel 600													
	thermal isolation, each 10mm; Monel 400													
	thermal isolation, each 10mm; PVDF													
	thermal isolation, each 10mm; Titanium Grade 2													
12. piping run														
HL	horizontal													
VL	vertical													
13. integrated RTD resistance thermocouple (not for Sensor of PVDF)														
T0	without													
TA	3-wire													
TB	2-wire, with ex-approval													
14. headtransm. for thermocouple														
15. process connection														
16. instrument valves														

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	316Ti (1.4571)			
X	A 182 F51 (1.4462) "Duplex"			
K	904L (1.4539)			
H	Hastelloy C4 (2.4610)			
Y	Incoloy 800 (1.4876)			
L	Inconel 600 (2.4816)			
M	Monel 400 (2.4360)			
D	PVDF, <i>max. pressure 6 bar, up to DN1200</i>			
T	B 348 Grade 2 (3.7035) "Titanium Grade 2"			
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: 316Ti	DN50	2"
C02	PN40	material: 316Ti	DN50	2"
C03	PN63 / 300 lbs	material: 316Ti	DN50	2"
C04	PN100 / 600 lbs	material: 316Ti	DN50	2"
C05	PN160	material: 316Ti	DN50	2"
C06	PN250 / 1500 lbs	material: 316Ti	DN50	2"
C07	PN320	material: 316Ti	DN50	2"
C08	PN400 / 2500 lbs	material: 316Ti	DN50	2"
C10	PN16 / 150 lbs	material: Duplex (1.4462)	DN50	2"
C11	PN40	material: Duplex (1.4462)	DN50	2"
C12	PN63 / 300 lbs	material: Duplex (1.4462)	DN50	2"
C13	PN100 / 600 lbs	material: Duplex (1.4462)	DN50	2"
C14	PN160	material: Duplex (1.4462)	DN50	2"
C15	PN250 / 1500 lbs	material: Duplex (1.4462)	DN50	2"
C16	PN320	material: Duplex (1.4462)	DN50	2"
C17	PN400 / 2500 lbs	material: Duplex (1.4462)	DN50	2"
C20	PN16 / 150 lbs	material: 904L (1.4539)	DN50	2"
C21	PN40	material: 904L (1.4539)	DN50	2"
C22	PN63 / 300 lbs	material: 904L (1.4539)	DN50	2"
C23	PN100 / 600 lbs	material: 904L (1.4539)	DN50	2"
C24	PN160	material: 904L (1.4539)	DN50	2"
C25	PN250 / 1500 lbs	material: 904L (1.4539)	DN50	2"
C26	PN320	material: 904L (1.4539)	DN50	2"
C28	PN400 / 2500 lbs	material: 904L (1.4539)	DN50	2"
C30	PN16 / 150 lbs	material: Hastelloy C4	DN50	2"
C31	PN40	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	material: Hastelloy C4	DN50	2"
C35	PN250 / 1500 lbs	material: Hastelloy C4	DN50	2"
C36	PN320	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, material and DN of Sensor flange			DIN	ANSI
C40	PN16 / 150 lbs	material: Incoloy 800	DN50	2"
C41	PN40	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	material: Incoloy 800	DN50	2"
C45	PN250 / 1500 lbs	material: Incoloy 800	DN50	2"
C46	PN320	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	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	material: Inconel 600	DN50	2"
C55	PN250 / 1500 lbs	material: Inconel 600	DN50	2"
C56	PN320	material: Inconel 600	DN50	2"
C57	PN400 / 2500 lbs	material: Inconel 600	DN50	2"
C60	PN16 / 150 lbs	material: Monel 400	DN50	2"
C61	PN40	material: Monel 400	DN50	2"
C62	PN63 / 300 lbs	material: Monel 400	DN50	2"
C63	PN100 / 600 lbs	material: Monel 400	DN50	2"
C64	PN160	material: Monel 400	DN50	2"
C65	PN250 / 1500 lbs	material: Monel 400	DN50	2"
C66	PN320	material: Monel 400	DN50	2"
C67	PN400 / 2500 lbs	material: Monel 400	DN50	2"
C70	PN16 / 150 lbs	material: PVDF, max. pressure 6 bar	DN50	2"
C80	PN16 / 150 lbs	material: Titanium Grade 2	DN50	2"
C81	PN40	material: Titanium Grade 2	DN50	2"
C82	PN63 / 300 lbs	material: Titanium Grade 2	DN50	2"
C83	PN100 / 600 lbs	material: Titanium Grade 2	DN50	2"
C84	PN160	material: Titanium Grade 2	DN50	2"
C85	PN250 / 1500 lbs	material: Titanium Grade 2	DN50	2"
C86	PN320	material: Titanium Grade 2	DN50	2"
C87	PN400 / 2500 lbs	material: Titanium Grade 2	DN50	2"
7. design assembly connecting pieces				
0	without			
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			
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)				
0	without			
C1	C.S.	PN16 / 150 lbs	DN50	2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN50	2"
X1	Duplex	PN16 / 150 lbs	DN50	2"
K1	904L (1.4539)	PN16 / 150 lbs	DN50	2"
H1	Hastelloy C4	PN16 / 150 lbs	DN50	2"
D1	Incoloy 800	PN16 / 150 lbs	DN50	2"
L1	Inconel 600	PN16 / 150 lbs	DN50	2"
M1	Monel 400	PN16 / 150 lbs	DN50	2"
V1	PVDF (max. PN6)	PN16 / 150 lbs	DN50	2"

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

T1	Titanium Grade 2	PN16 / 150 lbs	DN50	2"
C2	C.S.	PN40	DN50	2"
S2	316Ti (1.4571)	PN40	DN50	2"
X2	Duplex	PN40	DN50	2"
K2	904L (1.4539)	PN40	DN50	2"
H2	Hastelloy C4	PN40	DN50	2"
D2	Incoloy 800	PN40	DN50	2"
L2	Inconel 600	PN40	DN50	2"
M2	Monel 400	PN40	DN50	2"
T2	Titanium Grade 2	PN40	DN50	2"
C3	C.S.	PN63 / 300 lbs	DN50	2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN50	2"
X3	Duplex	PN63 / 300 lbs	DN50	2"
K3	904L (1.4539)	PN63 / 300 lbs	DN50	2"
H3	Hastelloy C4	PN63 / 300 lbs	DN50	2"
D3	Incoloy 800	PN63 / 300 lbs	DN50	2"
L3	Inconel 600	PN63 / 300 lbs	DN50	2"
M3	Monel 400	PN63 / 300 lbs	DN50	2"
T3	Titanium Grade 2	PN63 / 300 lbs	DN50	2"
C4	C.S.	PN100 / 600 lbs	DN50	2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN50	2"
X4	Duplex	PN100 / 600 lbs	DN50	2"
K4	904L (1.4539)	PN100 / 600 lbs	DN50	2"
H4	Hastelloy C4	PN100 / 600 lbs	DN50	2"
D4	Incoloy 800	PN100 / 600 lbs	DN50	2"
L4	Inconel 600	PN100 / 600 lbs	DN50	2"
M4	Monel 400	PN100 / 600 lbs	DN50	2"
T4	Titanium Grade 2	PN100 / 600 lbs	DN50	2"
C5	C.S.	PN160	DN50	2"
S5	316Ti (1.4571)	PN160	DN50	2"
X5	Duplex	PN160	DN50	2"
K5	904L (1.4539)	PN160	DN50	2"
H5	Hastelloy C4	PN160	DN50	2"
D5	Incoloy 800	PN160	DN50	2"
L5	Inconel 600	PN160	DN50	2"
M5	Monel 400	PN160	DN50	2"
T5	Titanium Grade 2	PN160	DN50	2"
C6	C.S.	PN250 / 1500 lbs	DN50	2"
S6	316Ti (1.4571)	PN250 / 1500 lbs	DN50	2"
X6	Duplex	PN250 / 1500 lbs	DN50	2"
K6	904L (1.4539)	PN250 / 1500 lbs	DN50	2"
H6	Hastelloy C4	PN250 / 1500 lbs	DN50	2"
D6	Incoloy 800	PN250 / 1500 lbs	DN50	2"
L6	Inconel 600	PN250 / 1500 lbs	DN50	2"
M6	Monel 400	PN250 / 1500 lbs	DN50	2"
T6	Titanium Grade 2	PN250 / 1500 lbs	DN50	2"
C7	C.S.	PN320	DN50	2"
S7	316Ti (1.4571)	PN320	DN50	2"
X7	Duplex	PN320	DN50	2"
K7	904L (1.4539)	PN320	DN50	2"
H7	Hastelloy C4	PN320	DN50	2"
D7	Incoloy 800	PN320	DN50	2"
L7	Inconel 600	PN320	DN50	2"
M7	Monel 400	PN320	DN50	2"
T7	Titanium Grade 2	PN320	DN50	2"
C8	C.S.	PN400 / 2500 lbs	DN50	2"
S8	316Ti (1.4571)	PN400 / 2500 lbs	DN50	2"
X8	Duplex	PN400 / 2500 lbs	DN50	2"
K8	904L (1.4539)	PN400 / 2500 lbs	DN50	2"
H8	Hastelloy C4	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 400	PN400 / 2500 lbs	DN50	2"											
T8	Titanium Grade 2	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: 316Ti (1.4571)														
X	end support, material: Duplex (1.4462)														
K	end support, material: 904L (1.4539)														
H	end support, material: Monel 400														
D	end support, material: Hastelloy C4														
L	end support, material: Incoloy 800														
M	end support, material: Inconel 600														
V	end support, material: PVDF (max. PN6)														
T	end support, material: Titanium Grade 2														
11. isolation															
KI	without														
X..	thermal isolation, each 10mm; 316Ti (1.4571)														
	thermal isolation, each 10mm; Duplex (1.4462)														
	thermal isolation, each 10mm; 904L (1.4539)														
	thermal isolation, each 10mm; Hast. C4 (2.4610)														
	thermal isolation, each 10mm; Incoloy 800														
	thermal isolation, each 10mm; Inconel 600														
	thermal isolation, each 10mm; Monel 400														
	thermal isolation, each 10mm; PVDF														
	thermal isolation, each 10mm; Titanium Grade 2														
12. piping run															
HL	horizontal														
VL	vertical														
13. integrated RTD resistance thermocouple (not for Sensor of PVDF)															
T0	without														
TA	3-wire														
TB	2-wire, with ex-approval														
14. headtransm. for thermocouple															
15. process connection															
16. instrument valves															

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	316Ti (1.4571)			
X	A 182 F51 (1.4462) "Duplex"			
K	904L (1.4539)			
H	Hastelloy C4 (2.4610)			
Y	Incoloy 800 (1.4876)			
L	Inconel 600 (2.4816)			
M	Monel 400 (2.4360)			
D	PVDF, <i>max. pressure 6 bar, up to DN1200</i>			
T	B 348 Grade 2 (3.7035) "Titanium Grade 2"			
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: 316Ti	DN65	2 1/2"
D02	PN40	material: 316Ti	DN65	2 1/2"
D03	PN63 / 300 lbs	material: 316Ti	DN65	2 1/2"
D04	PN100 / 600 lbs	material: 316Ti	DN65	2 1/2"
D05	PN160	material: 316Ti	DN65	2 1/2"
D06	PN250 / 1500 lbs	material: 316Ti	DN65	2 1/2"
D07	PN320	material: 316Ti	DN65	2 1/2"
D08	PN400 / 2500 lbs	material: 316Ti	DN65	2 1/2"
D10	PN16 / 150 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D11	PN40	material: Duplex (1.4462)	DN65	2 1/2"
D12	PN63 / 300 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D13	PN100 / 600 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D14	PN160	material: Duplex (1.4462)	DN65	2 1/2"
D15	PN250 / 1500 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D16	PN320	material: Duplex (1.4462)	DN65	2 1/2"
D17	PN400 / 2500 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D20	PN16 / 150 lbs	material: 904L (1.4539)	DN65	2 1/2"
D21	PN40	material: 904L (1.4539)	DN65	2 1/2"
D22	PN63 / 300 lbs	material: 904L (1.4539)	DN65	2 1/2"
D23	PN100 / 600 lbs	material: 904L (1.4539)	DN65	2 1/2"
D24	PN160	material: 904L (1.4539)	DN65	2 1/2"
D25	PN250 / 1500 lbs	material: 904L (1.4539)	DN65	2 1/2"
D26	PN320	material: 904L (1.4539)	DN65	2 1/2"
D27	PN400 / 2500 lbs	material: 904L (1.4539)	DN65	2 1/2"
D30	PN16 / 150 lbs	material: Hastelloy C4	DN65	2 1/2"
D31	PN40	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	material: Hastelloy C4	DN65	2 1/2"
D35	PN250 / 1500 lbs	material: Hastelloy C4	DN65	2 1/2"
D36	PN320	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, material and DN of Sensor flange			DIN	ANSI	
D40	PN16 / 150 lbs	material: Incoloy 800	DN65	2 1/2"	
D41	PN40	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	material: Incoloy 800	DN65	2 1/2"	
D45	PN250 / 1500 lbs	material: Incoloy 800	DN65	2 1/2"	
D46	PN320	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	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	material: Inconel 600	DN65	2 1/2"	
D55	PN250 / 1500 lbs	material: Inconel 600	DN65	2 1/2"	
D56	PN320	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	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	material: Monel	DN65	2 1/2"	
D65	PN250 / 1500 lbs	material: Monel	DN65	2 1/2"	
D66	PN320	material: Monel	DN65	2 1/2"	
D67	PN400 / 2500 lbs	material: Monel	DN65	2 1/2"	
D70	PN16 / 150 lbs	material: PVDF, max.PN6	DN65	2 1/2"	
D80	PN16 / 150 lbs	material: Titanium	DN65	2 1/2"	
D81	PN40	material: Titanium	DN65	2 1/2"	
D82	PN63 / 300 lbs	material: Titanium	DN65	2 1/2"	
D83	PN100 / 600 lbs	material: Titanium	DN65	2 1/2"	
D84	PN160	material: Titanium	DN65	2 1/2"	
D85	PN250 / 1500 lbs	material: Titanium	DN65	2 1/2"	
D86	PN320	material: Titanium	DN65	2 1/2"	
D87	PN400 / 2500 lbs	material: Titanium	DN65	2 1/2"	
7. design assembly connecting pieces	0 without				
	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				
	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)				
	0 without				
	C1	C.S.	PN16 / 150 lbs	DN65	2 1/2"
	S1	316Ti (1.4571)	PN16 / 150 lbs	DN65	2 1/2"
	X1	Duplex	PN16 / 150 lbs	DN65	2 1/2"
	K1	904L (1.4539)	PN16 / 150 lbs	DN65	2 1/2"
	M1	Hastelloy C4	PN16 / 150 lbs	DN65	2 1/2"
	H1	Incoloy 800	PN16 / 150 lbs	DN65	2 1/2"
	D1	Inconel 600	PN16 / 150 lbs	DN65	2 1/2"
	L1	Monel 400	PN16 / 150 lbs	DN65	2 1/2"
	V1	PVDF (max. PN6)	PN16 / 150 lbs	DN65	2 1/2"
	T1	Titanium Grade 2	PN16 / 150 lbs	DN65	2 1/2"

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

C2	C.S.	PN40	DN65	2 1/2"
S2	316Ti (1.4571)	PN40	DN65	2 1/2"
X2	Duplex	PN40	DN65	2 1/2"
K2	904L (1.4539)	PN40	DN65	2 1/2"
H2	Hastelloy C4	PN40	DN65	2 1/2"
D2	Incoloy 800	PN40	DN65	2 1/2"
L2	Inconel 600	PN40	DN65	2 1/2"
M2	Monel 400	PN40	DN65	2 1/2"
T2	Titanium Grade 2	PN40	DN65	2 1/2"
C3	C.S.	PN63 / 300 lbs	DN65	2 1/2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN65	2 1/2"
X3	Duplex	PN63 / 300 lbs	DN65	2 1/2"
K3	904L (1.4539)	PN63 / 300 lbs	DN65	2 1/2"
H3	Hastelloy C4	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 400	PN63 / 300 lbs	DN65	2 1/2"
T3	Titanium Grade 2	PN63 / 300 lbs	DN65	2 1/2"
C4	C.S.	PN100 / 600 lbs	DN65	2 1/2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN65	2 1/2"
X4	Duplex	PN100 / 600 lbs	DN65	2 1/2"
K4	904L (1.4539)	PN100 / 600 lbs	DN65	2 1/2"
H4	Hastelloy C4	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 400	PN100 / 600 lbs	DN65	2 1/2"
T4	Titanium Grade 2	PN100 / 600 lbs	DN65	2 1/2"
C5	C.S.	PN160	DN65	2 1/2"
S5	316Ti (1.4571)	PN160	DN65	2 1/2"
X5	Duplex	PN160	DN65	2 1/2"
K5	904L (1.4539)	PN160	DN65	2 1/2"
H5	Hastelloy C4	PN160	DN65	2 1/2"
D5	Incoloy 800	PN160	DN65	2 1/2"
L5	Inconel 600	PN160	DN65	2 1/2"
M5	Monel 400	PN160	DN65	2 1/2"
T5	Titanium Grade 2	PN160	DN65	2 1/2"
C6	C.S.	PN250 / 1500 lbs	DN65	2 1/2"
S6	316Ti (1.4571)	PN250 / 1500 lbs	DN65	2 1/2"
X6	Duplex	PN250 / 1500 lbs	DN65	2 1/2"
K6	904L (1.4539)	PN250 / 1500 lbs	DN65	2 1/2"
H6	Hastelloy C4	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 400	PN250 / 1500 lbs	DN65	2 1/2"
T6	Titanium Grade 2	PN250 / 1500 lbs	DN65	2 1/2"
C7	C.S.	PN320	DN65	2 1/2"
S7	316Ti (1.4571)	PN320	DN65	2 1/2"
X7	Duplex	PN320	DN65	2 1/2"
K7	904L (1.4539)	PN320	DN65	2 1/2"
H7	Hastelloy C4	PN320	DN65	2 1/2"
D7	Incoloy 800	PN320	DN65	2 1/2"
L7	Inconel 600	PN320	DN65	2 1/2"
M7	Monel 400	PN320	DN65	2 1/2"
T7	Titanium Grade 2	PN320	DN65	2 1/2"
C8	C.S.	PN400 / 2500 lbs	DN65	2 1/2"
S8	316Ti (1.4571)	PN400 / 2500 lbs	DN65	2 1/2"
X8	Duplex	PN400 / 2500 lbs	DN65	2 1/2"
K8	904L (1.4539)	PN400 / 2500 lbs	DN65	2 1/2"
H8	Hastelloy C4	PN400 / 2500 lbs	DN65	2 1/2"

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

<div>type of sensor</div> <div>inside diameter and wall thickness</div> <div>sensor material</div> <div>sensor flange</div> <div>gasket</div> <div>PN, material and DN of Sensor</div> <div>design assembly connecting pieces</div> <div>Assembly connecting piece with flange</div> <div>material connecting piece, with flange</div> <div>end support</div> <div>isolation</div> <div>pipng run</div>	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 400	PN400 / 2500 lbs	DN65 2 1/2"
	T8	Titanium Grade 2	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: 316Ti (1.4571)		
	X	end support, material: Duplex (1.4462)		
	K	end support, material: 904L (1.4539)		
	H	end support, material: Monel 400 (2.4360)		
	D	end support, material: Hastelloy C4 (2.4610)		
	L	end support, material: Incoloy 800 (1.4876)		
	M	end support, material: Inconel 600 (2.4816)		
	V	end support, material: PVDF (max. PN6)		
	T	end support, material: Titanium Grade 2		
	11. isolation			
	KI	without		
	X..	thermal isolation, each 10mm; 316Ti (1.4571)		
		thermal isolation, each 10mm; Duplex (1.4462)		
		thermal isolation, each 10mm; 904L (1.4539)		
		thermal isolation, each 10mm; Hast. C4 (2.4610)		
		thermal isolation, each 10mm; Incoloy 800		
	thermal isolation, each 10mm; Inconel 600			
	thermal isolation, each 10mm; Monel 400			
	thermal isolation, each 10mm; PVDF			
	thermal isolation, each 10mm; Titanium Grade 2			
12. piping run				
HL	horizontal			
VL	vertical			
13. integrated RTD resistance thermocouple (not for Sensor of PVDF)				
T0	without			
TA	3-wire			
TB	2-wire, with ex-approval			
14. headtransm. for thermocouple				
15. process connection				
16. instrument valves				

IBF-																			
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8.2 Series IBF-100 for Flue Gas Emissions to 232 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:

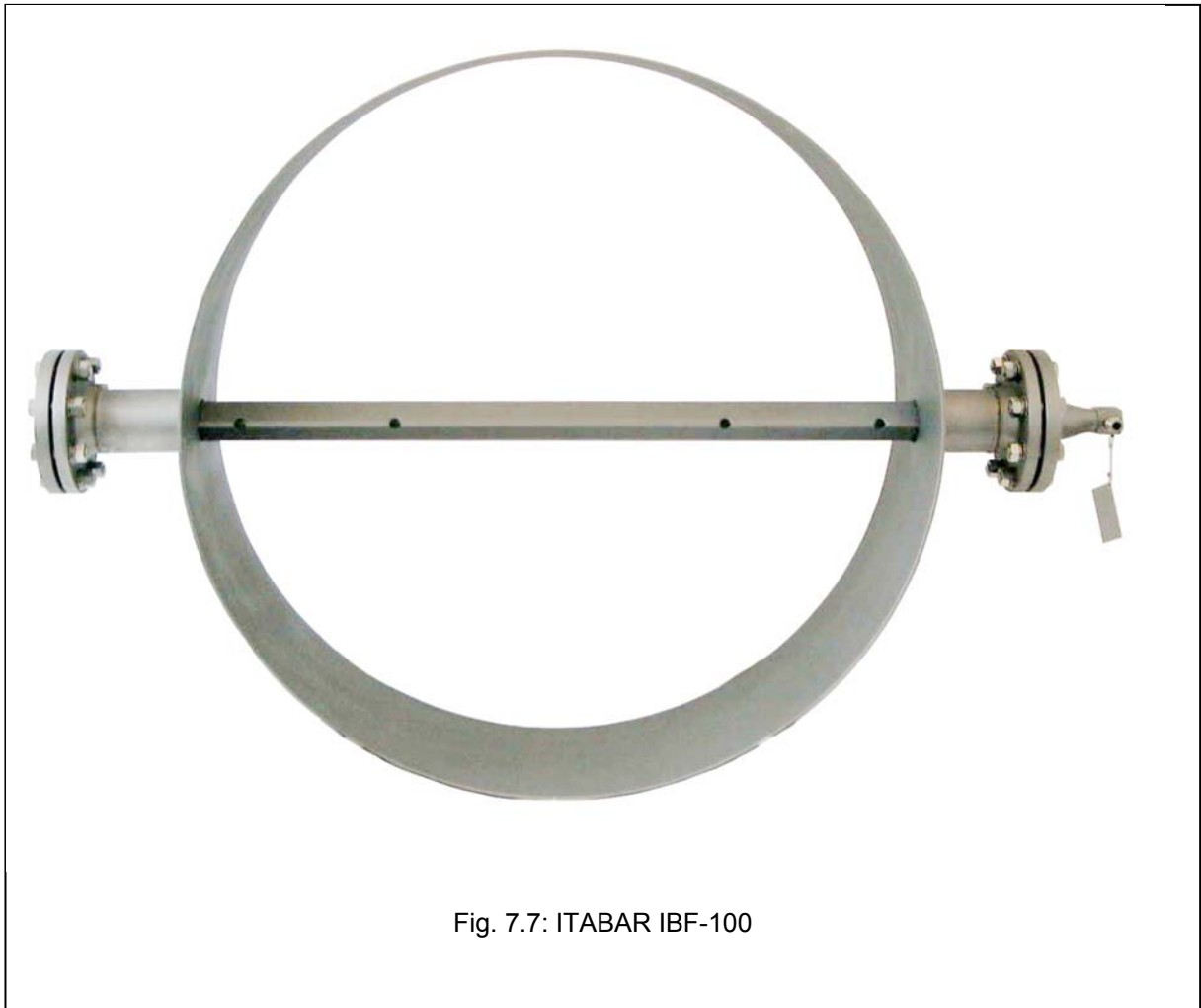
- 1) The frequency of cleaning requirements is reduced.
- 2) Cleaning by mechanical means or with air pressure is made easy.

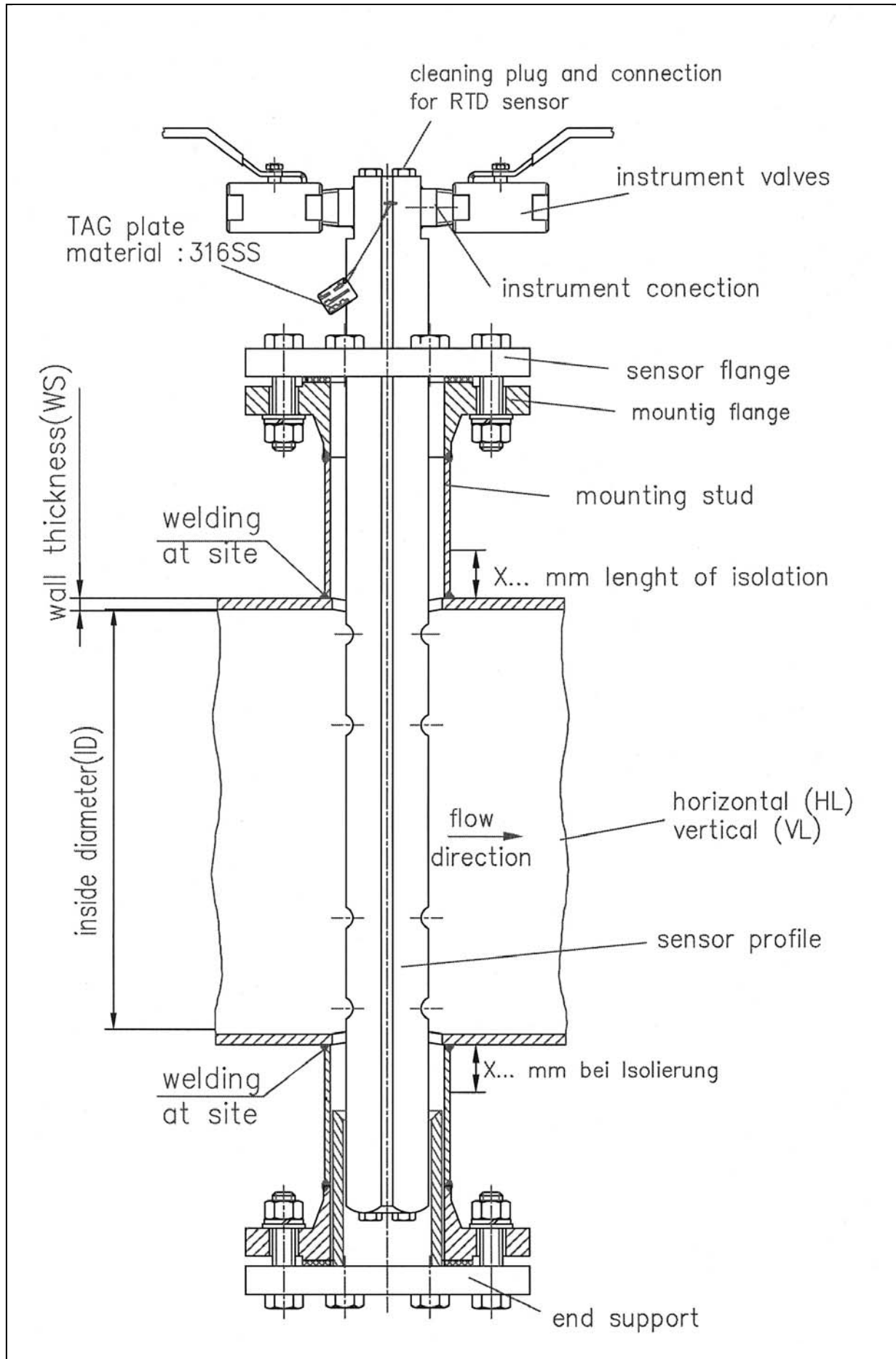
The design allows cleaning of the pressure chambers via the sensor's pipe mounting assembly as well as from its flanged end support. For cleaning purposes the two parallel pressure chambers have a round shape which runs over the entire length of the sensor.

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).





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	316Ti (1.4571) -standard-
K	904L (1.4539)
H	Hastelloy C4 (2.4610)
Y	Incoloy 800 (1.4876)
D	PVDF, max. pressure 6 bar, up to DN1000
L	Inconel 600 (2.4816)
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	
E1	PN16 / 150 lbs material: 316Ti DN80 3"
E2	PN16 / 150 lbs material: 904L (1.4539) DN80 3"
E3	PN16 / 150 lbs material: Hastelloy C4 (2.4610) DN80 3"
E4	PN16 / 150 lbs material: Incoloy800 (1.4876) DN80 3"
E5	PN16 / 150 lbs material: PVDF DN80 3"
E6	PN16 / 150 lbs material: Inconel 600 (2.4816) DN80 3"
7. design assembly connecting pieces	
0	without
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
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 allways identically to sensor flange.	
0	without
C1	PN16 / 150 lbs material: C.S. DN80 3"
S1	PN16 / 150 lbs material: 316Ti (1.4571) DN80 3"
K1	PN16 / 150 lbs material: 904L (1.4539) DN80 3"
H1	PN16 / 150 lbs material: Hastelloy C4 (2.4610) DN80 3"
Y1	PN16 / 150 lbs material: Incoloy 800 (1.4876) DN80 3"
D1	PN16 / 150 lbs material: PVDF DN80 3"
L1	PN16 / 150 lbs material: Inconel 600 (2.4816) DN80 3"
11. end support	
0	without end support (if build-laterally available.)
C	end support, material C.S.
S	end support, material: 316Ti (1.4571)
K	end support, material: 904L (1.4539)
H	end support, material: Hastelloy C4
Y	end support, material: Incoloy 800 (1.4876)
D	end support, material: PVDF
L	end support, material: Inconel 600 (2.4816)
12. isolation	
KI	without
X..	thermal isolation, each 10mm; 316Ti (1.4571)
	thermal isolation, each 10mm; 904L (1.4539)
	thermal isolation, each 10mm; Hast. C4 (2.4610)
	thermal isolation, each 10mm; Incoloy 800
	thermal isolation, each 10mm; PVDF
	thermal isolation, each 10mm; Inconel 600
13. piping run	
HL	horizontal
VL	vertical
14. integrated RTD resistance thermocouple (not for Sensor of PVDF)	
T0	without
TA	3-wire
TB	2-wire, with ex-approval
14. headtransm. for thermocouple	
15. process connection	
16. instrument valves	

Pictures connection head for RTD resistance thermocouple

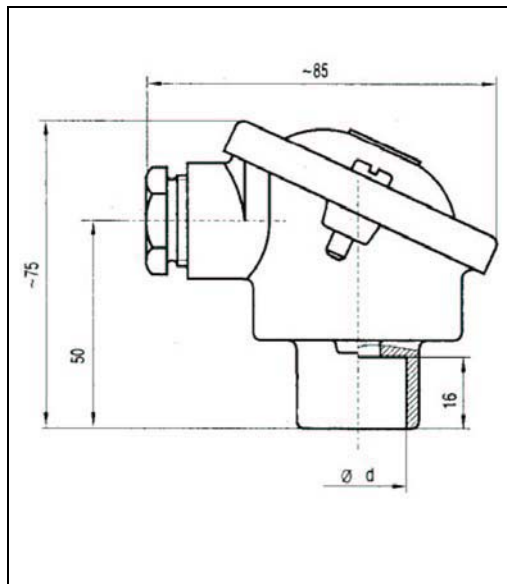


Fig. 7.8: sensor head form B DIN 43729

for RTD without transmitter

material: aluminium

connection: $\text{Ø}d = \text{M}24 \times 1,5$

cable entry: $\text{M}20 \times 1,5$

protection class: IP54

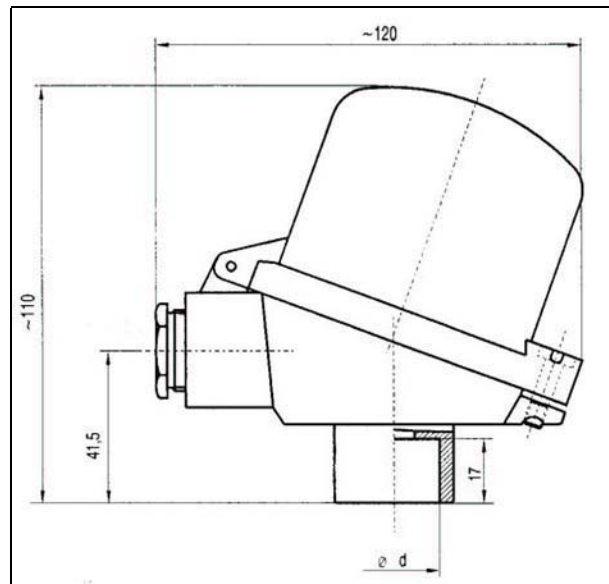


Fig. 7.9: sensor head form BUZH DIN 43729

for RTD with transmitter

material: aluminium

connection: $\text{Ø}d = \text{M}24 \times 1,5$

cable entry: $\text{M}20 \times 1,5$

protection class: IP54

2. order specification ITABAR-Flow-Sensor

Headtransmitter for RTD resistance thermocouple			
	<i>transmitter</i>	<i>explosion-approval</i>	<i>connection head</i>
0	without	----	form B
1	4-20 mA	without	form BUZH
2	4-20 mA/ Hart	without	form BUZH
3	Profibus PA	without	form BUZH
4	Foundation Fieldbus	without	form BUZH
5	4-20 mA	ATEX EEx ia	form BUZH
6	4-20 mA/ Hart	ATEX EEx ia	form BUZH
7	Profibus PA	ATEX EEx ia	form BUZH
8	Foundation Fieldbus	ATEX EEx ia	form BUZH
Y	other, please specify		

Pictures of Shut-Off Valves for Pressure Connections
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Fig. 7.15: Ball valve PN 40 (580 psi), 1.4401 (316 SS)	Fig. 7.16: Shut off valve ½ “ NPT, PN 400 (5801 psi), 1.4401 (316 SS)	Fig. 7.17: 3-way-manifold PN 400 (5801 psi), 1.4401 (316 SS)
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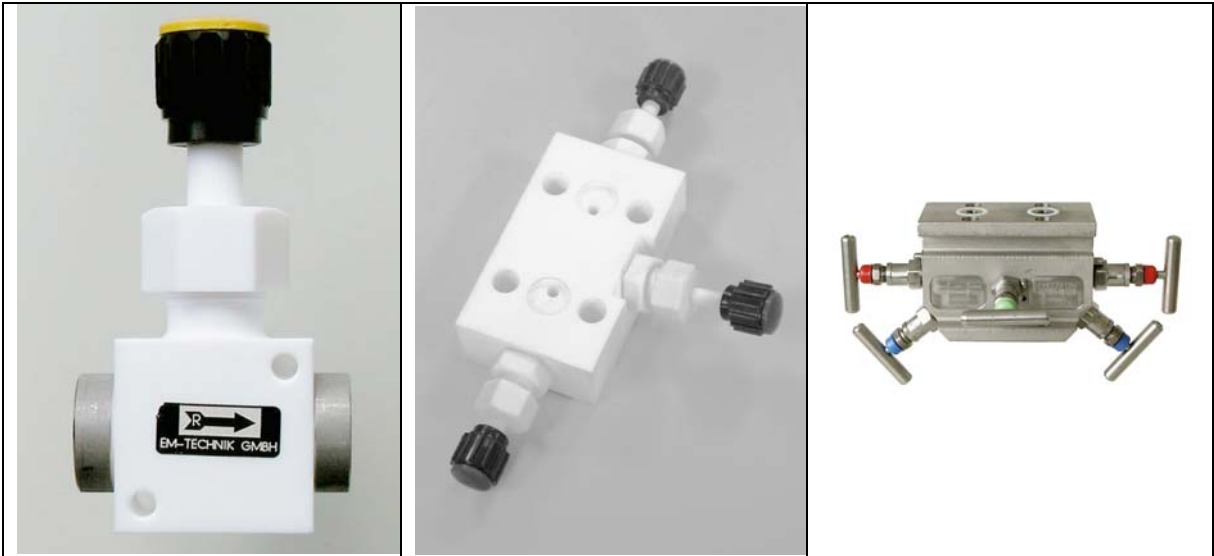


Fig. 7.18: Shut off valve PTFE	Fig. 7.19: 3-way-manifold PTFE	Fig. 7.20: 5-way-manifold 1.4401 (316 SS)
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2. Order specification ITABAR-Flow-Sensor

Instrument connection and shut-off device

type IBF- 20, 21, 25, 26, 35, 36, 65, 66, 100

instrument connection

A04 sensorhead with 1/4" NPT-M

A03 sensorhead with 1/2" NPT-M

flange plate to direct mount a 3-way-manifold

A06 flange plate to direct mount a 3-way-manifold material: 316Ti

A07 flange plate to direct mount a 3-way-manifold material: Duplex (1.4462)

A08 flange plate to direct mount a 3-way-manifold material: 904L (1.4539)

A09 flange plate to direct mount a 3-way-manifold material: Hastelloy C4

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

A11 flange plate to direct mount a 3-way-manifold material: Monel 400

A12 flange plate to direct mount a 3-way-manifold material: Titanium Grade 2

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

A14 flange plate to direct mount a 3-way-manifold material: Incoloy 800

flange plate to direct mount a 5-way-manifold

A15 flange plate to direct mount a 5-way-manifold material: 316Ti

A16 flange plate to direct mount a 5-way-manifold material: Duplex (1.4462)

A17 flange plate to direct mount a 5-way-manifold material: 904L (1.4539)

A18 flange plate to direct mount a 5-way-manifold material: Hastelloy C4

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

A20 flange plate to direct mount a 5-way-manifold material: Monel 400

A21 flange plate to direct mount a 5-way-manifold material: Titanium Grade 2

A22 flange plate to direct mount a 5-way-manifold material: PVDF

A23 flange plate to direct mount a 5-way-manifold material: Incoloy 800

shut-off device for effect pressure pipe (1 pair for valves)

A00 without shut-off-device

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

A56 ball valve PN40, case A182-F316H (1.4401) / female thread 1/2" NPT , packing: PTFE

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

A58 ball valve PN40, case A182-F316H (1.4401) / female thread 1/4" NPT , packing: PTFE

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 A182-F316H (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 A182-F316H (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-way-manifold, PN400, case A182-F316H (1.4401) / packing: PTFE (only with A06-A14)

A67 direct mount, with 3-way-manifold, PN10, case PTFE / packing: PTFE (only with A06-A14)

A71 direct mount, with 5-way-manifold, PN400, case A182-F316H (1.4401) / packing: PTFE (only with A15-23)

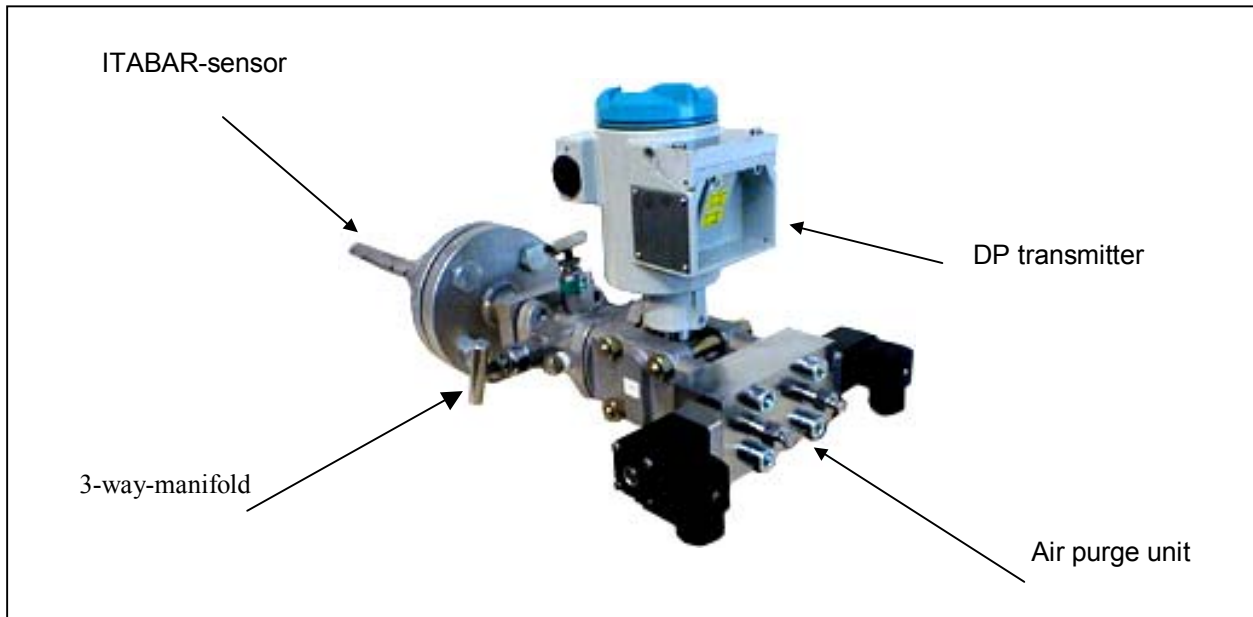
accessories

E12 1 pair of screw joints 1/2"-NPT-M / Ø12mm; 316Ti

E14 1 pair of screw joints 1/2"-NPT-M / Ø14mm; 316Ti



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 mm², 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 87 psig (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.

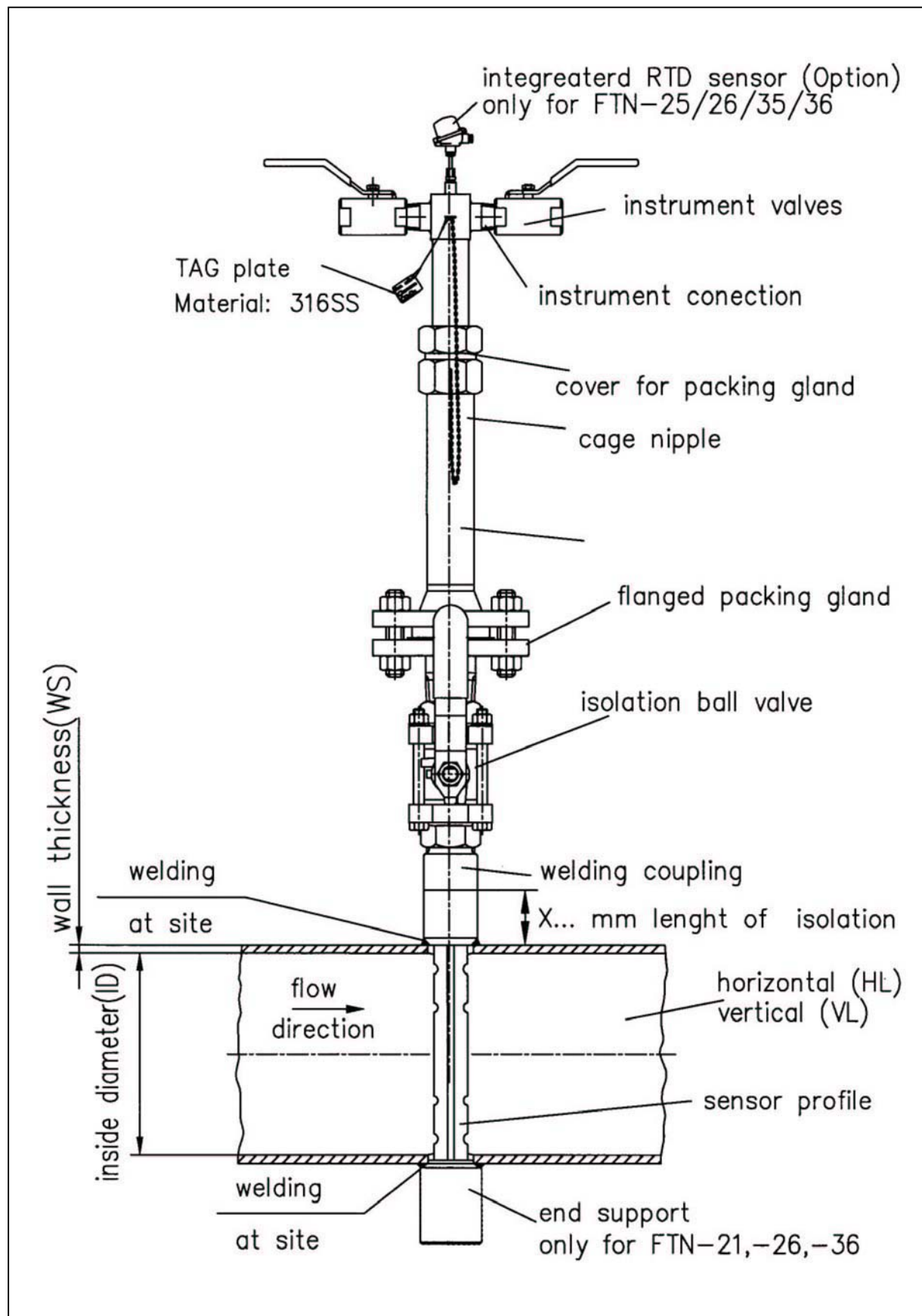
A FTN sensor is usable up to an operating pressure of 87 psi and an operating temperature of up to 392 °F (200°C).

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.



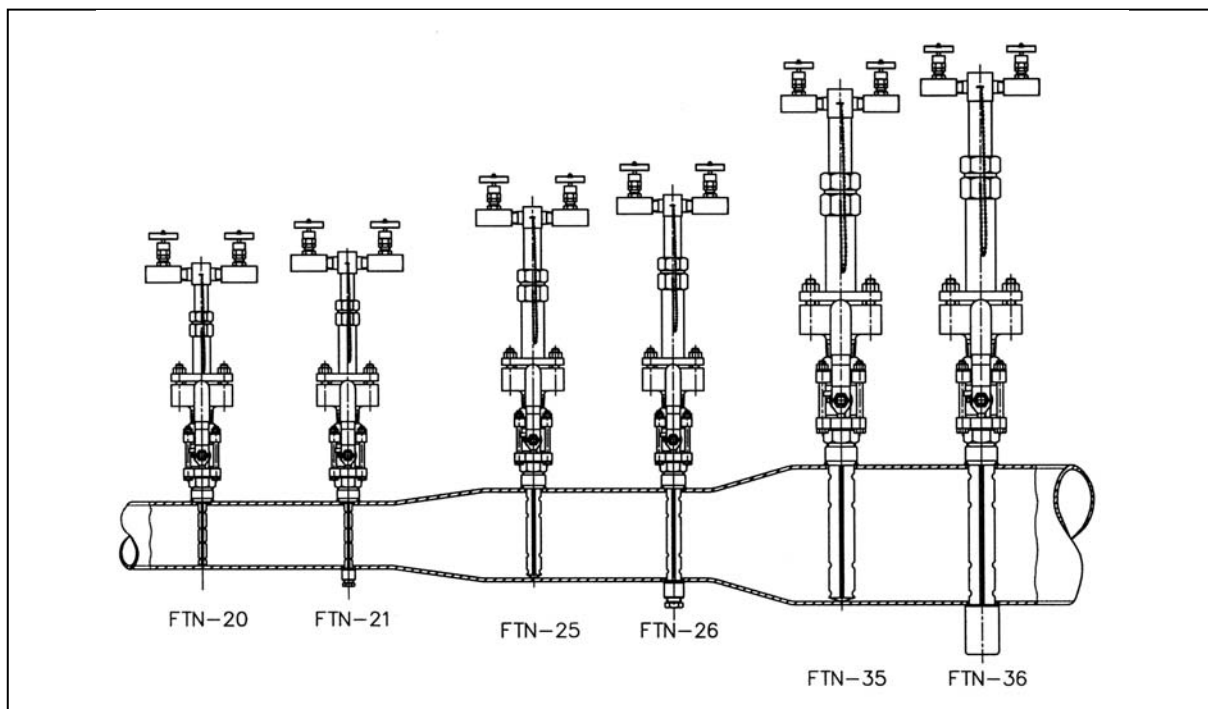
Fig.:9.1: Pitot tube sensor FTN-25

Construction Drawing for ITABAR Series FTN



Order Data for Model Series FTN20/21/25/26/35/36 to 87 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. 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	316Ti (1.4571)													
4. welding coupling														
0	without													
1	material: C.S.													
2	material 316Ti (1.4571)													
5.end support (only FTN-21)														
0	without end support													
C	end support, material: C.S.													
S	end support, material: 316Ti (1.4571)													
6. isolation valve for the sensor profile														
A01	ball valve 1", material: C.S.										PN16 / 150 lbs			
A02	ball valve 1", material: A182-F316/316 (1.4401)										PN16 / 150 lbs			
7. flanged packing gland														
S	material: 316Ti (1.4571)													
8. cage nipple														
PC	material: C.S.													
PS	material: 316Ti (1.4571)													
9. packing material for the flanged and welded packing gland														
1	packing material: PTFE, max 200°C													
2	packing material: Graphite, max 400°C													
10. thermal isolation														
KI	without													
X..	thermal isolation in inches or mm, each 10mm													
11. piping run														
HL	horizontal													
VL	vertical													
													12. process connection	
													13. instrument valves	

1. Order specification ITABAR-FLOW-Sensor, series FTN-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	316Ti (1.4571)
4. welding coupling	
0	without
1	material: C.S.
2	material 316Ti (1.4571)
5. end support (only FTN-26)	
0	without end support
C	end support, material: C.S.
S	end support, material: 316Ti (1.4571)
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: A182-F316/316 (1.4401) PN16 / 150 lbs
7. flanged packing gland	
S	material: 316Ti
8. cage nipple	
PC	material: C.S.
PS	material: 316Ti (1.4571)
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphite, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, each 10mm
11. piping run	
HL	horizontal
VL	vertical
12. integrated RTD resistance thermocouple	
T0	without
TA	3-wire
TB	2-wire, with ex-approval
13. headtransm. for thermocouple	
14. process connection	
15. instrument valves	
16. accessories	

FTN- /

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

[illegible]

9.1 Model Series FTM to 580 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 580 psi (PN40) and an operating temperature of up to 300°C (572°F).

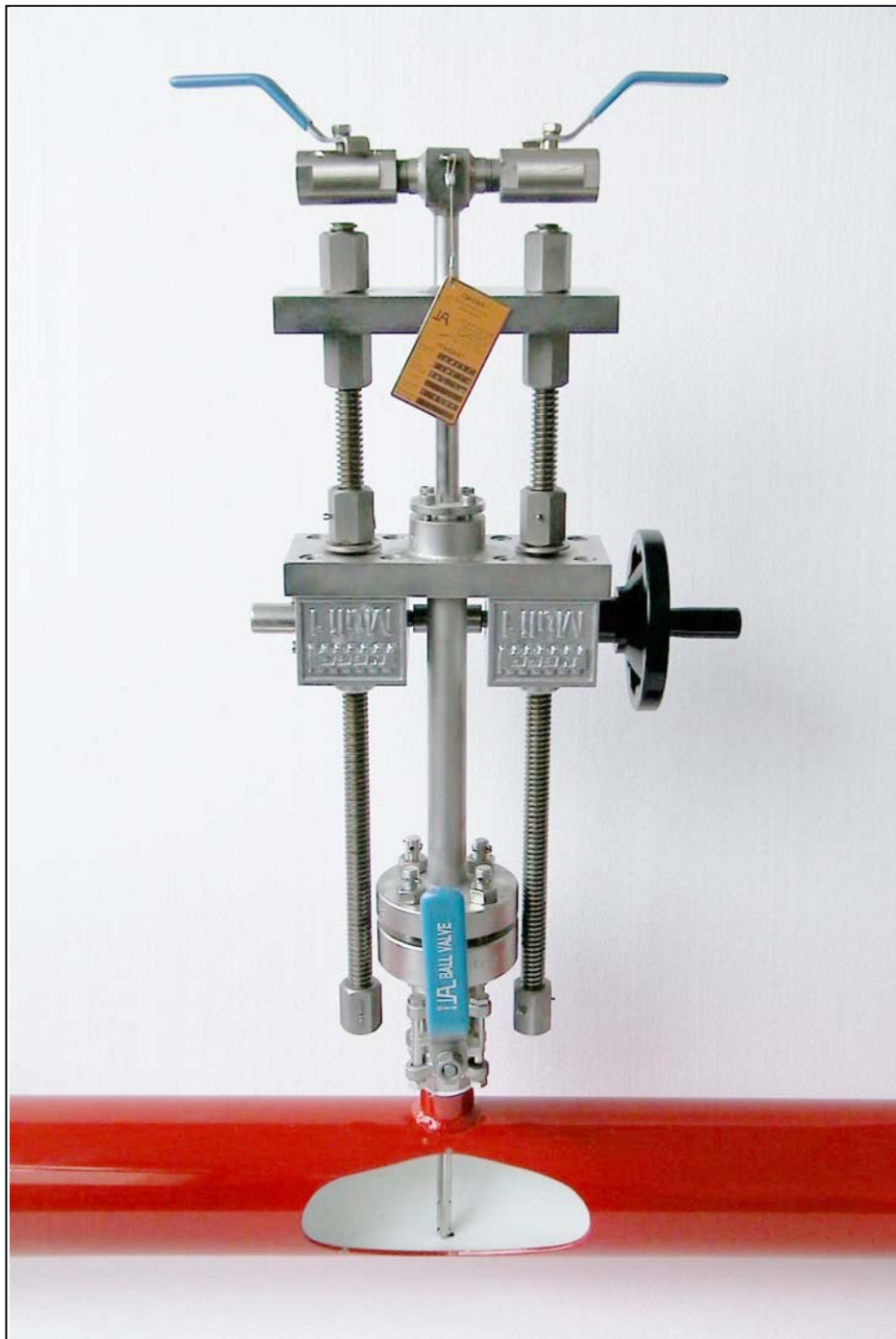
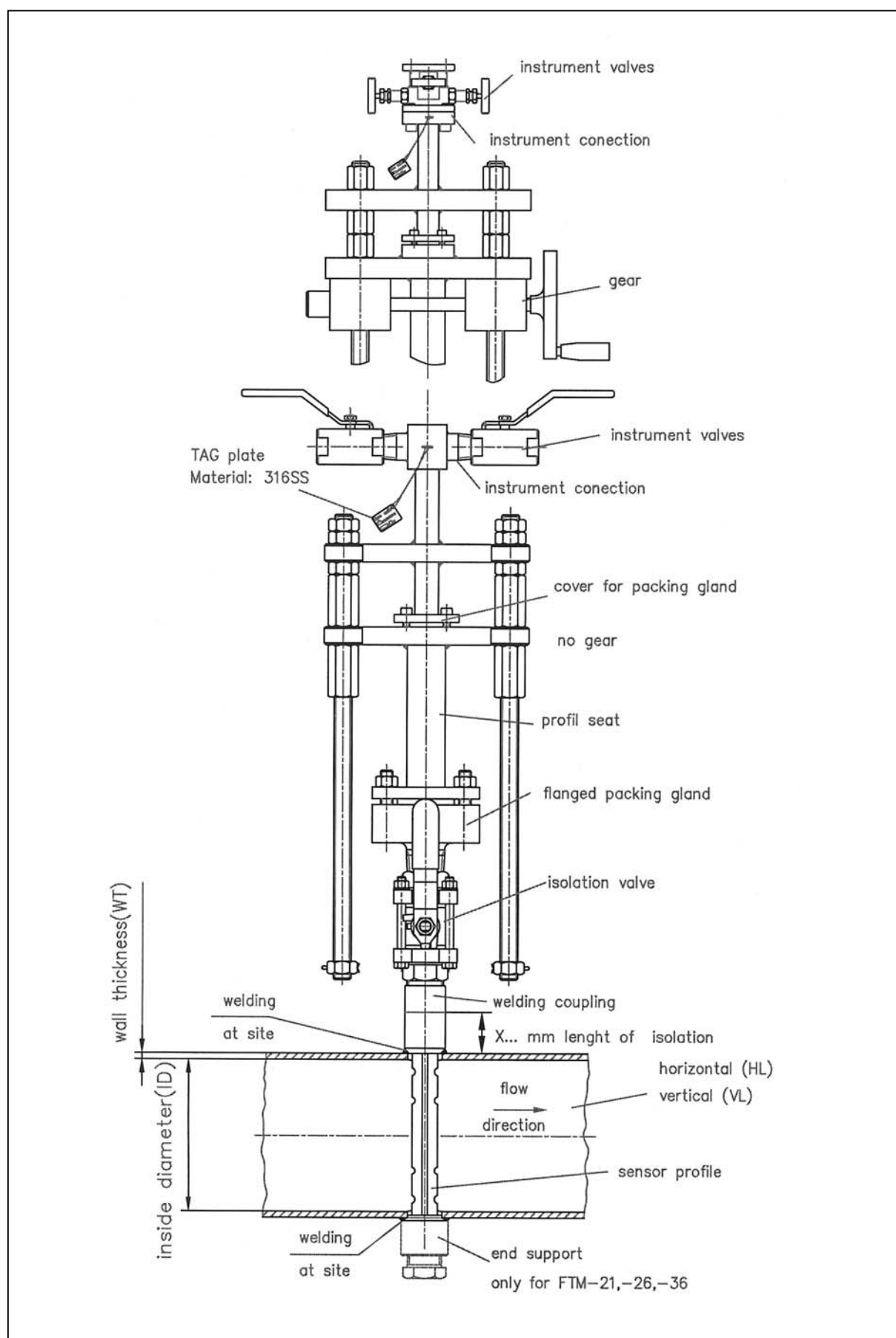


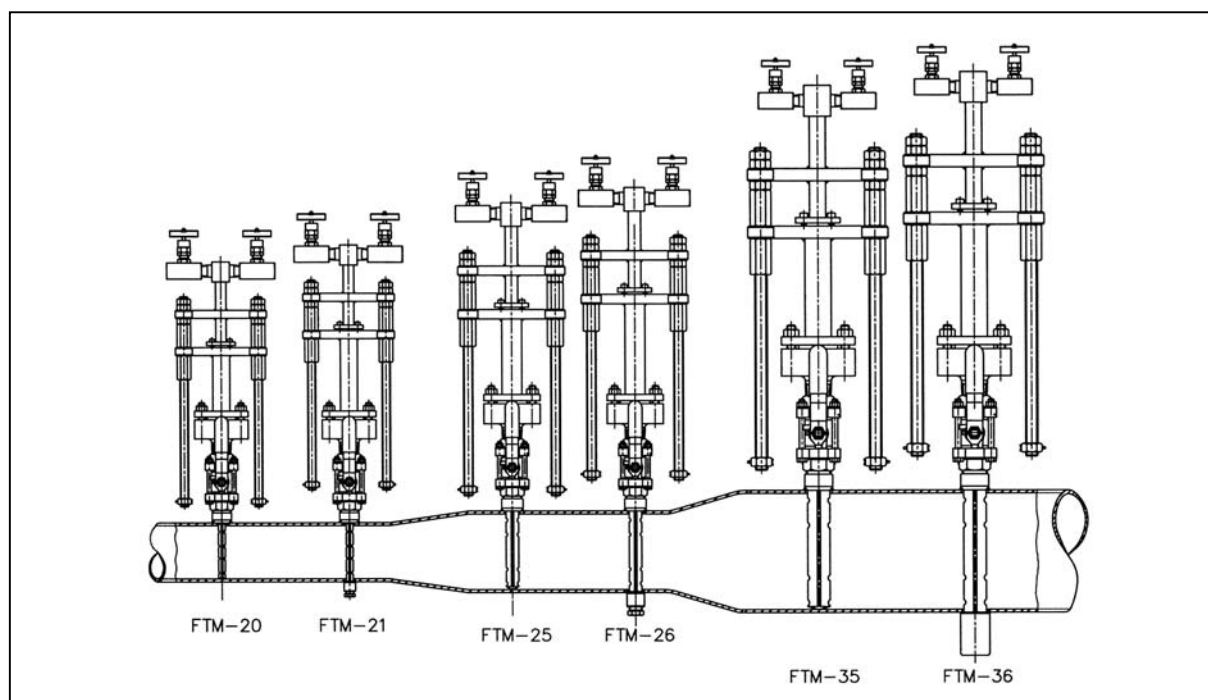
Fig. 9.2: FTM-20 with gear box and hand wheel (option)

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	316Ti (1.4571)																		
4. welding coupling																			
0	without																		
1	material: C.S.																		
2	material: 316Ti (1.4571)																		
5. end support (only FTM-21)																			
0	without end support																		
C	end support, material: C.S.																		
S	end support, material: 316Ti (1.4571)																		
6. isolation valve for the sensor profile																			
A01	ball valve 1", material: C.S.														PN16 / 150 lbs				
A02	ball valve 1", material: A182-F316/316 (1.4401)														PN16 / 150 lbs				
S01	gate valve 1", material: C.S.														PN16 / 150 lbs				
S02	gate valve 1", material: A182-F316/316 (1.4401)														PN16 / 150 lbs				
A03	ball valve 1", material: C.S.														PN40 / 300 lbs				
A04	ball valve 1", material: A182-F316/316 (1.4401)														PN40 / 300 lbs				
S03	gate valve 1", material: C.S.														PN40 / 300 lbs				
S04	gate valve 1", material: A182-F316/316 (1.4401)														PN40 / 300 lbs				
7. flanged packing gland																			
S	material: 316Ti (1.4571)																		
8. cage nipple																			
PC	material: C.S.																		
PS	material: 316Ti (1.4571)																		
9. packing material for the flanged and welded packing gland																			
1	packing material: PTFE, max 200°C																		
2	packing material: Graphite, max 400°C																		
10. thermal isolation																			
KI	without																		
X..	thermal isolation in inches or mm, each 10mm																		
11. piping run																			
HL	horizontal																		
VL	vertical																		
12. gear material of gear box																			
0	without gear														--				
1	with gear														die-cast aluminium				
2	with gear														stainless steel				
13. headtransm. for thermocouple																			
14. process connection																			
15. instrument valves																			
16. accessories																			

FTM-																			
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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	316Ti (1.4571)
4. welding coupling	
0	without
1	material: C.S.
2	material 316Ti
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: A182-F316/316 (1.4401) PN16 / 150 lbs
S05	gate valve 1 1/2", material: C.S. PN16 / 150 lbs
S06	gate valve 1 1/2", material: A182-F316/316 (1.4401) PN16 / 150 lbs
A07	ball valve 1 1/2", material: C.S. PN40 / 300 lbs
A08	ball valve 1 1/2", material: A182-F316/316 (1.4401) PN40 / 300 lbs
S07	gate valve 1 1/2", material: C.S. PN40 / 300 lbs
S08	gate valve 1 1/2", material: A182-F316/316 (1.4401) PN40 / 300 lbs
7. flanged packing gland	
S	material: 316Ti
8. cage nipple	
PC	material: C.S.
PS	material: 316Ti
9. packing material for the flanged and welded packing gland	
1	packing material: PTFE, max 200°C
2	packing material: Graphite, max 400°C
10. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, each 10mm
11. piping run	
HL	horizontal
VL	vertical
12. gear material of gear box	
0	without gear --
1	with gear die-cast aluminium
2	with gear stainless steel
13. integrated RTD resistance thermocouple	
T0	without
TA	3-wire
TB	2-wire, with ex-approval
13. headtransm. for thermocouple	
14. process connection	
15. instrument valves	
16. accessories	

FTM- /

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

[illegible]

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

Instrument connection, shutt-off device and accessories

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

flange plate to direct mount a 3-way-manifold

A06 flange plate to direct mount a 3-way-manifold material: 316Ti (1.4571)

flange plate to direct mount a 5-way-manifold

A15 flange plate to direct mount a 5-way-manifold material: 316Ti (1.4571)



shut-off device for effect pressure pipe (1 pair for valves)

A00 without shut-off device

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

A56 ball valve PN40, case A182-F316H (1.4401) / female thread 1/2" NPT , packing: PTFE

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

A58 ball valve PN40, case A182-F316H (1.4401) / female thread 1/4" NPT , packing: PTFE

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 A182-F316H (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 A182-F316H (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, A182-F316H (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-way-manifold, PN400, case A182-F316H (1.4401) / packing: PTFE (only with A06)

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

A71 direct mount, with 5-way-manifold, PN400, case A182-F316H (1.4401) / packing: PTFE (only with A15)



accessories

E12 1 pair of screw joints 1/2"-NPT-M / Ø12mm; 316Ti (1.4571)

E14 1 pair of screw joints 1/2"-NPT-M / Ø14mm; 316Ti (1.4571)



9.2 Model Series FTH to 1450 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.

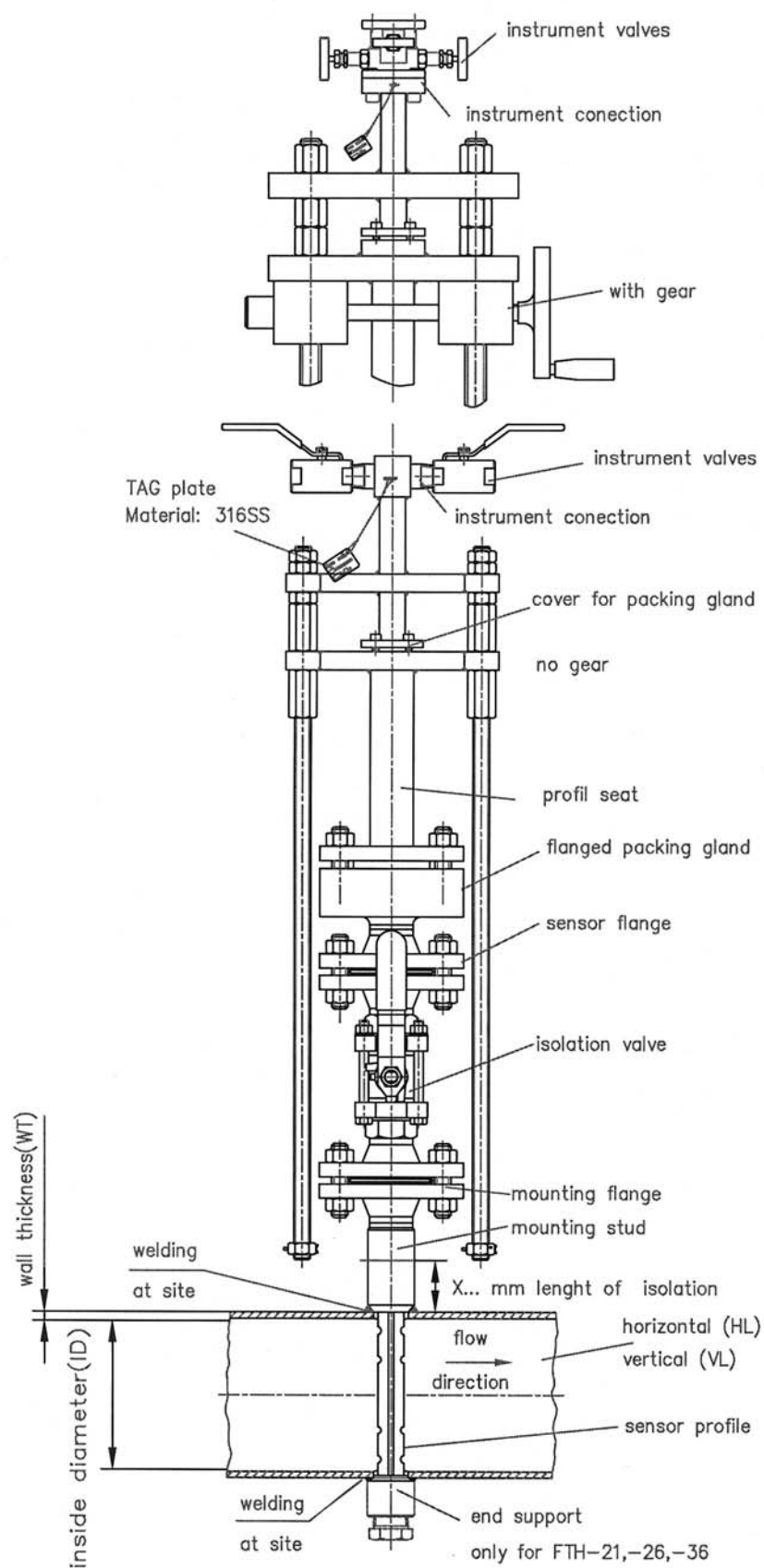
The installation / removal of the sensor is facilitated via a pair of guiding spindles or a gear box with hand wheel (optional).

The FTH sensor is designed for applications with a maximum operating pressure of 1450 psi and a maximum operating temperature of 400°C (752°F).



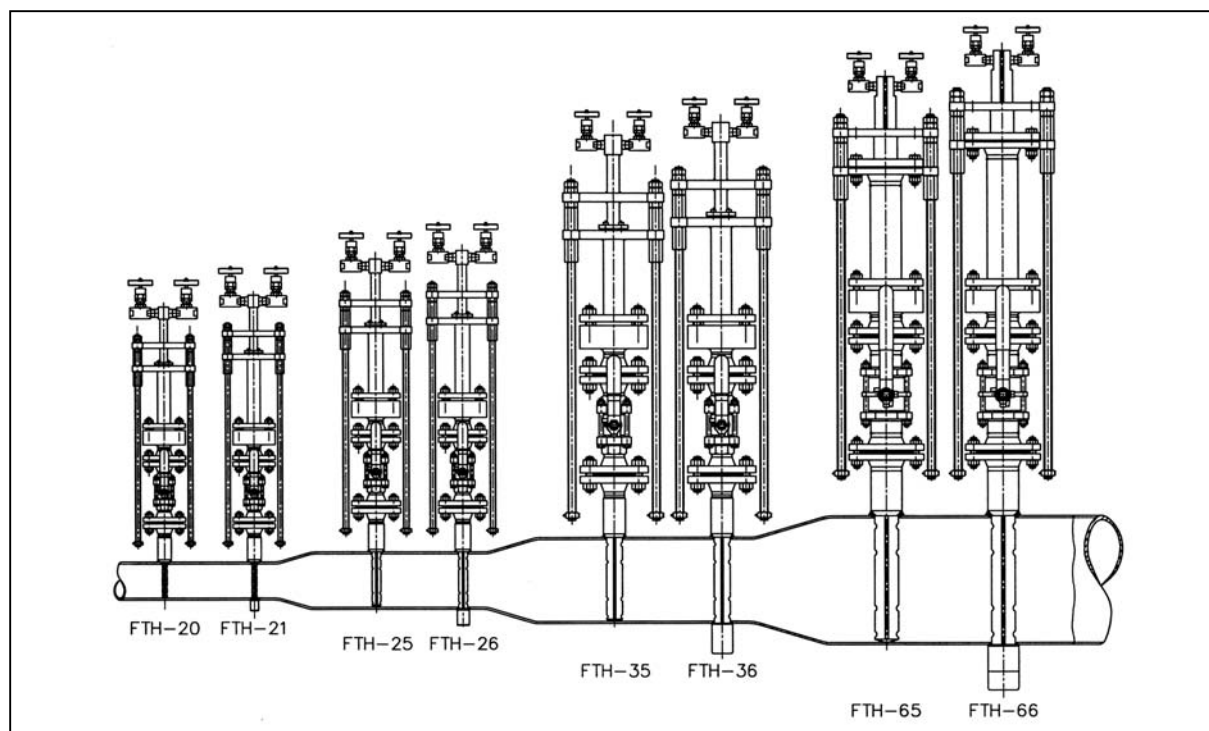
Fig. 9.3: Pitot tube sensor FTH-20 w/o gear box

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	316Ti (1.4571) -standard-	
K	904L (1.4539)	
X	A 182 F51 (1.4462) "Duplex"	
H	Hastelloy C4 (2.4610)	
M	Monel 400 (2.4360)	
Y	Incoloy 800 (1.4876)	
L	Inconel 600 (2.4816)	
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: 316Ti (1.4571)	DN25 1"
B02	PN40 material: 316Ti (1.4571)	DN25 1"
B03	PN63 / 300 lbs material: 316Ti (1.4571)	DN25 1"
B04	PN100 / 600 lbs material: 316Ti (1.4571)	DN25 1"
B10	PN16 / 150 lbs material: Duplex (1.4462)	DN25 1"
B11	PN40 material: Duplex (1.4462)	DN25 1"
B12	PN63 / 300 lbs material: Duplex (1.4462)	DN25 1"
B13	PN100 / 600 lbs material: Duplex (1.4462)	DN25 1"
B20	PN16 / 150 lbs material: 904L (1.4539)	DN25 1"
B21	PN40 material: 904L (1.4539)	DN25 1"
B22	PN63 / 300 lbs material: 904L (1.4539)	DN25 1"
B23	PN100 / 600 lbs material: 904L (1.4539)	DN25 1"
B30	PN16 / 150 lbs material: Hastelloy C4 (2.4610)	DN25 1"
B31	PN40 material: Hastelloy C4 (2.4610)	DN25 1"
B32	PN63 / 300 lbs material: Hastelloy C4 (2.4610)	DN25 1"
B33	PN100 / 600 lbs material: Hastelloy C4 (2.4610)	DN25 1"
B40	PN16 / 150 lbs material: Incoloy 800 (1.4876)	DN25 1"
B41	PN40 material: Incoloy 800 (1.4876)	DN25 1"
B42	PN63 / 300 lbs material: Incoloy 800 (1.4876)	DN25 1"
B43	PN100 / 600 lbs material: Incoloy 800 (1.4876)	DN25 1"
B50	PN16 / 150 lbs material: Inconel 600 (2.4816)	DN25 1"
B51	PN40 material: Inconel 600 (2.4816)	DN25 1"
B52	PN63 / 300 lbs material: Inconel 600 (2.4816)	DN25 1"
B53	PN100 / 600 lbs material: Inconel 600 (2.4816)	DN25 1"
B60	PN16 / 150 lbs material: Monel 400 (2.4360)	DN25 1"
B61	PN40 material: Monel 400 (2.4360)	DN25 1"
B62	PN63 / 300 lbs material: Monel 400 (2.4360)	DN25 1"
B63	PN100 / 600 lbs material: Monel 400 (2.4360)	DN25 1"
7. design assembly connecting pieces		
0	without	
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	
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. Order specification ITABAR-FLOW-Sensor, series FTH-20 / 21

9. material connecting piece, with flange (max. pressure rating)				
allways identically to sensor flange.				
0	without			
C1	C.S.	PN16 / 150 lbs	DN25	1"
S1	316Ti (1.4571) <i>-standard-</i>	PN16 / 150 lbs	DN25	1"
X1	904L (1.4539)	PN16 / 150 lbs	DN25	1"
K1	A 182 F51 (1.4462) "Duplex"	PN16 / 150 lbs	DN25	1"
H1	Hastelloy C4 (2.4610)	PN16 / 150 lbs	DN25	1"
Y1	Incoloy 800 (1.4876)	PN16 / 150 lbs	DN25	1"
L1	Inconel 600 (2.4816)	PN16 / 150 lbs	DN25	1"
M1	Monel 400 (2.4360)	PN16 / 150 lbs	DN25	1"
C2	C.S.	PN40	DN25	1"
S2	316Ti (1.4571) <i>-standard-</i>	PN40	DN25	1"
X2	904L (1.4539)	PN40	DN25	1"
K2	A 182 F51 (1.4462) "Duplex"	PN40	DN25	1"
H2	Hastelloy C4 (2.4610)	PN40	DN25	1"
Y2	Incoloy 800 (1.4876)	PN40	DN25	1"
L2	Inconel 600 (2.4816)	PN40	DN25	1"
M2	Monel 400 (2.4360)	PN40	DN25	1"
C3	C.S.	PN63 / 300 lbs	DN25	1"
S3	316Ti (1.4571) <i>-standard-</i>	PN63 / 300 lbs	DN25	1"
X3	904L (1.4539)	PN63 / 300 lbs	DN25	1"
K3	A 182 F51 (1.4462) "Duplex"	PN63 / 300 lbs	DN25	1"
H3	Hastelloy C4 (2.4610)	PN63 / 300 lbs	DN25	1"
Y3	Incoloy 800 (1.4876)	PN63 / 300 lbs	DN25	1"
L3	Inconel 600 (2.4816)	PN63 / 300 lbs	DN25	1"
M3	Monel 400 (2.4360)	PN63 / 300 lbs	DN25	1"
C4	C.S.	PN100 / 600 lbs	DN25	1"
S4	316Ti (1.4571) <i>-standard-</i>	PN100 / 600 lbs	DN25	1"
X4	904L (1.4539)	PN100 / 600 lbs	DN25	1"
K4	A 182 F51 (1.4462) "Duplex"	PN100 / 600 lbs	DN25	1"
H4	Hastelloy C4 (2.4610)	PN100 / 600 lbs	DN25	1"
Y4	Incoloy 800 (1.4876)	PN100 / 600 lbs	DN25	1"
L4	Inconel 600 (2.4816)	PN100 / 600 lbs	DN25	1"
M4	Monel 400 (2.4360)	PN100 / 600 lbs	DN25	1"
10. end support (only FTH-21)				
0	without support			
C	end support, material: C.S.			
S	end support, material: 316Ti (1.4571)			
X	end support, material: A 182 F51 (1.4462) "Duplex"			
K	end support, material: 904L (1.4539)			
H	end support, material: Hastelloy C4 (2.4610)			
Y	end support, material: Incoloy 800 (1.4876)			
L	end support, material: Inconel 600 (2.4816)			
M	end support, material: Monel 400 (2.4360)			
11. isolation valve for the sensor profile				
12. flanged packing gland				
S	material: 316Ti <i>-standard-</i>			
X	material: A 182 F51 (1.4462) "Duplex"			
K	material: 904L (1.4539)			
H	material: Hastelloy C4 (2.4610)			
Y	material: Incoloy 800 (1.4876)			
L	material: Inconel 600 (2.4816)			
M	material: Monel 400 (2.4360)			
13. cage nipple				
PC	material: C.S. <i>-standard-</i>			
PS	material: 316Ti			
PX	material: A 182 F51 (1.4462) "Duplex"			
P3	material: 904L (1.4539)			
PH	material: Hastelloy C4 (2.4610)			
PY	material: Incoloy 800 (1.4876)			
PL	material: Inconel 600 (2.4816)			
PM	material: Monel 400 (2.4360)			
14. packing material for the flanged and welded packing gland				
1	packing material: PTFE, max 200°C			
2	packing material: Graphite, max 400°C			
15. gears material of gear box				
0	without gears	--		
1	with gears	die-cast aluminium		
2	with gears	stainless steel		

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

[illegible]

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: A182-F316H (1.4401)
MF03	ball valve DN25 / PN40, material: C.S.
MF04	ball valve DN25 / PN40, material: A182-F316H (1.4401)
MF05	ball valve DN25 / PN40, material: A 182 F51 (1.4462) "Duplex"
MF06	ball valve DN25 / PN40, material: Monel 400 (2.4360)
MF07	ball valve DN25 / PN40, material: Hastelloy C4 (2.4610)
MF08	ball valve DN25 / PN40, material: Incoloy 800 (1.4876)
MF09	ball valve DN25 / PN40, material: Inconel 600 (2.4616)
MS01	gate valve DN25 / PN100, material: C.S.
MS02	gate valve DN25 / PN100, material: A182-F316H (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: A182-F316H (1.4401)
AF03	ball valve, 1" ANSI 300 lbs, material: C.S.
AF04	ball valve, 1" ANSI 300 lbs, material: A182-F316H (1.4401)
AF05	ball valve, 1" ANSI 300 lbs, material: A 182 F51 (1.4462) "Duplex"
AF06	ball valve, 1" ANSI 300 lbs, material: Monel 400 (2.4360)
AF07	ball valve, 1" ANSI 300 lbs, material: Hastelloy C4 (2.4610)
AF08	ball valve, 1" ANSI 300 lbs, material: Incoloy 800 (1.4876)
AF09	ball valve, 1" ANSI 300 lbs, material: Inconel 600 (2.4816)
AS01	gate valve, 1" ANSI / 600lbs, material: C.S.
AS02	gate valve, 1" ANSI / 600lbs, material: A182-F316H (1.4401)



accessories

E12	1 pair of screw joints 1/2"-NPT-M / Ø12mm; 316Ti (1.4571)
E14	1 pair of screw joints 1/2"-NPT-M / Ø14mm; 316Ti (1.4571)



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 316Ti (1.4571) **-standard-**
K 904L (1.4539)
X A 182 F51 (1.4462) "Duplex"
H Hastelloy C4 (2.4610)
M Monel 400 (2.4360)
Y Incoloy 800 (1.4876)
L Inconel 600 (2.4816)

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: 316Ti (1.4571)	DN32	1 1/2"
B02	PN40	material: 316Ti (1.4571)	DN32	1 1/2"
B03	PN63 / 300 lbs	material: 316Ti (1.4571)	DN40	1 1/2"
B04	PN100 / 600 lbs	material: 316Ti (1.4571)	DN40	1 1/2"
B10	PN16 / 150 lbs	material: Duplex (1.4462)	DN32	1 1/2"
B11	PN40	material: Duplex (1.4462)	DN32	1 1/2"
B12	PN63 / 300 lbs	material: Duplex (1.4462)	DN40	1 1/2"
B13	PN100 / 600 lbs	material: Duplex (1.4462)	DN40	1 1/2"
B20	PN16 / 150 lbs	material: 904L (1.4539)	DN32	1 1/2"
B21	PN40	material: 904L (1.4539)	DN32	1 1/2"
B22	PN63 / 300 lbs	material: 904L (1.4539)	DN40	1 1/2"
B23	PN100 / 600 lbs	material: 904L (1.4539)	DN40	1 1/2"
B30	PN16 / 150 lbs	material: Hastelloy C4 (2.4610)	DN32	1 1/2"
B31	PN40	material: Hastelloy C4 (2.4610)	DN32	1 1/2"
B32	PN63 / 300 lbs	material: Hastelloy C4 (2.4610)	DN40	1 1/2"
B33	PN100 / 600 lbs	material: Hastelloy C4 (2.4610)	DN40	1 1/2"
B40	PN16 / 150 lbs	material: Incoloy 800 (1.4876)	DN32	1 1/2"
B41	PN40	material: Incoloy 800 (1.4876)	DN32	1 1/2"
B42	PN63 / 300 lbs	material: Incoloy 800 (1.4876)	DN40	1 1/2"
B43	PN100 / 600 lbs	material: Incoloy 800 (1.4876)	DN40	1 1/2"
B50	PN16 / 150 lbs	material: Inconel 600 (2.4816)	DN32	1 1/2"
B51	PN40	material: Inconel 600 (2.4816)	DN32	1 1/2"
B52	PN63 / 300 lbs	material: Inconel 600 (2.4816)	DN40	1 1/2"
B53	PN100 / 600 lbs	material: Inconel 600 (2.4816)	DN40	1 1/2"
B60	PN16 / 150 lbs	material: Monel 400 (2.4360)	DN32	1 1/2"
B61	PN40	material: Monel 400 (2.4360)	DN32	1 1/2"
B62	PN63 / 300 lbs	material: Monel 400 (2.4360)	DN40	1 1/2"
B63	PN100 / 600 lbs	material: Monel 400 (2.4360)	DN40	1 1/2"

7. design assembly connecting pieces

- 0 without
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
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.

- 0 without

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

C1	C.S.	PN16 / 150 lbs	DN32	1 1/2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN32	1 1/2"
X1	A 182 F51 (1.4462) "Duplex"	PN16 / 150 lbs	DN32	1 1/2"
K1	904L (1.4539)	PN16 / 150 lbs	DN32	1 1/2"
H1	Hastelloy C4 (2.4610)	PN16 / 150 lbs	DN32	1 1/2"
Y1	Incoloy 800 (1.4876)	PN16 / 150 lbs	DN32	1 1/2"
L1	Inconel 600 (2.4816)	PN16 / 150 lbs	DN32	1 1/2"
M1	Monel 400 (2.4360)	PN16 / 150 lbs	DN32	1 1/2"
C2	C.S.	PN40	DN32	1 1/2"
S2	316Ti (1.4571)	PN40	DN32	1 1/2"
X2	A 182 F51 (1.4462) "Duplex"	PN40	DN32	1 1/2"
K2	904L (1.4539)	PN40	DN32	1 1/2"
H2	Hastelloy C4 (2.4610)	PN40	DN32	1 1/2"
Y2	Incoloy 800 (1.4876)	PN40	DN32	1 1/2"
L2	Inconel 600 (2.4816)	PN40	DN32	1 1/2"
M2	Monel 400 (2.4360)	PN40	DN32	1 1/2"
C3	C.S.	PN63 / 300 lbs	DN40	1 1/2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN40	1 1/2"
X3	A 182 F51 (1.4462) "Duplex"	PN63 / 300 lbs	DN40	1 1/2"
K3	904L (1.4539)	PN63 / 300 lbs	DN40	1 1/2"
H3	Hastelloy C4 (2.4610)	PN63 / 300 lbs	DN40	1 1/2"
Y3	Incoloy 800 (1.4876)	PN63 / 300 lbs	DN40	1 1/2"
L3	Inconel 600 (2.4816)	PN63 / 300 lbs	DN40	1 1/2"
M3	Monel 400 (2.4360)	PN63 / 300 lbs	DN40	1 1/2"
C4	C.S.	PN100 / 600 lbs	DN40	1 1/2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN40	1 1/2"
X4	A 182 F51 (1.4462) "Duplex"	PN100 / 600 lbs	DN40	1 1/2"
K4	904L (1.4539)	PN100 / 600 lbs	DN40	1 1/2"
H4	Hastelloy C4 (2.4610)	PN100 / 600 lbs	DN40	1 1/2"
Y4	Incoloy 800 (1.4876)	PN100 / 600 lbs	DN40	1 1/2"
L4	Inconel 600 (2.4816)	PN100 / 600 lbs	DN40	1 1/2"
M4	Monel 400 (2.4360)	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: 316Ti (1.4571)		
	X	end support, material: A 182 F51 (1.4462) "Duplex"		
	K	end support, material: 904L (1.4539)		
	H	end support, material: Hastelloy C4 (2.4610)		
	Y	end support, material: Incoloy 800 (1.4876)		
	L	end support, material: Inconel 600 (2.4816)		
	M	end support, material: Monel 400 (2.4360)		
	11. isolation valve for the sensor profile			
	12. flanged packing gland			
	S	material: 316Ti -standard-		
	X	material: A 182 F51 (1.4462) "Duplex"		
	K	material: 904L (1.4539)		
	H	material: Hastelloy C4 (2.4610)		
	Y	material: Incoloy 800 (1.4876)		
	L	material: Inconel 600 (2.4816)		
	M	material: Monel 400 (2.4360)		
	13. cage nipple			
	PC	material: C.S. -standard-		
	PS	material: 316Ti		
	PX	material: A 182 F51 (1.4462) "Duplex"		
	P3	material: 904L (1.4539)		
PH	material: Hastelloy C4 (2.4610)			
PY	material: Incoloy 800 (1.4876)			
PL	material: Inconel 600 (2.4816)			
PM	material: Monel 400 (2.4360)			

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

[illegible]

2. Order specification ITABAR-Flow-Sensor, series Flo-Tap**Instrument connection and shutt-off device****type FTH-25/26****isolation valve for the sensor profile, DIN**

MF08	ball valve, DN32 / PN16, material: C.S.
MF09	ball valve, DN32 / PN16, material: A182-F316H (1.4401)
MF10	ball valve, DN32 / PN16, material: A 182 F51 (1.4462) "Duplex"
MF11	ball valve, DN32 / PN16, material: Monel 400 (2.4360)
MF12	ball valve, DN32 / PN16, material: Hastelloy C4 (2.4610)
MF13	ball valve, DN32 / PN40, material: C.S.
MF14	ball valve, DN32 / PN40, material: A 182-F316 (1.4401)
MF15	ball valve, DN32 / PN40, material: A 182 F51 (1.4462) "Duplex"
MF16	ball valve, DN32 / PN40, material: Monel 400 (2.4360)
MF17	ball valve, DN32 / PN40, material: Hastelloy C4 (2.4610)
MF25	ball valve, DN32 / PN40, material: Incoloy 800 (1.4876)
MF26	ball valve, DN32 / PN40, material: Inconel 600 (2.4816)
MF18	ball valve, DN40 / PN63, material C.S.
MF19	ball valve, DN40 / PN63, material: A182-F318H (1.4401)
MF20	ball valve, DN40 / PN63, material: A 182 F51 (1.4462) "Duplex"
MF21	ball valve, DN40 / PN63, material: Monel 400 (2.4360)
MF22	ball valve, DN40 / PN63, material: Hastelloy C4 (2.4610)
MF23	ball valve, DN40 / PN63, material: Incoloy 800 (1.4876)
MF24	ball valve, DN40 / PN63, material: Inconel 600 (2.4816)
MS10	gate valve DN40 / PN100, material: C.S.
MS11	gate valve DN40 / PN100, material: A 182 F51 (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: A182-F316H (1.4401)
AF10	ball valve, 1 1/2" ANSI 150 lbs, material: A 182 F51 (1.4462) "Duplex"
AF11	ball valve, 1 1/2" ANSI 150 lbs, material: Monel 400 (2.4360)
AF12	ball valve, 1 1/2" ANSI 150 lbs, material: Hastelloy C4 (2.4610)
AF13	ball valve, 1 1/2" ANSI 300 lbs, material: C.S.
AF14	ball valve, 1 1/2" ANSI 300 lbs, material: A182-F316H (1.4401)
AF15	ball valve, 1 1/2" ANSI 300 lbs, material: A 182 F51 (1.4462) "Duplex"
AF16	ball valve, 1 1/2" ANSI 300 lbs, material: Monel 400 (2.4360)
AF17	ball valve, 1 1/2" ANSI 300 lbs, material: Hastelloy C4 (2.4610)
AF18	ball valve, 1 1/2" ANSI 300 lbs, material: Incoloy 800 (1.4876)
AF19	ball valve, 1 1/2" ANSI 300 lbs, material: Inconel 600 (2.4816)
AS10	gate valve 1 1/2" ANSI 600 lbs, material: C.S.
AS11	gate valve, 1 1/2" ANSI 600 lbs, material: A182-F316H (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 316Ti (1.4571) **-standard-**
K 904L (1.4539)
X A 182 F51 (1.4462) "Duplex"
H Hastelloy C4 (2.4610)
M Monel 400 (2.4360)
Y Incoloy 800 (1.4876)
L Inconel 600 (2.4816)

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: 316Ti (1.4571)	DN50	2"
C02	PN40	material: 316Ti (1.4571)	DN50	2"
C03	PN63 / 300 lbs	material: 316Ti (1.4571)	DN50	2"
C04	PN100 / 600 lbs	material: 316Ti (1.4571)	DN50	2"
C10	PN16 / 150 lbs	material: Duplex (1.4462)	DN50	2"
C11	PN40	material: Duplex (1.4462)	DN50	2"
C12	PN63 / 300 lbs	material: Duplex (1.4462)	DN50	2"
C13	PN100 / 600 lbs	material: Duplex (1.4462)	DN50	2"
C20	PN16 / 150 lbs	material: 904L (1.4539)	DN50	2"
C21	PN40	material: 904L (1.4539)	DN50	2"
C22	PN63 / 300 lbs	material: 904L (1.4539)	DN50	2"
C23	PN100 / 600 lbs	material: 904L (1.4539)	DN50	2"
C30	PN16 / 150 lbs	material: Hastelloy C4 (2.4610)	DN50	2"
C31	PN40	material: Hastelloy C4 (2.4610)	DN50	2"
C32	PN63 / 300 lbs	material: Hastelloy C4 (2.4610)	DN50	2"
C33	PN100 / 600 lbs	material: Hastelloy C4 (2.4610)	DN50	2"
C40	PN16 / 150 lbs	material: Incoloy 800 (1.4876)	DN50	2"
C41	PN40	material: Incoloy 800 (1.4876)	DN50	2"
C42	PN63 / 300 lbs	material: Incoloy 800 (1.4876)	DN50	2"
C43	PN100 / 600 lbs	material: Incoloy 800 (1.4876)	DN50	2"
C50	PN16 / 150 lbs	material: Inconel 600 (2.4816)	DN50	2"
C51	PN40	material: Inconel 600 (2.4816)	DN50	2"
C52	PN63 / 300 lbs	material: Inconel 600 (2.4816)	DN50	2"
C53	PN100 / 600 lbs	material: Inconel 600 (2.4816)	DN50	2"
C60	PN16 / 150 lbs	material: Monel 400 (2.4360)	DN50	2"
C61	PN40	material: Monel 400 (2.4360)	DN50	2"
C62	PN63 / 300 lbs	material: Monel 400 (2.4360)	DN50	2"
C63	PN100 / 600 lbs	material: Monel 400 (2.4360)	DN50	2"

7. design assembly connecting pieces

- 0 without
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
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.

- 0 without

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

C1	C.S.	PN16 / 150 lbs	DN50	2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN50	2"
X1	A 182 F51 (1.4462) "Duplex"	PN16 / 150 lbs	DN50	2"
K1	904L (1.4539)	PN16 / 150 lbs	DN50	2"
H1	Hastelloy C4 (2.4610)	PN16 / 150 lbs	DN50	2"
Y1	Incoloy 800 (1.4876)	PN16 / 150 lbs	DN50	2"
L1	Inconel 600 (2.4816)	PN16 / 150 lbs	DN50	2"
M1	Monel 400 (2.4360)	PN16 / 150 lbs	DN50	2"
C2	C.S.	PN40	DN50	2"
S2	316Ti (1.4571)	PN40	DN50	2"
X2	A 182 F51 (1.4462) "Duplex"	PN40	DN50	2"
K2	904L (1.4539)	PN40	DN50	2"
H2	Hastelloy C4 (2.4610)	PN40	DN50	2"
Y2	Incoloy 800 (1.4876)	PN40	DN50	2"
L2	Inconel 600 (2.4816)	PN40	DN50	2"
M2	Monel 400 (2.4360)	PN40	DN50	2"
C3	C.S.	PN63 / 300 lbs	DN50	2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN50	2"
X3	A 182 F51 (1.4462) "Duplex"	PN63 / 300 lbs	DN50	2"
K3	904L (1.4539)	PN63 / 300 lbs	DN50	2"
H3	Hastelloy C4 (2.4610)	PN63 / 300 lbs	DN50	2"
Y3	Incoloy 800 (1.4876)	PN63 / 300 lbs	DN50	2"
L3	Inconel 600 (2.4816)	PN63 / 300 lbs	DN50	2"
M3	Monel 400 (2.4360)	PN63 / 300 lbs	DN50	2"
C4	C.S.	PN100 / 600 lbs	DN50	2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN50	2"
X4	A 182 F51 (1.4462) "Duplex"	PN100 / 600 lbs	DN50	2"
K4	904L (1.4539)	PN100 / 600 lbs	DN50	2"
H4	Hastelloy C4 (2.4610)	PN100 / 600 lbs	DN50	2"
Y4	Incoloy 800 (1.4876)	PN100 / 600 lbs	DN50	2"
L4	Inconel 600 (2.4816)	PN100 / 600 lbs	DN50	2"
M4	Monel 400 (2.4360)	PN100 / 600 lbs	DN50	2"
	10. end support (only FTH-36)			
	O	without support		
	C	end support, material: C.S.		
	S	end support, material: 316Ti (1.4571)		
	X	end support, material: A 182 F51 (1.4462) "Duplex"		
	K	end support, material: 904L (1.4539)		
	H	end support, material: Hastelloy C4 (2.4610)		
	Y	end support, material: Incoloy 800 (1.4876)		
	L	end support, material: Inconel 600 (2.4816)		
	M	end support, material: Monel 400 (2.4360)		
	11. isolation valve for the sensor profile			
	7. flanged packing gland			
	S	material: 316Ti -standard-		
	X	material: A 182 F51 (1.4462) "Duplex"		
	K	material: 904L (1.4539)		
	H	material: Hastelloy C4 (2.4610)		
	Y	material: Incoloy 800 (1.4876)		
	L	material: Inconel 600 (2.4816)		
	M	material: Monel 400 (2.4360)		
	13. cage nipple			
	PC	material: C.S. -standard-		
	PS	material: 316Ti		
	PX	material: A 182 F51 (1.4462) "Duplex"		
	P3	material: 904L (1.4539)		
	PH	material: Hastelloy C4 (2.4610)		
	PY	material: Incoloy 800 (1.4876)		
	PL	material: Inconel 600 (2.4816)		
	PM	material: Monel 400 (2.4360)		
	14. packing material for the flanged and welded packing gland			
	1	packing material: PTFE, max 200°C		
	2	packing material: Graphite, max 400°C		

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

[illegible]

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

Instrument connection and shutt-off device

type FTH-35/36

isolation valve for the sensor profile, DIN

MF30	ball valve DN50 / PN16, material: C.S.
MF31	ball valve DN50 / PN16, material: A182-F316H (1.4401)
MF32	ball valve DN50 / PN16, material: A 182 F51 (1.4462) "Duplex"
MF33	ball valve DN50 / PN16, material: Monel 400 (2.4360)
MF34	ball valve DN50 / PN16, material: Hastelloy C4 (2.4610)
MF35	ball valve DN50 / PN40, material: C.S.
MF36	ball valve DN50 / PN40, material: A182-F316H (1.4401)
MF37	ball valve DN50 / PN40, material: A 182 F51 (1.4462) "Duplex"
MF38	ball valve DN50 / PN40, material: Monel 400 (2.4360)
MF39	ball valve DN50 / PN40, material: Hastelloy C4 (2.4610)
MF47	ball valve DN50 / PN40, material: Incoloy 800 (1.4876)
MF48	ball valve DN50 / PN40, material: Inconel 600 (2.4816)
MF40	ball valve DN50 / PN63, material: C.S.
MF41	ball valve DN50 / PN63, material: A182-F316H (1.4401)
MF42	ball valve DN50 / PN63, material: A 182 F51 (1.4462) "Duplex"
MF43	ball valve DN50 / PN63, material: Monel 400 (2.4360)
MF44	ball valve DN50 / PN63, material: Hastelloy C4 (2.4610)
MF45	ball valve DN50 / PN63, material: Incoloy 800 (1.4876)
MF46	ball valve DN50 / PN63, material: Inconel 600 (2.4816)
MS20	gate valve, DN50 / PN100, material: C.S.
MS21	gate valve DN50 / PN100, material: A 182-F316H (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: A182-F316H (1.4401)
AF32	ball valve 2" ANSI 150 lbs, material: A 182 F51 (1.4462) "Duplex"
AF33	ball valve 2" ANSI 150 lbs, material: Monel 400 (2.4360)
AF34	ball valve 2" ANSI 150 lbs, material: Hastelloy C4 (2.4610)
AF35	ball valve 2" ANSI 300 lbs, material: C.S.
AF36	ball valve, 2" ANSI 300 lbs, Werkstoff: A182-F316H (1.4401)
AF37	ball valve 2" ANSI 300 lbs, material: A 182 F51 (1.4462) "Duplex"
AF38	ball valve 2" ANSI 300 lbs, material: Monel 400 (2.4360)
AF39	ball valve 2" ANSI 300 lbs, material: Hastelloy C4 (2.4610)
AF40	ball valve 2" ANSI 300 lbs, material: Incoloy 800 (1.4876)
AF41	ball valve 2" ANSI 300 lbs, material: Inconel 600 (2.4816)
AS20	gate valve 2" ANSI 600 lbs, material: C.S.
AS21	gate valve 2" ANSI 600 lbs, material: A182-F316H (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	316Ti (1.4571) -standard-
K	904L (1.4539)
X	A 182 F51 (1.4462) "Duplex"
H	Hastelloy C4 (2.4610)
M	Monel 400 (2.4360)
Y	Incoloy 800 (1.4876)
L	Inconel 600 (2.4816)

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: 316Ti (1.4571)	DN65	2 1/2"
D02	PN40	material: 316Ti (1.4571)	DN65	2 1/2"
D03	PN63 / 300 lbs	material: 316Ti (1.4571)	DN65	2 1/2"
D04	PN100 / 600 lbs	material: 316Ti (1.4571)	DN65	2 1/2"
D10	PN16 / 150 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D11	PN40	material: Duplex (1.4462)	DN65	2 1/2"
D12	PN63 / 300 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D13	PN100 / 600 lbs	material: Duplex (1.4462)	DN65	2 1/2"
D20	PN16 / 150 lbs	material: 904L (1.4539)	DN65	2 1/2"
D21	PN40	material: 904L (1.4539)	DN65	2 1/2"
D22	PN63 / 300 lbs	material: 904L (1.4539)	DN65	2 1/2"
D23	PN100 / 600 lbs	material: 904L (1.4539)	DN65	2 1/2"
D30	PN16 / 150 lbs	material: Hastelloy C4 (2.4610)	DN65	2 1/2"
D31	PN40	material: Hastelloy C4 (2.4610)	DN65	2 1/2"
D32	PN63 / 300 lbs	material: Hastelloy C4 (2.4610)	DN65	2 1/2"
D33	PN100 / 600 lbs	material: Hastelloy C4 (2.4610)	DN65	2 1/2"
D40	PN16 / 150 lbs	material: Incoloy 800 (1.4876)	DN65	2 1/2"
D41	PN40	material: Incoloy 800 (1.4876)	DN65	2 1/2"
D42	PN63 / 300 lbs	material: Incoloy 800 (1.4876)	DN65	2 1/2"
D43	PN100 / 600 lbs	material: Incoloy 800 (1.4876)	DN65	2 1/2"
D50	PN16 / 150 lbs	material: Inconel 600 (2.4816)	DN65	2 1/2"
D51	PN40	material: Inconel 600 (2.4816)	DN65	2 1/2"
D52	PN63 / 300 lbs	material: Inconel 600 (2.4816)	DN65	2 1/2"
D53	PN100 / 600 lbs	material: Inconel 600 (2.4816)	DN65	2 1/2"
D60	PN16 / 150 lbs	material: Monel 400 (2.4360)	DN65	2 1/2"
D61	PN40	material: Monel 400 (2.4360)	DN65	2 1/2"
D62	PN63 / 300 lbs	material: Monel 400 (2.4360)	DN65	2 1/2"
D63	PN100 / 600 lbs	material: Monel 400 (2.4360)	DN65	2 1/2"

7. design assembly connecting pieces

0	without
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
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.

0	without
---	---------

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

C1	C.S.	PN16 / 150 lbs	DN65	2 1/2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN65	2 1/2"
X1	A 182 F51 (1.4462) "Duplex"	PN16 / 150 lbs	DN65	2 1/2"
K1	904L (1.4539)	PN16 / 150 lbs	DN65	2 1/2"
H1	Hastelloy C4 (2.4610)	PN16 / 150 lbs	DN65	2 1/2"
Y1	Incoloy 800 (1.4876)	PN16 / 150 lbs	DN65	2 1/2"
L1	Inconel 600 (2.4816)	PN16 / 150 lbs	DN65	2 1/2"
M1	Monel 400 (2.4360)	PN16 / 150 lbs	DN65	2 1/2"

C2	C.S.	PN40	DN65	2 1/2"
S2	316Ti (1.4571)	PN40	DN65	2 1/2"
X2	A 182 F51 (1.4462) "Duplex"	PN40	DN65	2 1/2"
K2	904L (1.4539)	PN40	DN65	2 1/2"
H2	Hastelloy C4 (2.4610)	PN40	DN65	2 1/2"
Y2	Incoloy 800 (1.4876)	PN40	DN65	2 1/2"
L2	Inconel 600 (2.4816)	PN40	DN65	2 1/2"
M2	Monel 400 (2.4360)	PN40	DN65	2 1/2"

C3	C.S.	PN63 / 300 lbs	DN65	2 1/2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN65	2 1/2"
X3	A 182 F51 (1.4462) "Duplex"	PN63 / 300 lbs	DN65	2 1/2"
K3	904L (1.4539)	PN63 / 300 lbs	DN65	2 1/2"
H3	Hastelloy C4 (2.4610)	PN63 / 300 lbs	DN65	2 1/2"
Y3	Incoloy 800 (1.4876)	PN63 / 300 lbs	DN65	2 1/2"
L3	Inconel 600 (2.4816)	PN63 / 300 lbs	DN65	2 1/2"
M3	Monel 400 (2.4360)	PN63 / 300 lbs	DN65	2 1/2"

C4	C.S.	PN100 / 600 lbs	DN65	2 1/2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN65	2 1/2"
X4	A 182 F51 (1.4462) "Duplex"	PN100 / 600 lbs	DN65	2 1/2"
K4	904L (1.4539)	PN100 / 600 lbs	DN65	2 1/2"
H4	Hastelloy C4 (2.4610)	PN100 / 600 lbs	DN65	2 1/2"
Y4	Incoloy 800 (1.4876)	PN100 / 600 lbs	DN65	2 1/2"
L4	Inconel 600 (2.4816)	PN100 / 600 lbs	DN65	2 1/2"
M4	Monel 400 (2.4360)	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: 316Ti (1.4571)
X	end support, material: A 182 F51 (1.4462) "Duplex"
K	end support, material: 904L (1.4539)
H	end support, material: Hastelloy C4 (2.4610)
Y	end support, material: Incoloy 800 (1.4876)
L	end support, material: Inconel 600 (2.4816)
M	end support, material: Monel 400 (2.4360)

11. isolation valve for the sensor profile

7. flanged packing gland

S	material: 316Ti - standard -
X	material: A 182 F51 (1.4462) "Duplex"
K	material: 904L (1.4539)
H	material: Hastelloy C4 (2.4610)
Y	material: Incoloy 800 (1.4876)
L	material: Inconel 600 (2.4816)
M	material: Monel 400 (2.4360)

13. cage nipple

PC	material: C.S. - standard -
PS	material: 316Ti
PX	material: A 182 F51 (1.4462) "Duplex"
P3	material: 904L (1.4539)
PH	material: Hastelloy C4 (2.4610)
PY	material: Incoloy 800 (1.4876)
PL	material: Inconel 600 (2.4816)
PM	material: Monel 400 (2.4360)

14. packing material for the flanged and welded packing gland

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

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

[illegible]

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

Instrument connection and shutt-off device

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: A182-F316H (1.4401)
MF52	ball valve, DN65 / PN16, material: A 182 F51 (1.4462) "Duplex"
MF53	ball valve, DN65 / PN16, material: Monel 400 (2.4360)
MF54	ball valve, DN65 / PN16, material: Hastelloy C4 (2.4610)
MF55	ball valve, DN65 / PN40, material: C.S.
MF56	ball valve, DN65 / PN40, material: A182-F316H (1.4401)
MF57	ball valve, DN65 / PN40, material: A182 F51 (1.4462) "Duplex"
MF57	ball valve, DN65 / PN40, material: Monel 400 (2.4360)
MF58	ball valve, DN65 / PN40, material: Hastelloy C4 (2.4610)
MF66	ball valve, DN65 / PN40, material: Incoloy 800 (1.4876)
MF67	ball valve, DN65 / PN40, material: Inconel 600 (2.4816)
MF59	ball valve, DN65 / PN63, material: C.S.
MF60	ball valve, DN65 / PN63, material: A182-F316H (1.4401)
MF61	ball valve, DN65 / PN63, material: A 182 F51 (1.4862) "Duplex"
MF62	ball valve, DN65 / PN63, material: Monel 400 (2.4360)
MF63	ball valve, DN65 / PN63, material: Hastelloy C4 (2.4610)
MF64	ball valve, DN65 / PN63, material: Incoloy 800 (1.4876)
MF65	ball valve, DN65 / PN63, material: Inconel 600 (2.4816)
MS30	gate valve, DN65 / PN100, material: C.S.
MS31	gate valve, DN65 / PN100, material: A182-F316H (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: A182-F316H (1.4401)
AF52	ball valve, 2 1/2" ANSI 150 lbs, material: A 182 F51 (1.4862) "Duplex"
AF53	ball valve, 2 1/2" ANSI 150 lbs, material: Monel 400 (2.4360)
AF54	ball valve, 2 1/2" ANSI 150 lbs, material: Hastelloy C4 (2.4610)
AF55	ball valve, 2 1/2" ANSI 300 lbs, material: C.S.
AF56	ball valve, 2 1/2" ANSI 300 lbs, material: A182-F316H (1.4401)
AF57	ball valve, 2 1/2" ANSI 300 lbs, material: A 182 F51 (1.4862) "Duplex"
AF58	ball valve, 2 1/2" ANSI 300 lbs, Werkstoff: Monel 400 (2.4360)
AF59	ball valve, 2 1/2" ANSI 300 lbs, material: Hastelloy C4 (2.4610)
AF60	ball valve, 2 1/2" ANSI 300 lbs, material: Incoloy 800 (1.4862)
AF61	ball valve, 2 1/2" ANSI 300 lbs, material: Inconel 600 (2.4816)
AS30	gate valve, 2 1/2" ANSI 600 lbs, material: C.S.
AS31	gate valve, 2 1/2" ANSI 600 lbs, material: A182-F316H (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

A03	sensorhead with 1/2" NPT outside thread	
A04	sensorhead with 1/4" NPT outside thread	
	flange plate to direct mount a 3-way-manifold	
A06	flange plate to direct mount a 3-way-manifold	material: 316Ti (1.4571)
A07	flange plate to direct mount a 3-way-manifold	material: A 182 F51 (1.4462) "Duplex"
A08	flange plate to direct mount a 3-way-manifold	material: 904L (1.4539)
A09	flange plate to direct mount a 3-way-manifold	material: Hastelloy C4 (2.4610)
A10	flange plate to direct mount a 3-way-manifold	material: Inconel 600 (2.4816)
A11	flange plate to direct mount a 3-way-manifold	material: Monel 400 (2.4360)
A14	flange plate to direct mount a 3-way-manifold	material: Incoloy 800 (1.4876)
	flange plate to direct mount a 5-way-manifold	
A15	flange plate to direct mount a 5-way-manifold	material: 316Ti (1.4571)
A16	flange plate to direct mount a 5-way-manifold	material: A 182 F51 (1.4462) "Duplex"
A17	flange plate to direct mount a 5-way-manifold	material: 904L (1.4539)
A18	flange plate to direct mount a 5-way-manifold	material: Hastelloy C4 (2.4610)
A19	flange plate to direct mount a 5-way-manifold	material: Inconel 600 (2.4816)
A20	flange plate to direct mount a 5-way-manifold	material: Monel 400 (2.4360)
A23	flange plate to direct mount a 5-way-manifold	material: Incoloy 800 (1.4876)

shut-off device for effect pressure pipe (1 pair for valves).

A00	without	
A55	ball valve PN40, case C.S. / female thread 1/2" NPT , packing: PTFE	
A56	ball valve PN40, case A182-F316H (1.4401) / female thread 1/2" NPT , packing: PTFE	
A57	ball valve PN40, case C.S. / female thread 1/4" NPT , packing: PTFE	
A58	ball valve PN40, case A182-F316H (1.4401) / female thread 1/4" NPT , packing: PTFE	
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 A182-F316H (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 A182-F316H (1.4401) / female thread 1/4" 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, A182-F316H (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-way-manifold, PN400, case A182-F316H (1.4401) / packing: PTFE (only with A06)	
A67	direct mount, with 3-way-manifold, PN10, case PTFE / packing: PTFE (only with A06)	
A71	direct mount, with 5-way-manifold, PN400, case A182-F316H (1.4401) / packing: PTFE (only with A15)	

accessories

E12	1 pair of screw joints 1/2"-NPT-M / Ø12mm; 316Ti (1.4571)
E14	1 pair of screw joints 1/2"-NPT-M / Ø14mm; 316Ti (1.4571)

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

IBRD	IBFD	FTMD	FTHD
			
IBFD-HT	IBFD-HTG		
			

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
316Ti (1.4571) st steel	---	---	---	---	X	X
16 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)						
14571 (316Ti) (IBFD to max. 450°C / 842°F, IBRD to max. 200°C / 392°F)	X	X	---	---	X	X
1.5415, 16 Mo 3 (to max. 530°C / 986°F)	---	---	X	X	---	---
1.7335, 13 CrMo 4 4 (to max. 570°C / 1058°F)	---	---	X	X	---	---
1.7380, 10 CrMo 9 10 (to max. 600°C / 1112°F)	---	---	X	X	---	---
1.4903, 10 CrMoVNb 91 (to max. 650°C / 1202 °F)	---	---	X	X	---	---
Type of mounting assembly:						
Threaded weld-o-let (to max. 200°C / 392°F)	X	---	---	---	---	---
Welding nipple (to max. 200°C / 392 °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

10.2 Type IBRD to 232.1 PSI (16 bar) and 392°F (200°C)

Description

The ITABAR steam sensors series IBRD are designed to measure steam up to 235.2 PSI (16 bar) and 392°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.

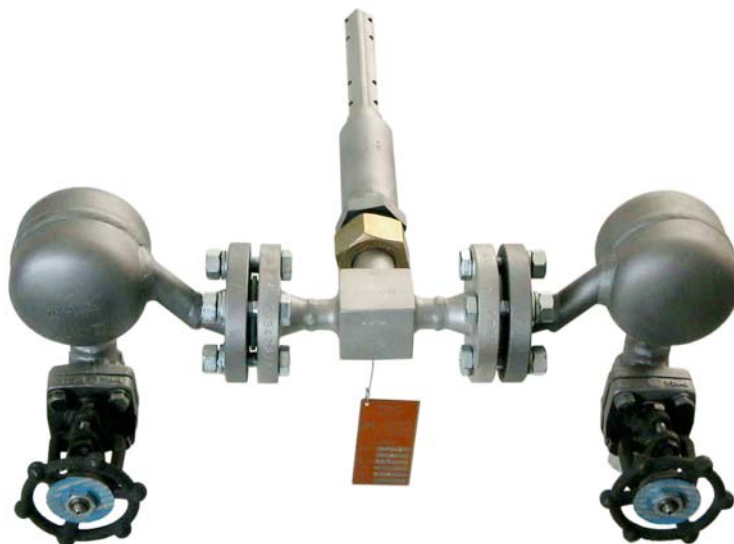
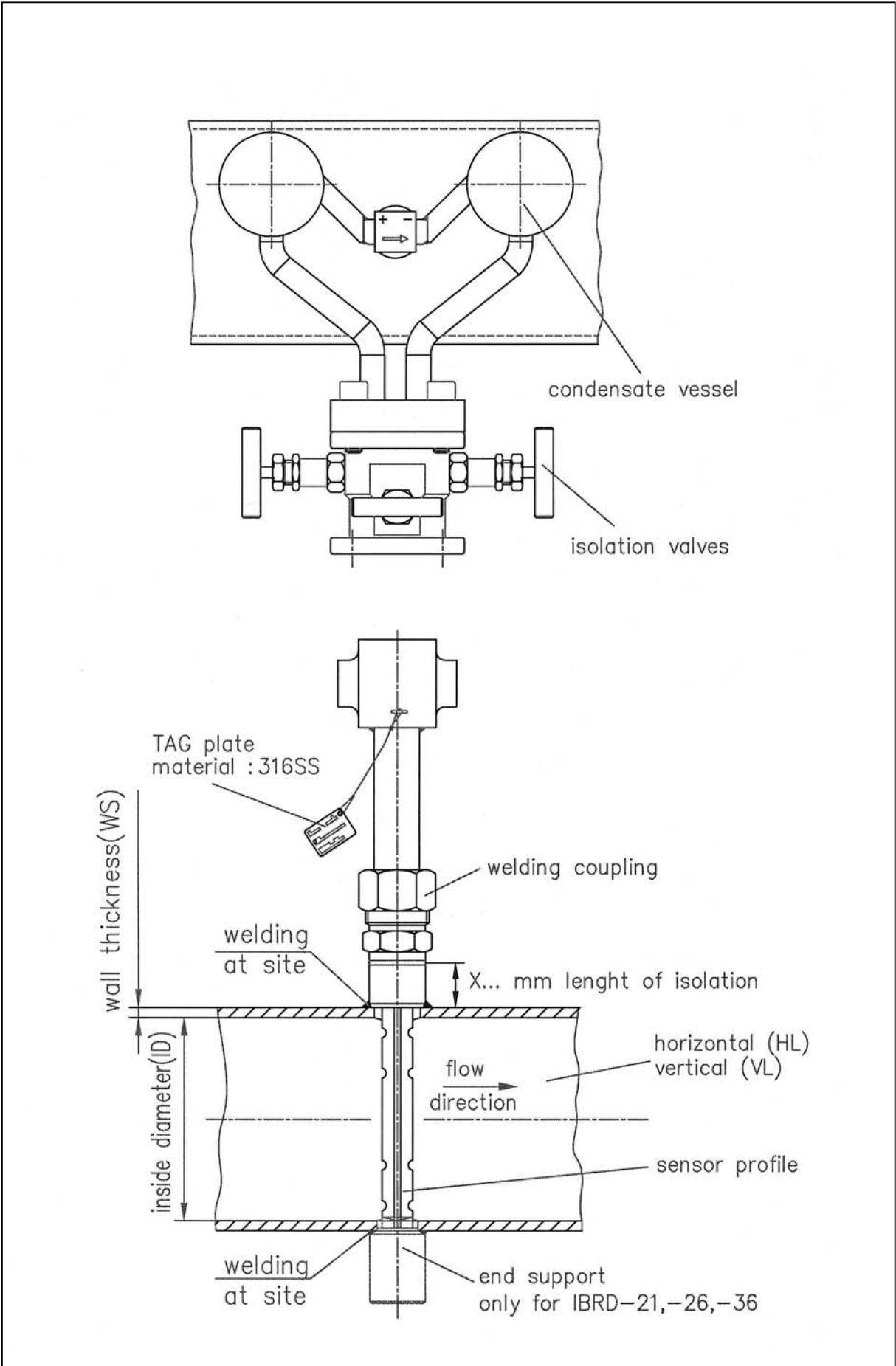


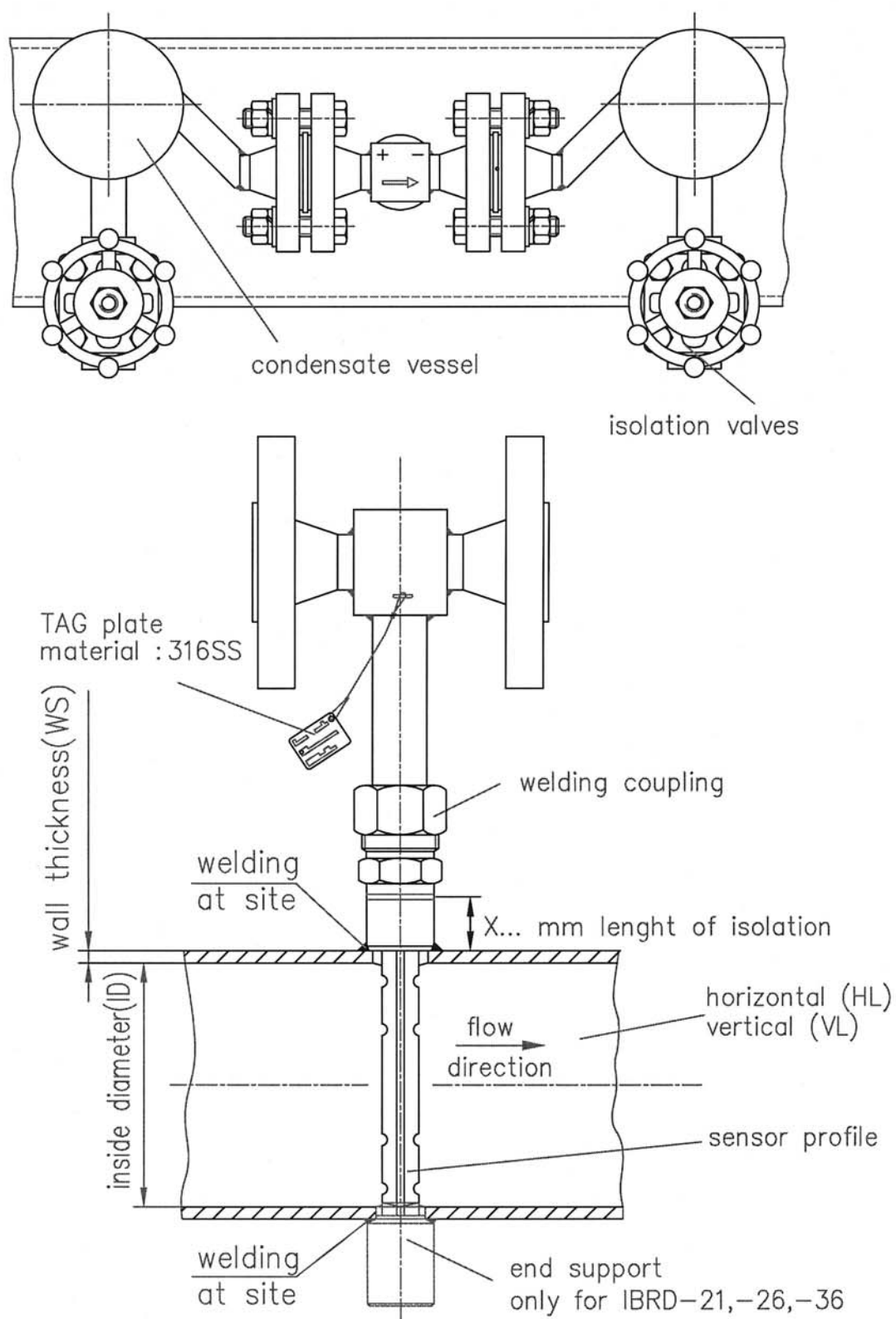
Fig. 8.2: DP sensor to measure volumetric steam flow. The components: threaded weld-o-let, sensor head with flanges, condensate pots and screwed on ANSI-Slide valve 800 lbs

Compact Version ITABAR Series IBRD with Flange Plate



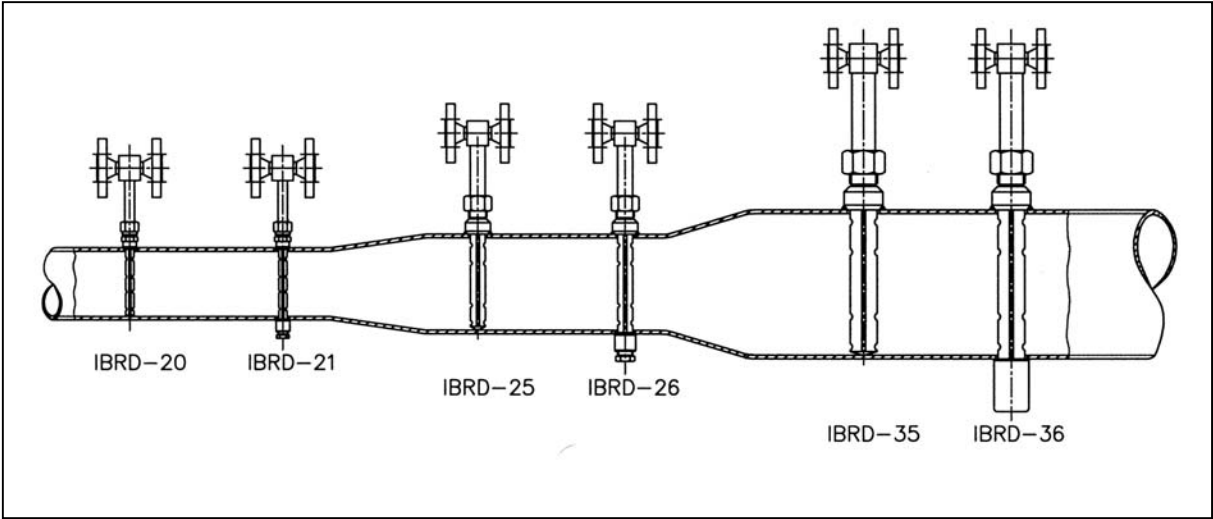
ITABAR Series IBRD, Flanged Connection at Sensor Head

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. 232.1 psi, T-max. 392°F

To Be Decided By Customer Before Sensor Selection

1. Remote mounting of DP transmitter – separate from the sensor (connections via Hermeto 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 (87,02 PSI/ abs.)
7. Temperature 158,85°C (317.93°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	316Ti (1.4571)								
4. welding coupling									
0	without								
1	material: C.S.								
2	material: 316Ti (1.4571)								
5. end support (only IBRD-21)									
0	without end support								
C	end support, material: C.S.								
S	end support, material: 316Ti (1.4571)								
6. instrument connection and condensate vessels									
7. isolation									
KI	without								
X..	thermal isolation in inches or mm,								
8. piping run									
HL	horizontal								
VL	vertical								
9. instrument valves									

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	316Ti (1.4571)								
4. welding coupling									
0	without								
1	material: C.S.								
2	material: 316Ti (1.4571)								
5. end support (only IBRD-26)									
0	without end support								
C	end support, material: C.S.								
S	end support, material: 316Ti (1.4571)								
6. instrument connection and condensate vessels									
7. isolation									
KI	without								
X..	thermal isolation in inches or mm,								
8. piping run									
HL	horizontal								
VL	vertical								
9. integrated RTD resit. thermocouple									
T0	without								
TA	3-wire								
TB	2-wire, with ex-approval								
10. transm. for thermocouple									
11. instrument valves									

IBRD-			/		S					
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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	316Ti (1.4571)													
4. welding coupling														
0	without													
1	material: C.S.													
2	material: 316Ti (1.4571)													
5. end support (only IBRD-36)														
0	without end support													
C	end support, material: C.S.													
S	end support, material: 316Ti (1.4571)													
6. instrument connection and condensate vessels														
7. isolation														
KI	without													
X..	thermal isolation in inches or mm,													
8. piping run														
HL	horizontal													
VL	vertical													
9. integrated RTD resit. thermocouple														
T0	without													
TA	3-wire													
TB	2-wire, with ex-approval													
														10. transm. for thermocouple
														11. instrument valves

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

Order specification condensate vessel**IBRD 20, 21, 25, 26, 35, 36****flanged joint at sensor head (1 pair)**

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 for condensat vessel

H	A 285 (P 265 GH) "heavy boiler plate HII"	size: Ø 88,9 x 5 mm
S	316Ti (1.4571)	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 (1 pair)**

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 (1.4404) 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 (1 pair)**

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

material and size condensate vessel

H	A 285 (P 265 GH) "heavy boiler plate HII"	size: Ø 88,9 x 5 mm
S	316Ti (1.4571)	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 3-way-manifold	material: 316Ti (1.4571)
A15	flange plate for 5-way-manifold	material: 316Ti (1.4571)

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-manifold, PN400, A182-F316H (1.4401) / packing: graphite
A71	5-way-manifold, PN400, A182-F316H (1.4401) / packing: graphite

Picture of Condensate Pots

Material	Wall thickness [mm]						
		Medium temperature (°C / °F)					
		300 / 572	350 / 662	400 / 752	450 / 842	500 / 932	550 / 1022
		max. operating pressure (bar / PSIG)					
H11	5,6	91,1/1321	84,2/1221	77,8/1128	74,7/1083	-/-	-/-
316Ti	5,0	92,1/1336	88,9/1289	85,7/1242	83,2/1206	81,9/1187	80,6/1169
15Mo3	5.0	109,0/1580	102,6/1488	96,3/1396	93,1/1350	89,9/1303	85,7/1242

Fig. 8.10: condensate pot, Ø 3.5 inches / 88,9 mm



8.8.2 Pressure- Temperature Tables for Shut-Off Valves

Code	Maximum operating pressure at temperature													°F °C
	32 0	212 100	302 150	392 200	482 250	572 300	662 350	752 400	797 425	842 450	887 475	932 500	1022 550	
A81	1987	1929	1885	1841	1775	1581	1362	1160	1001	827	624	-	-	PSI bar
	137	133	130	127	121	109	96	80	69	57	43	-	-	
A82	2002	1929	1885	1841	1755	1581	1407	1291	1233	1189	1088	972	855	PSI bar
	138	133	130	127	121	109	97	89	85	82	75	67	59	



Fig. 8.13: Construction of small slidegate valve. A09

10.3 Sensor Series IBFD 100 bar (1450 psi) and 450°C (842°F)

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 1450psi). The maximum possible temperature is 842°F. The standard sensor material is 316 stainless steel (1.4571).

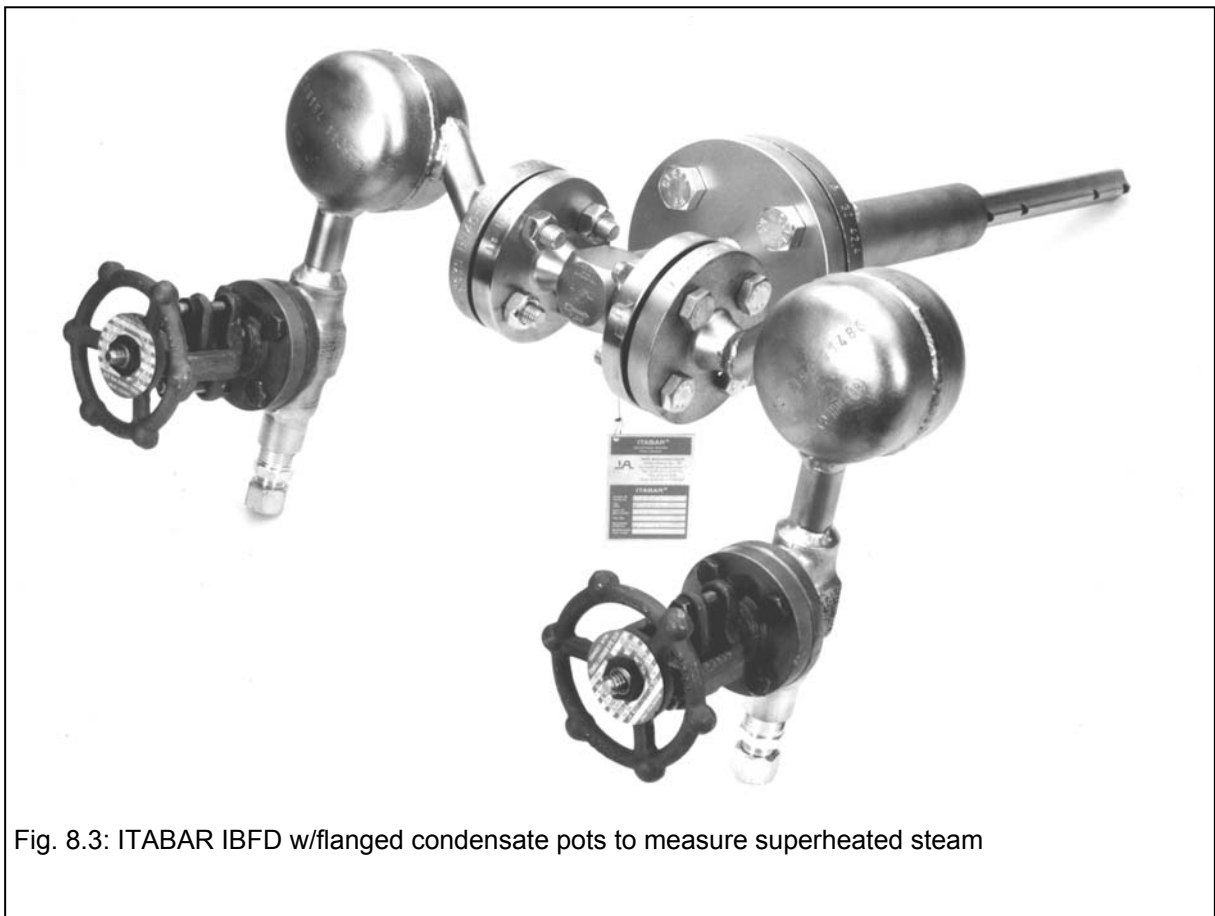
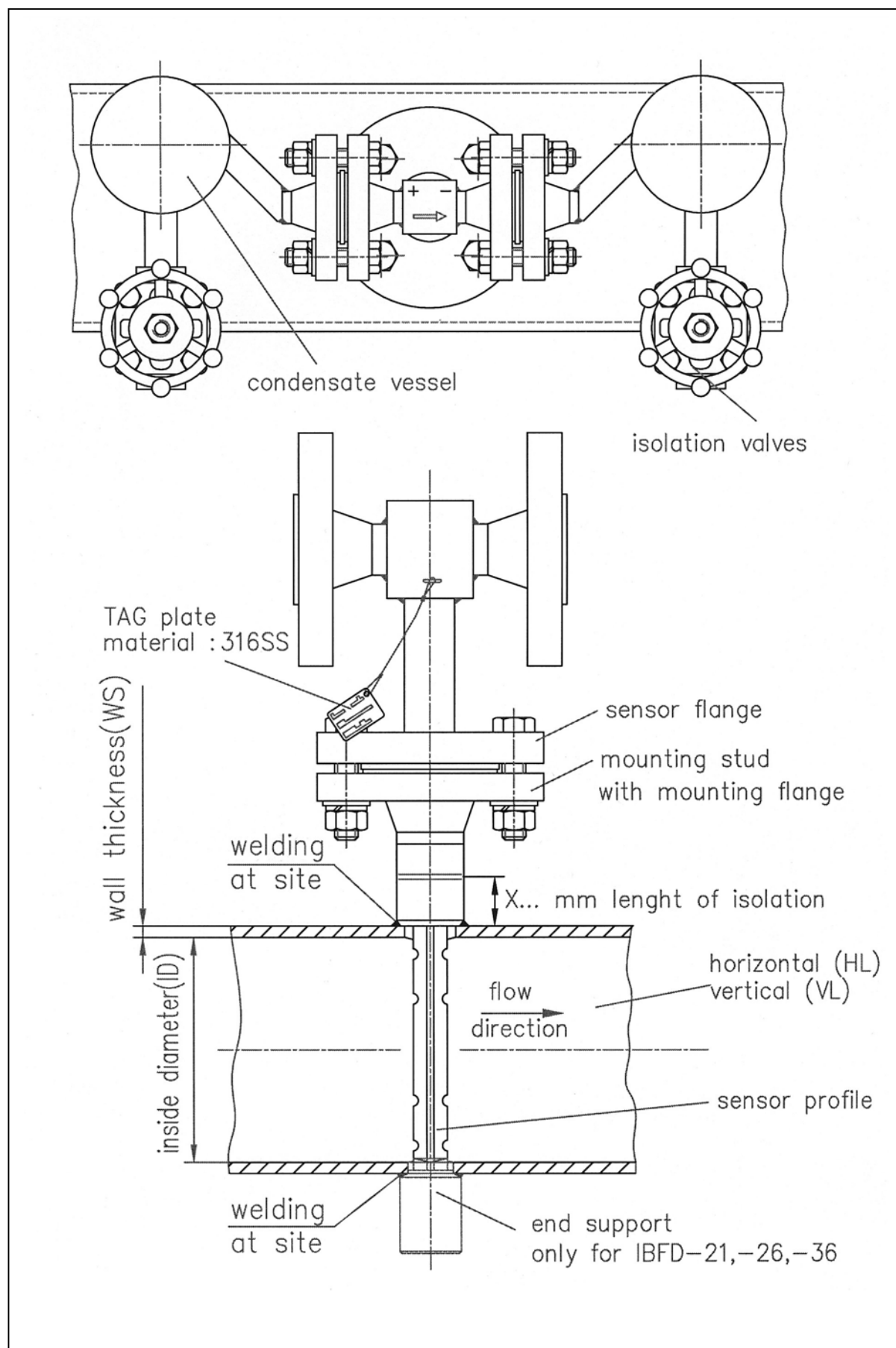
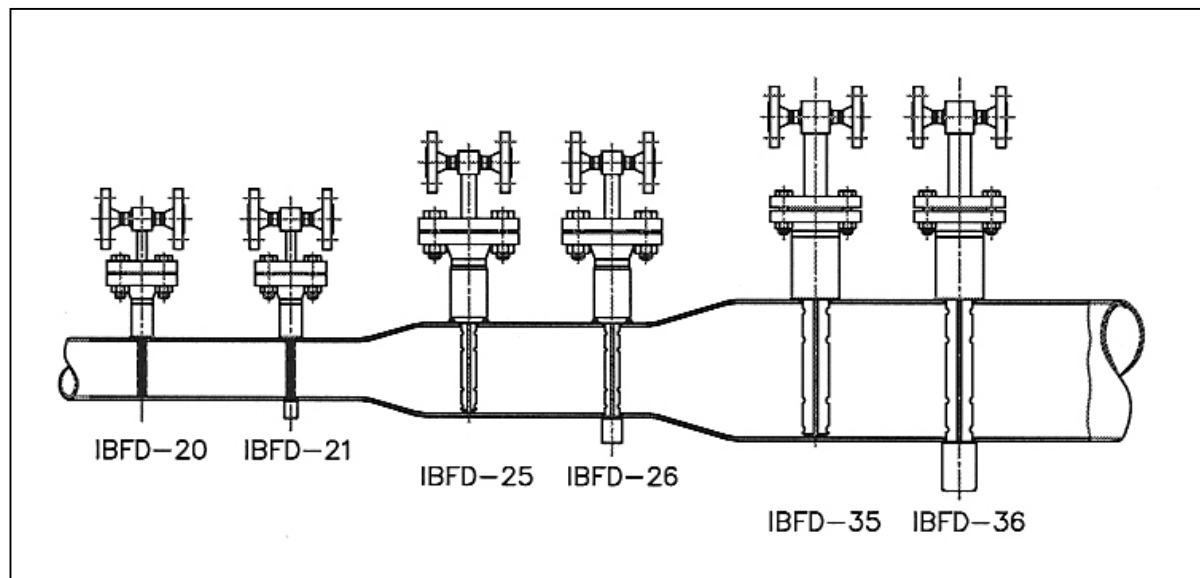


Fig. 8.3: ITABAR IBFD w/flanged condensate pots to measure superheated steam



Order Data for ITABAR Series IBFD

1. Sensor Type



Pipe ID inches mm		Maxium Flow Volume GPM ^(water see below)					
		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	---	---	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	316Ti (1.4571) <i>-standard-</i>			
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		DN25	1"
3	PN63 / 300 lbs		DN25	1"
4	PN100 / 600 lbs		DN25	1"
5	PN160		DN25	1"
6	PN250 / 1500 lbs		DN25	1"
7	PN320		DN25	1"
8	PN400 / 2500 lbs		DN25	1"
7. design assembly connecting pieces				
0	without			
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.				
0	without			
C1	C.S.	PN16 / 150 lbs	DN25	1"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN25	1"
P1	A 335 Grade P1 (1.5415, 16 Mo 3)	PN16 / 150 lbs	DN25	1"
R1	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN16 / 150 lbs	DN25	1"
V1	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN16 / 150 lbs	DN25	1"
Q1	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN16 / 150 lbs	DN25	1"
C2	C.S.	PN40	DN25	1"
S2	316Ti (1.4571)	PN40	DN25	1"
P2	A 335 Grade P1 (1.5415, 16 Mo 3)	PN40	DN25	1"
R2	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN40	DN25	1"
V2	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN40	DN25	1"
Q2	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN40	DN25	1"
C3	C.S.	PN63 / 300 lbs	DN25	1"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN25	1"
P3	A 335 Grade P1 (1.5415, 16 Mo 3)	PN63 / 300 lbs	DN25	1"
R3	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN63 / 300 lbs	DN25	1"
V3	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN63 / 300 lbs	DN25	1"
Q3	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN63 / 300 lbs	DN25	1"
C4	C.S.	PN100 / 600 lbs	DN25	1"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN25	1"
P4	A 335 Grade P1 (1.5415, 16 Mo 3)	PN100 / 600 lbs	DN25	1"
R4	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN100 / 600 lbs	DN25	1"
V4	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN100 / 600 lbs	DN25	1"
Q4	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN100 / 600 lbs	DN25	1"

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

[illegible]

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	316Ti (1.4571) -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		DN32	1 1/2"
3	PN63 / 300 lbs		DN40	1 1/2"
4	PN100 / 600 lbs		DN40	1 1/2"
5	PN160		DN40	1 1/2"
6	PN250 / 1500 lbs		DN40	1 1/2"
7	PN320		DN40	1 1/2"
8	PN400 / 2500 lbs		DN40	1 1/2"
7. design assembly connecting pieces				
0	without			
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			
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.				
0	without			
C1	C.S.	PN16 / 150 lbs	DN32	1 1/2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN32	1 1/2"
P1	A 335 Grade P1 (1.5415, 16 Mo 3)	PN16 / 150 lbs	DN32	1 1/2"
R1	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN16 / 150 lbs	DN32	1 1/2"
V1	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN16 / 150 lbs	DN32	1 1/2"
Q1	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN16 / 150 lbs	DN32	1 1/2"
C2	C.S.	PN40	DN32	1 1/2"
S2	316Ti (1.4571)	PN40	DN32	1 1/2"
P2	A 335 Grade P1 (1.5415, 16 Mo 3)	PN40	DN32	1 1/2"
R2	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN40	DN32	1 1/2"
V2	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN40	DN32	1 1/2"
Q2	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN40	DN32	1 1/2"
C3	C.S.	PN63 / 300 lbs	DN40	1 1/2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN40	1 1/2"
P3	A 335 Grade P1 (1.5415, 16 Mo 3)	PN63 / 300 lbs	DN40	1 1/2"
R3	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN63 / 300 lbs	DN40	1 1/2"
V3	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN63 / 300 lbs	DN40	1 1/2"
Q3	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN63 / 300 lbs	DN40	1 1/2"
C4	C.S.	PN100 / 600 lbs	DN40	1 1/2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN40	1 1/2"
P4	A 335 Grade P1 (1.5415, 16 Mo 3)	PN100 / 600 lbs	DN40	1 1/2"
R4	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN100 / 600 lbs	DN40	1 1/2"
V4	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN100 / 600 lbs	DN40	1 1/2"
Q4	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN100 / 600 lbs	DN40	1 1/2"
C5	C.S.	PN160	DN40	1 1/2"
S5	316Ti (1.4571)	PN160	DN40	1 1/2"
P5	A 335 Grade P1 (1.5415, 16 Mo 3)	PN160	DN40	1 1/2"
R5	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN160	DN40	1 1/2"
V5	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN160	DN40	1 1/2"
Q5	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN160	DN40	1 1/2"

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

[illegible]

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	316Ti (1.4571)	-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	DN50	2"
3	PN63 / 300 lbs	DN50	2"
4	PN100 / 600 lbs	DN50	2"
5	PN160	DN50	2"
6	PN250 / 1500 lbs	DN50	2"
7	PN320	DN50	2"
8	PN400 / 2500 lbs	DN50	2"
7. design assembly connecting pieces			
0	without		
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		
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
allways identically to sensor flange.			
0	without		
C1	C.S.	PN16 / 150 lbs	DN50 2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN50 2"
P1	A 335 Grade P1 (1.5415, 16 Mo 3)	PN16 / 150 lbs	DN50 2"
R1	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN16 / 150 lbs	DN50 2"
V1	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN16 / 150 lbs	DN50 2"
Q1	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN16 / 150 lbs	DN50 2"
C2	C.S.	PN40	DN50 2"
S2	316Ti (1.4571)	PN40	DN50 2"
P2	A 335 Grade P1 (1.5415, 16 Mo 3)	PN40	DN50 2"
R2	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN40	DN50 2"
V2	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN40	DN50 2"
Q2	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN40	DN50 2"
C3	C.S.	PN63 / 300 lbs	DN50 2"
S3	316Ti (1.4571)	PN63 / 300 lbs	DN50 2"
P3	A 335 Grade P1 (1.5415, 16 Mo 3)	PN63 / 300 lbs	DN50 2"
R3	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN63 / 300 lbs	DN50 2"
V3	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN63 / 300 lbs	DN50 2"
Q3	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN63 / 300 lbs	DN50 2"
C4	C.S.	PN100 / 600 lbs	DN50 2"
S4	316Ti (1.4571)	PN100 / 600 lbs	DN50 2"
P4	A 335 Grade P1 (1.5415, 16 Mo 3)	PN100 / 600 lbs	DN50 2"
R4	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN100 / 600 lbs	DN50 2"
V4	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN100 / 600 lbs	DN50 2"
Q4	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN100 / 600 lbs	DN50 2"

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 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							continued				
																				9. material connecting piece, with flange (max. press. rat.)		DN	ANSI	
																				always identically to sensor flange.				
																				C5	C.S.	PN160	DN50	2"
																				S5	316Ti (1.4571)	PN160	DN50	2"
																				P5	A 335 Grade P1 (1.5415, 16 Mo 3)	PN160	DN50	2"
																				R5	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN160	DN50	2"
																				V5	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN160	DN50	2"
																				Q5	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN160	DN50	2"
																				C6	C.S.	PN250 / 1500 lbs	DN50	2"
																				S6	316Ti (1.4571)	PN250 / 1500 lbs	DN50	2"
																				P6	A 335 Grade P1 (1.5415, 16 Mo 3)	PN250 / 1500 lbs	DN50	2"
																				R6	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN250 / 1500 lbs	DN50	2"
																				V6	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN250 / 1500 lbs	DN50	2"
																				Q6	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN250 / 1500 lbs	DN50	2"
																				C7	C.S.	PN320	DN50	2"
																				S7	316Ti (1.4571)	PN320	DN50	2"
																				P7	A 335 Grade P1 (1.5415, 16 Mo 3)	PN320	DN50	2"
																				R7	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN320	DN50	2"
																				V7	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN320	DN50	2"
																				Q7	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN320	DN50	2"
																				C8	C.S.	PN400 / 2500 lbs	DN50	2"
																				S8	316Ti (1.4571)	PN400 / 2500 lbs	DN50	2"
																				P8	A 335 Grade P1 (1.5415, 16 Mo 3)	PN400 / 2500 lbs	DN50	2"
																				R8	A 335 Grade P11 (1.7335, 13CrMo 4 4)	PN400 / 2500 lbs	DN50	2"
																				V8	A 335 Grade P22 (1.7380, 10CrMo 9 10)	PN400 / 2500 lbs	DN50	2"
																				Q8	A 335 Grade P91 (1.4903, X10 CrMoVNb 91)	PN400 / 2500 lbs	DN50	2"
																				10. end support (only IBFD-36)				
																				0	without support			
																				C	end support, material: C.S.			
																				S	end support, material: 316Ti (1.4571)			
P	end support, material: A 335 Grade P1 (1.5415, 16 Mo 3)																							
R	end support, material: A 335 Grade P11 (1.7335; 13CrMo 4 4)																							
V	end support, material: A 335 Grade P22 (1.7380; 10CrMo 9 10)																							
Q	end support, material: A 335 Grade P91 (1.4903; X10CrMoVNb 91)																							
11. condeseate vessel with connection																								
12. thermal isolation																								
KI	without																							
X..	thermal isolation in inches or mm, please specify, each 10mm																							
13. piping run																								
HL	horizontal																							
VL	vertical																							
14. integrated RTD resit. thermocouple																								
TO	without																							
TA	3-wire																							
TB	2-wire, with ex-approval																							
15. transm. for thermocouple																								
16. process connection, (only for A1)																								
17. Instrum. Valves																								

Order specification condensate vessel (up to PN100)		
IBFD 20, 21, 25, 26, 35, 36		
flanged joint at sensor head (1 pair)		
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 for condensat vessel	
	H	A 285 (P 265 GH) "heavy boiler plate HII" size: Ø 88,9 x 5 mm
	S	316Ti (1.4571) size: Ø 88,9 x 3,2 mm
	P	A 335 Grade P1 (1.5415, 16 Mo 3) size: 90 x 17,5 mm
	V	A 335 Grade P11 (1.7335, 13CrMo 4 4) size: 90 x 17,5 mm

Order specification instrument connection and shut-off valve		(up to PN100)
IBFD- 20, 21, 25, 26, 35, 36		
shut-off device for effect pressure pipe, standard with weld together condensate vessel (1 pair)		
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 (1.4404) case: 316L, packing: graphite-fibre glas	
only with K1		
A13	shut-off valve; PN400; mat. A335 Gr. P1 (1.5415 / 16 Mo 3); connection: welding stud Ø21.3x3.2mm; packing: graphite	
A14	shut-off valve; PN400; mat. A335 Gr. P11 (1.7335 / 13CrMo44); connection: welding stud Ø21.3x3.2mm; packing: graphite	
direct weldet 5-way manifold (only with K1)		
A72	5-way-manifold, PN400, 316Ti (1.4571) / packing: graphite	

Order specification condensate vessel (only compact construction)		
IBFD 20, 21, 25, 26, 35, 36 (up to PN100)		
flanged joint of sensor head (1 pair)		
A1	condensate vessel with sensor head, effect pressure pipe and mounting flange welds directly	
	material and size condensate vessel	
	H	A 285 (P 265 GH) "heavy boiler plate HII" size: Ø 88,9 x 5 mm
	S	316Ti (1.4571) size: Ø 88,9 x 3,2 mm
	P	A 335 Grade P1 (1.5415/ 16 Mo 3) size: 90 x 17,5 mm
	V	A 355 Grade P11 (1.7335/ 13 Cr Mo 4 4) size: 90 x 17,5 mm

Order specification connection, only with A1 (up to PN100)		
type IBFD- 20, 21, 25, 26, 35, 36		
connection		
A06	flange plate for 3-way-manifold	material: 316Ti (1.4571)
A15	flange plate for 5-way-manifold	material: 316Ti (1.4571)

Order specification for shut-off valve, only with A1 (up to PN100)		
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-manifold, PN400, A182-F316H (1.4401) / packing: graphit	
A71	5-way-manifold, PN400, A182-F316H (1.4401) / packing: graphite	

Order specification connection and shut-off device**(up to PN400)****IBFD 20, 21, 25, 26, 35, 36****high-pressure shut-off valve acc. VdTÜV**

material case

shut-off device for effect pressure pipe (1 pair)		short name	DIN / ANSI material no.	dimension welding connection	packing
A16	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 No.45	16 Mo 3	1.5415 A335 Gr. P1	21,3 x 3,2 mm	graphite
A17	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 No.45	13 CrMo 4 4	1.7335 A335 Gr. P11	21,3 x 3,2 mm	graphite
A18	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 No.45	10 CrMo 9 10	1.7380 A335 Gr. P22	21,3 x 3,2 mm	graphite
A19	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	16 Mo 3	1.5415 A335 Gr. P1	21,3 x 3,2 mm	graphite
A20	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	13 CrMo 4 4	1.7335 A335 Gr. P11	21,3 x 3,2 mm	graphite
A21	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	10 CrMo 9 10	1.7380 A335 Gr. P22	21,3 x 3,2 mm	graphite
A22	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	X10CrMoVNb91	1.4903 A335 Gr. P91	21,3 x 3,2 mm	graphite



If double stop valves are required please to code, for example: A16-A16

Combination condensate vessel and shut-off valve**(up to PN400)****IBFD 20, 21, 25, 26, 35, 36**

shut-off device for effect pressure pipe (1 pair)		short name	DIN / ANSI material no.	packing
KV02	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	16 Mo 3	1.5415 A335 Gr. P1	graphite
KV03	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	13 CrMo 4 4	1.7335 A335 Gr. P11	graphite
KV04	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	10 CrMo 9 10	1.7380 A335 Gr. P22	graphite



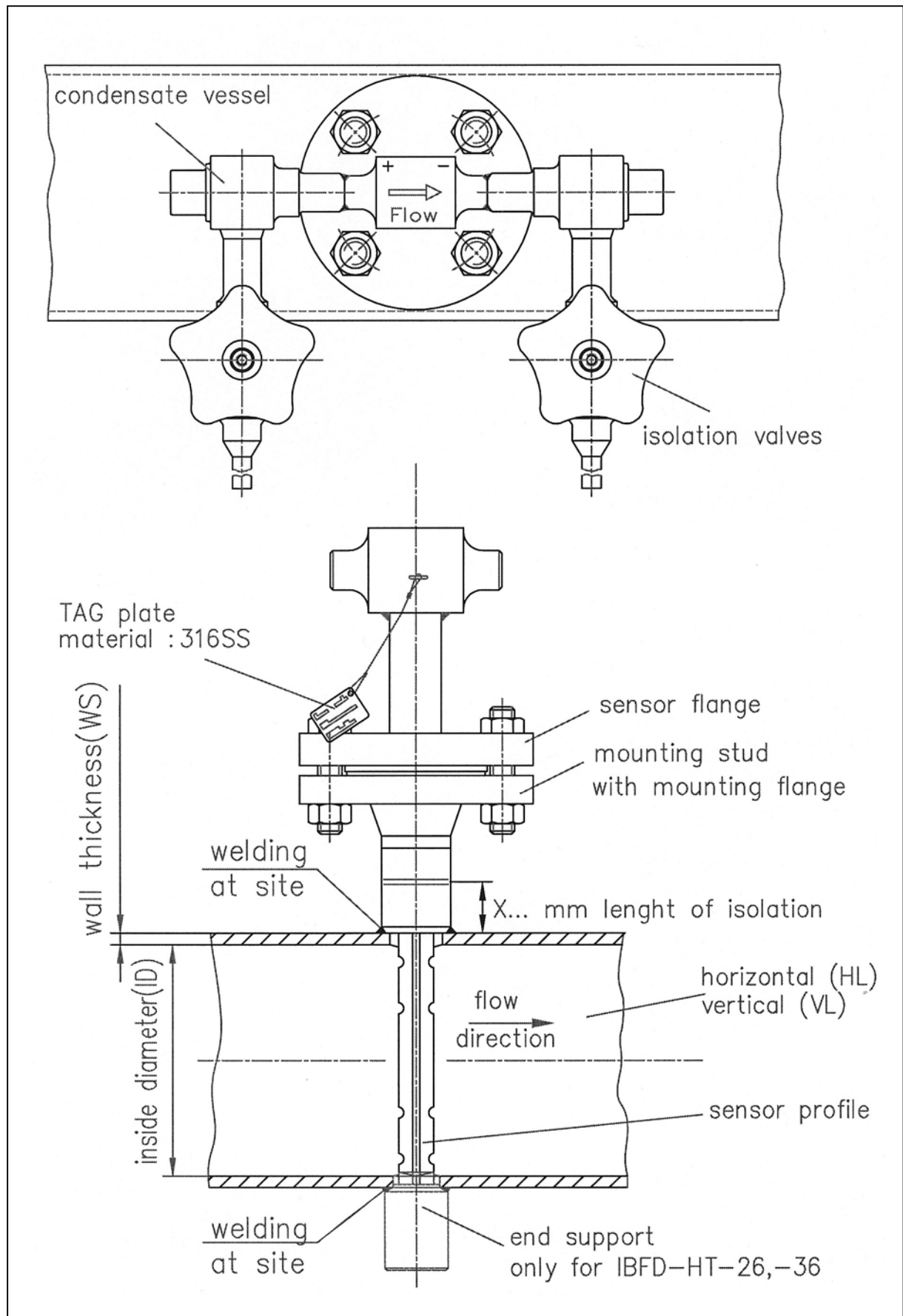
11.0 Series IBFD-HT for Superheated Steam to 400 bar (5802 psi) and 650°C (1202°F)

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.

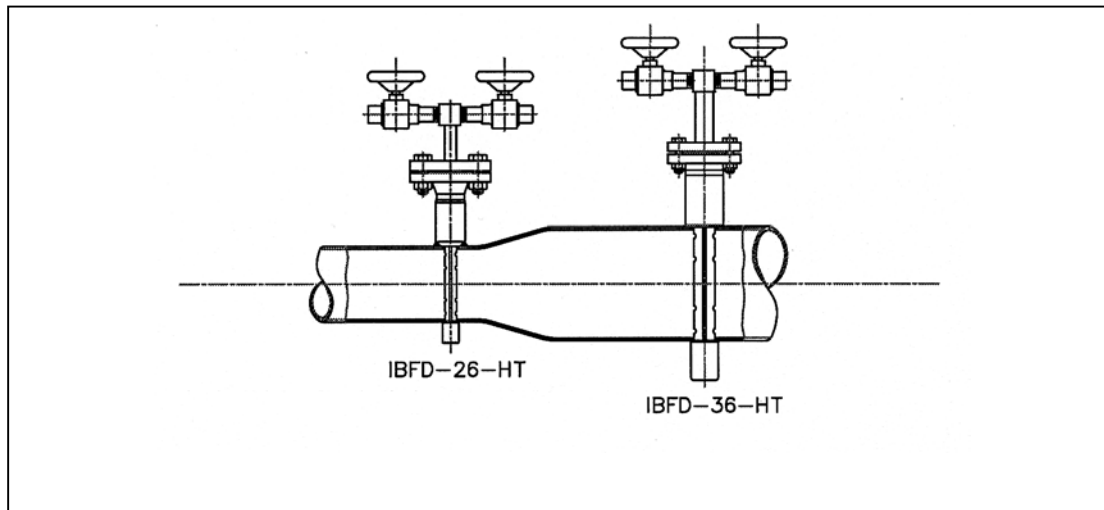
Materials	Max. Steam Temperature
1.5415 (16 Mo 3)	530 °C / 986 °F
1.7335 (10 CrMo 4 4)	570 °C / 1058 °F
1.7380 (10 CrMo 9 10)	600 °C / 1112 °F
1.4903 (10 CrMoVNB 91)	650 °C / 1202 °F





Order Data for ITABAR Series IBFD-HT

1. Sensor Type



Pipe ID Inches	Maximal allowable Volume Flow 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. 5802 PSI (400 bar), T-max. 1202 °F (650°C)

Order Example for ITABAR Flow Sensor, HT-Version

Existing Process Data

Pipe size	12"
Medium	Steam
Pressure	3770 PSI (260 bar)
Temperature	1184°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 Dimensions: 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 (16 Mo 3)	(A182 -A335 GP1)	530°C		
V	1.7335 (13 CrMo 4 4)	(A182 F12 -A335 GP12)	570°C		
R	1.7380 (10 CrMo 9 10)	(A182 F22 -A335 GP22)	600°C		
C	1.4903 (X 10 CrMoVNb 91)	(A182 F91 -A335 GP91)	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 E				
2	flanges acc. ANSI, Dichtleiste RF				
3	flanges acc. ANSI, gasket strip SF (smooth finish)				
4	flanges acc. ANSI, gasket strip RTJ				
6. PN, material and DN of Sensor flange				DIN	ANSI
A1	PN16 / 150 lbs	material: 1.5415 (16 Mo 3)	DN32	1 1/2"	
A2	PN40	material: 1.5415 (16 Mo 3)	DN32	1 1/2"	
A3	PN63 / 300 lbs	material: 1.5415 (16 Mo 3)	DN40	1 1/2"	
A4	PN100 / 600 lbs	material: 1.5415 (16 Mo 3)	DN40	1 1/2"	
A5	PN160	material: 1.5415 (16 Mo 3)	DN40	1 1/2"	
A6	PN250 / 1500 lbs	material: 1.5415 (16 Mo 3)	DN40	1 1/2"	
A7	PN320	material: 1.5415 (16 Mo 3)	DN40	1 1/2"	
A8	PN400 / 2500 lbs	material: 1.5415 (16 Mo 3)	DN40	1 1/2"	
B1	PN16 / 150 lbs	material: 1.7335 (13 CrMo 4 4)	DN32	1 1/2"	
B2	PN40	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	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	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	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	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	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 (X 10 CrMoVNb 91)	DN32	1 1/2"	
D2	PN40	material: 1.4903 (X 10 CrMoVNb 91)	DN32	1 1/2"	
D3	PN63 / 300 lbs	material: 1.4903 (X 10 CrMoVNb 91)	DN40	1 1/2"	
D4	PN100 / 600 lbs	material: 1.4903 (X 10 CrMoVNb 91)	DN40	1 1/2"	
D5	PN160	material: 1.4903 (X 10 CrMoVNb 91)	DN40	1 1/2"	
D6	PN250 / 1500 lbs	material: 1.4903 (X 10 CrMoVNb 91)	DN40	1 1/2"	
D7	PN320	material: 1.4903 (X 10 CrMoVNb 91)	DN40	1 1/2"	
D8	PN400 / 2500 lbs	material: 1.4903 (X 10 CrMoVNb 91)	DN40	1 1/2"	
7. design assembly connecting pieces					
0	without				
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
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

0	without			
S15	1.5415 (16 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 (X 10 CrMoVNb 91)	PN16 / 150 lbs	DN32	1 1/2"
	(not weld together with material 1.7335)			
S16	1.5415 (16 Mo 3)	PN40	DN32	1 1/2"
S45	1.7335 (13 CrMo 4 4)	PN40	DN32	1 1/2"
S92	1.7380 (10 CrMo 9 10)	PN40	DN32	1 1/2"
S31	1.4903 (X 10 CrMoVNb 91)	PN40	DN32	1 1/2"
	(not weld together with material 1.7335)			
S17	1.5415 (16 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 (X 10 CrMoVNb 91)	PN63 / 300 lbs	DN40	1 1/2"
	(not weld together with material 1.7335)			
S18	1.5415 (16 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 (X 10 CrMoVNb 91)	PN100 / 600 lbs	DN40	1 1/2"
	(not weld together with material 1.7335)			
S19	1.5415 (16 Mo 3)	PN160	DN40	1 1/2"
S48	1.7335 (13 CrMo 4 4)	PN160	DN40	1 1/2"
S95	1.7380 (10 CrMo 9 10)	PN160	DN40	1 1/2"
S34	1.4903 (X 10 CrMoVNb 91)	PN160	DN40	1 1/2"
	(not weld together with material 1.7335)			
S20	1.5415 (16 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 (X 10 CrMoVNb 91)	PN250 / 1500 lbs	DN40	1 1/2"
	(not weld together with material 1.7335)			
S21	1.5415 (16 Mo 3)	PN320	DN40	1 1/2"
S50	1.7335 (13 CrMo 4 4)	PN320	DN40	1 1/2"
S97	1.7380 (10 CrMo 9 10)	PN320	DN40	1 1/2"
S36	1.4903 (X 10 CrMoVNb 91)	PN320	DN40	1 1/2"
	(not weld together with material 1.7335)			
S22	1.5415 (16 Mo 3)	PN400 / 2500 lbs	DN40	1 1/2"
S51	1.7335 (13 CrMo 4 4)	PN400 / 2500 lbs	DN40	1 1/2"
S98	1.7380 (10 CrMo 9 10)	PN400 / 2500 lbs	DN40	1 1/2"
S37	1.4903 (X 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	end support; material: 1.5415 (16 Mo 3)
V	end support; material: 1.7335 (13 CrMo 4 4)
R	end support; material: 1.7380 (10 CrMo 9 10)
C	end support; material: 1.4903 (X 10 CrMoVNb 91)

11. condensate vessel with connection

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

<div>type of sensor</div> <div>inside diameter and wall thickness</div> <div>sensor material</div> <div>sensor flange</div> <div>gasket</div> <div>PN, material and DN of Sensor flange</div> <div>design assembly connecting pieces</div> <div>assembly connecting piece with flange</div> <div>material connecting piece, with flange</div> <div>end support</div> <div>condesate vessel with connection</div> <div>process connection</div>	12. process connection & instr. Valves									
	13. thermal isolation									
	KI	without								
	X..	thermal isolation, each 10 mm, 1.5415								
		thermal isolation, each 10 mm, 1.7335								
		thermal isolation , each 10 mm, 1.7380								
		thermal isolation, each 10 mm, 1.4903								
	14. piping run									
	HL	horizontal								
	VL	vertical								

IBFD-	26-HT	/													
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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 (16 Mo 3)	(A182 -A335 GP1)	530°C
V	1.7335 (13 CrMo 4 4)	(A182 F12 -A335 GP12)	570°C
R	1.7380 (10 CrMo 9 10)	(A182 F22 -A335 GP22)	600°C
C	1.4903 (X 10 CrMoVNb 91)	(A182 F91 -A335 GP91)	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, gasket strip RF
- 3 flanges acc. ANSI, gasket strip SF (smooth finish)
- 4 flanges acc. ANSI, gasket strip RTJ

6.PN, material and DN of Sensor flange

			DIN	ANSI
A1	PN16 / 150 lbs	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A2	PN40	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A3	PN63 / 300 lbs	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A4	PN100 / 600 lbs	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A5	PN160	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A6	PN250 / 1500 lbs	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A7	PN320	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"
A8	PN400 / 2500 lbs	material: A335 GP1 (1.5415 / 16 Mo 3)	DN50	2"

B1	PN16 / 150 lbs	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B2	PN40	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B3	PN63 / 300 lbs	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B4	PN100 / 600 lbs	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B5	PN160	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B6	PN250 / 1500 lbs	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B7	PN320	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"
B8	PN400 / 2500 lbs	material: A335 GP11 (1.7335/13 CrMo 4 4)	DN50	2"

C1	PN16 / 150 lbs	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C2	PN40	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C3	PN63 / 300 lbs	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C4	PN100 / 600 lbs	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C5	PN160	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C6	PN250 / 1500 lbs	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C7	PN320	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"
C8	PN400 / 2500 lbs	material: A335 GP22 (1.7380/10 CrMo 9 10)	DN50	2"

D1	PN16 / 150 lbs	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D2	PN40	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D3	PN63 / 300 lbs	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D4	PN100 / 600 lbs	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D5	PN160	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D6	PN250 / 1500 lbs	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D7	PN320	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"
D8	PN400 / 2500 lbs	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)	DN50	2"

7. design assembly connecting pieces

- 0 without
- 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			
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
0	without			
S15	A335 GP1 (1.5415/16 Mo 3)	PN16 / 150 lbs	DN50	2"
S44	A335 GP11 (1.7335/13 CrMo 4 4)	PN16 / 150 lbs	DN50	2"
S91	A335 GP22 (1.7380/10 CrMo 9 10)	PN16 / 150 lbs	DN50	2"
S30	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN16 / 150 lbs	DN50	2"
S16	A335 GP1 (1.5415/16 Mo 3)	PN40	DN50	2"
S45	A335 GP11 (1.7335/13 CrMo 4 4)	PN40	DN50	2"
S92	A335 GP22 (1.7380/10 CrMo 9 10)	PN40	DN50	2"
S31	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN40	DN50	2"
S17	A335 GP1 (1.5415/16 Mo 3)	PN63 / 300 lbs	DN50	2"
S46	A335 GP11 (1.7335/13 CrMo 4 4)	PN63 / 300 lbs	DN50	2"
S93	A335 GP22 (1.7380/10 CrMo 9 10)	PN63 / 300 lbs	DN50	2"
S32	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN63 / 300 lbs	DN50	2"
S18	A335 GP1 (1.5415/16 Mo 3)	PN100 / 600 lbs	DN50	2"
S47	A335 GP11 (1.7335/13 CrMo 4 4)	PN100 / 600 lbs	DN50	2"
S94	A335 GP22 (1.7380/10 CrMo 9 10)	PN100 / 600 lbs	DN50	2"
S33	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN100 / 600 lbs	DN50	2"
S19	A335 GP1 (1.5415/16 Mo 3)	PN160	DN50	2"
S48	A335 GP11 (1.7335/13 CrMo 4 4)	PN160	DN50	2"
S95	A335 GP22 (1.7380/10 CrMo 9 10)	PN160	DN50	2"
S34	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN160	DN50	2"
S20	A335 GP1 (1.5415/16 Mo 3)	PN250 / 1500 lbs	DN50	2"
S49	A335 GP11 (1.7335/13 CrMo 4 4)	PN250 / 1500 lbs	DN50	2"
S96	A335 GP22 (1.7380/10 CrMo 9 10)	PN250 / 1500 lbs	DN50	2"
S35	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN250 / 1500 lbs	DN50	2"
S21	A335 GP1 (1.5415/16 Mo 3)	PN320	DN50	2"
S50	A335 GP11 (1.7335/13 CrMo 4 4)	PN320	DN50	2"
S97	A335 GP22 (1.7380/10 CrMo 9 10)	PN320	DN50	2"
S36	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN320	DN50	2"
S22	A335 GP1 (1.5415/16 Mo 3)	PN400 / 2500 lbs	DN50	2"
S51	A335 GP11 (1.7335/13 CrMo 4 4)	PN400 / 2500 lbs	DN50	2"
S97	A335 GP22 (1.7380/10 CrMo 9 10)	PN400 / 2500 lbs	DN50	2"
S37	A335 GP91 (1.4903/X 10 CrMoVNb 91) (not weld together with material 1.7335)	PN400 / 2500 lbs	DN50	2"
10. end support				
0	without end support (if build-laterally available.)			
P	material: A335 GP1 (1.5415/16 Mo 3)			
V	material: A335 GP11 (1.7335/13 CrMo 4 4)			
R	material: A335 GP22 (1.7380/10 CrMo 9 10)			
C	material: A335 GP91 (1.4903/X 10 CrMoVNb 91)			
11. condensate vessel with connection				

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

[illegible]

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

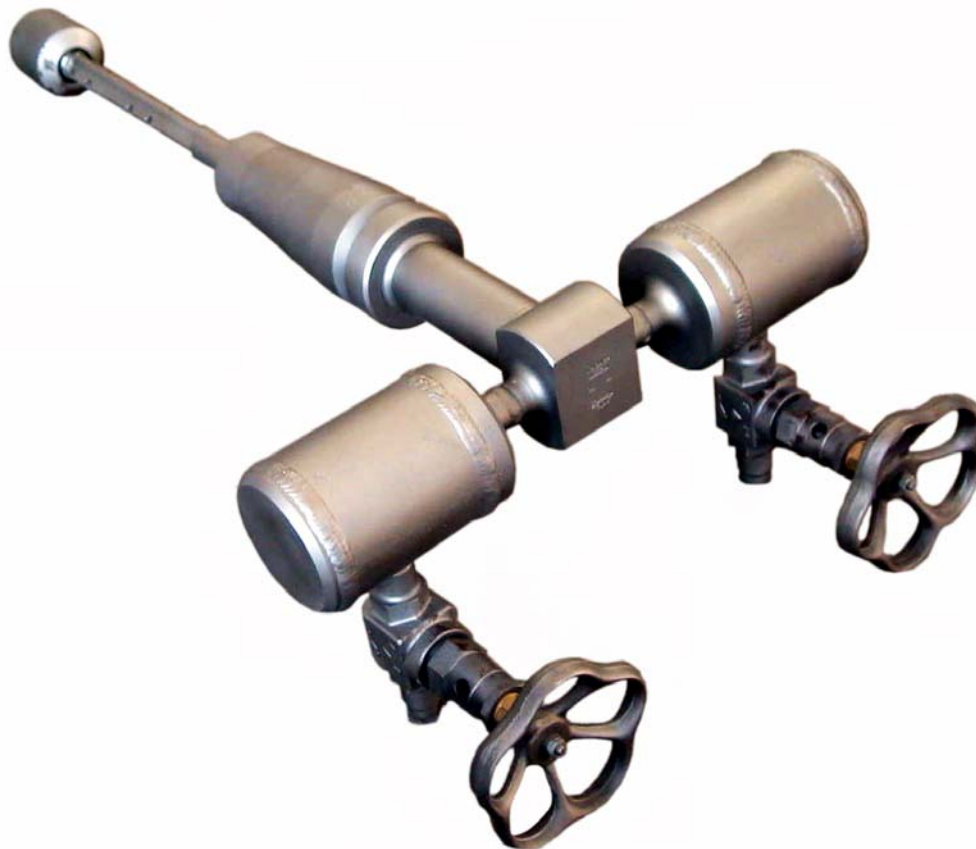
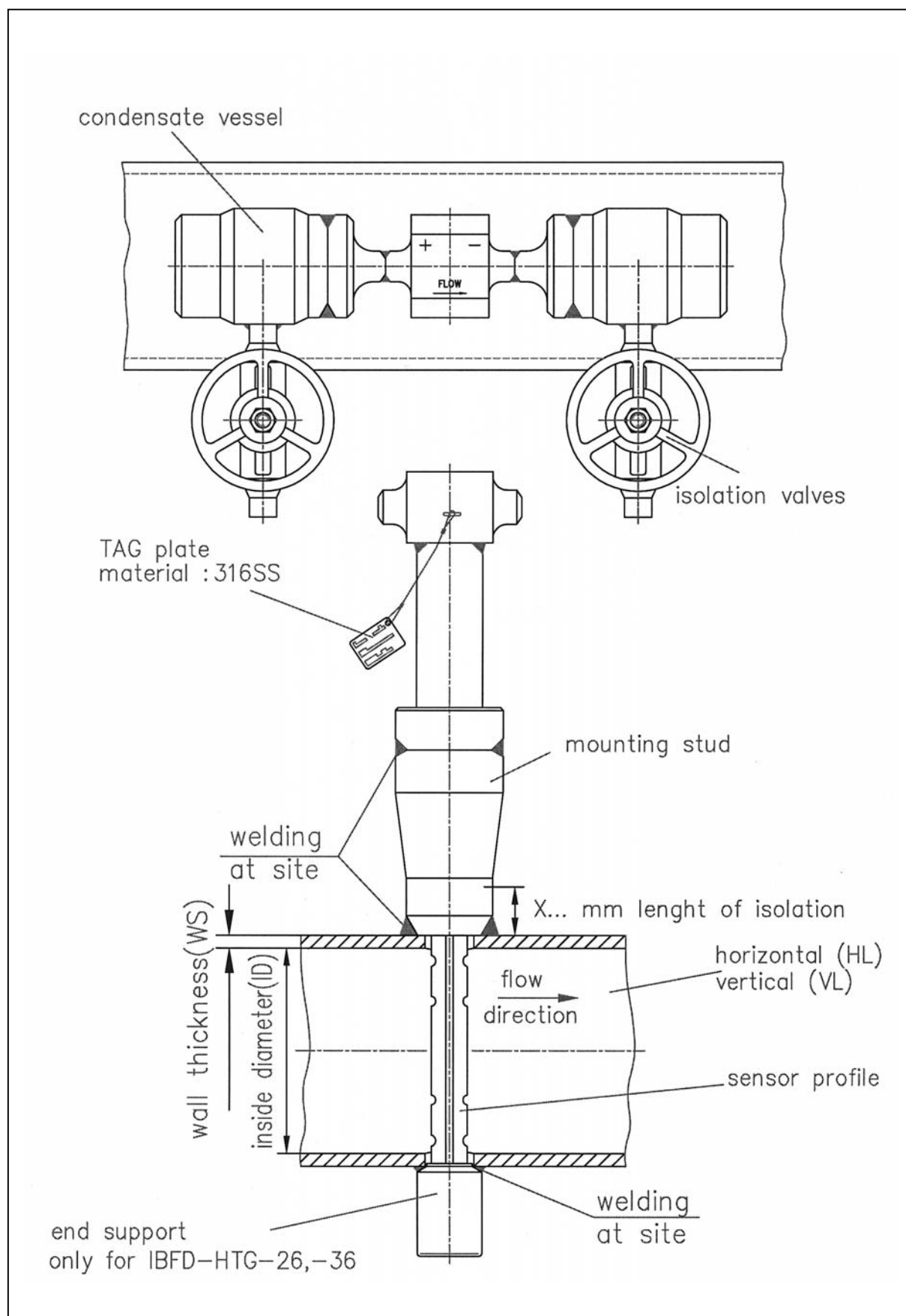
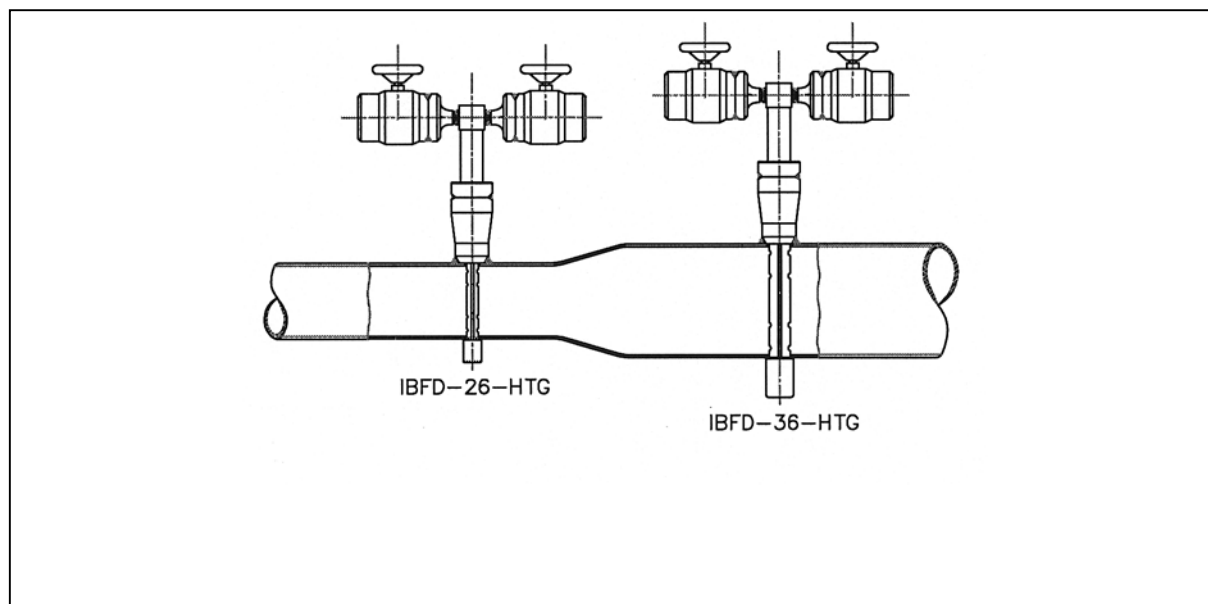


Fig. 8.5: ITABAR IBFD-HTG for superheated steam



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 $T = 68\text{ }^{\circ}\text{F}$. 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. temp.
P	1.5415 (16 Mo 3)	(A182	-A335	GP1)					530°C
V	1.7335 (13 CrMo 4 4)	(A182	F12	-A335	GP12)				570°C
R	1.7380 (10 CrMo 9 10)	(A182	F22	-A335	GP22)				600°C
C	1.4903 (10 CrMoVNb 91)	(A182	F91	-A335	GP91)				650°C
4. condensate vessel with connection									
5. thermal isolation									
KI	without								
X..	thermal isolation, each 10 mm, 1.5415 (A182 -A335 GP1)								
	thermal isolation, each 10 mm, 1.7335 (A182 F12 -A335 GP12)								
	thermal isolation , each 10 mm, 1.7380 (A182 F22 -A335 GP22)								
	thermal isolation, each 10 mm, 1.4903 (A182 F91 -A335 GP91)								
6. piping run									
HL	horizontal								
VL	vertical								
7. process connection									
IBFD-	26-HTG		/						

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									
P	1.5415 (16 Mo 3)	(A182	-A335 GP1)	max. op. temp.					
V	1.7335 (13 CrMo 4 4)	(A182 F12	-A335 GP12)	530°C					
R	1.7380 (10 CrMo 9 10)	(A182 F22	-A335 GP22)	570°C					
C	1.4903 (10 CrMoVNb 91)	(A182 F91	-A335 GP91)	600°C					
4. condeseate vessel with connection									
5. thermal isolation									
KI	without								
X..	thermal isolation, each 10 mm, 1.5415 (A182 -A335 GP1)								
	thermal isolation, each 10 mm, 1.7335 (A182 F12 -A335 GP12)								
	thermal isolation, each 10 mm, 1.7380 (A182 F22 -A335 GP22)								
	thermal isolation, each 10 mm, 1.4903 (A182 F91 -A335 GP91)								
6. piping run									
HL	horizontal								
VL	vertical								
7. process connection									

IBFD-	36-HTG	/							
-------	--------	---	--	--	--	--	--	--	--

Pressure Rating Assembly Flange

		° F ° C	Operating temperature															
			572 300	662 350	752 400	842 450	932 500	950 510	968 520	986 530	1004 540	1022 550	1040 560	1058 570	1076 580	1112 600	1148 620	1202 650
Code	Material	Pressure rating	Max Operating Pressure (PSIG) Max Operating Pressure (bar)															
C1	C22.8	PN16 / 150 lbs	138 9.5	87 6	87 6	72.5 5												
S1	1.4571		167 11.5	159.5 11	159.5 11	145 10												
P1	1.5415		159.5 11	145 10	138 9.5	130.5 9	116 8											
R1	1.7335		174 12	159.5 11	145 10	138 9.5	138 9.5	116 8	101.5 7	87 6	72.5 5	58 4						
C2	C22.8	PN40 / 300 lbs	348 24	145 10														
S2	1.4571		406 28	377 26	362.5 25	348 24												
P2	1.5415		391.5 27	362.5 25	333.5 23	319 22	304.5 21											
R2	1.7335		435 30	391.5 27	377 26	348 24	348 24	290 20	246.5 17	217.5 15	188.5 13	145 10						
C3	C22.8	PN63 / 300 lbs	345 24	145 10														
S3	1.4571		406 28	377 26	362.5 25	348 24												
P3	1.5415		391.5 27	362.5 25	333.5 23	319 22	304.5 21											
R3	1.7335		435 30	391.5 27	377 26	348 24	348 24	290 20	246.5 17	217.5 15	188.5 13	145 10						
S3	1.7380		493 34	449.5 31	435 30	406 28	406 28	348 24	319 22	275.5 19	261 18	217.5 15	174 12					
V3	1.4903		551 38	507.5 35	493 34	493 34	478.5 33	420.5 29	391.5 27	348 24	333.5 23	275.5 19	246.5 17					
C4	C22.8	PN100/ 600 lbs	870 60	798 55														
S4	1.4571		1001 69	957 66	928 64	870 60												
P4	1.5415		957 66	914 63	856 59	827 57	798 55											
R4	1.7335		1059 73	986 68	928 64	885 61	856 59	725 50	638 44	537 37	450 31	377 26						
S4	1.7380		1117 77	1044 72	986 68	942 65	928 64	798 55	711 49	594.5 41	508 35	435 30	406 28					
V4	1.4903		1175 81	1088 75	1044 72	1001 69	986 68	856 59	783 54	667 46	566 39	508 35	479 33					
C5	C22.8	PN160/ 1500 lbs	1392 96	1305 90														
S5	1.4571		1595 110	1523 105	1378 94	1363 95												
P5	1.5415		1537 106	1450 100	1363 94	1320 91	1276 88											
R5	1.7335		1682 116	1566 108	1494 103	1407 97	1363 94	1160 80	1015 70	870 60	725 50	595 41						
S5	1.7380		1769 122	1653 114	1581 109	1508 104	1465 101	1247 86	1102 76	957 66	812 56	682 47	653 45					
V5	1.4903		1847 126	1740 120	1668 115	1595 110	1552 107	1465 101	1175 81	1044 72	899 62	769 53	740 51					
C6	C22.8	PN250/ 1500 lbs	2785 192	2031 140														
S6	1.4571		3060 211	2393 165	2321 160	2176 150												
P6	1.5415		3089 213	2277 157	2147 148	2074 143	2002 138											
R6	1.7335		3379 233	2466 170	2335 161	2205 152	2147 148	1740 120	1392 96	1247 86	1088 75	928 64						

Pressure Rating Assembly Flange

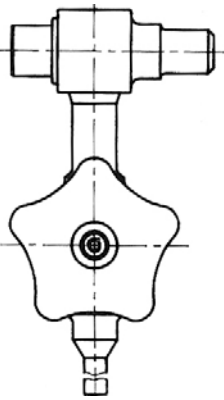
			Operating temperature															
		°F °C	572 300	662 350	752 400	842 450	932 500	950 510	968 520	986 530	1004 540	1022 550	1040 560	1058 570	1076 580	1112 600	1148 620	1202 650
Code	Material	Pressure rating	Max Operating Pressure (PSIG) Max Operating Pressure (bar)															
S6	1.7380	PN250 / 1500	3423 236	2582 178	2466 170	2350 162	2219 153	1755 121	1421 98	1291 89	1131 78	986 68	856 59	769 53				
V6	1.4903	lbs	3510 242	2669 184	2553 176	2437 168	2306 159	1856 128	1537 106	1407 97	1233 85	1073 74	943 65	856 59				
C7	C22.8	PN320 / 2500 lbs	2785 192	2611 180														
S7	1.4571		3060 211	3046 210	2901 200	2640 182												
P7	1.5415		3089 213	2915 201	2741 189	2654 183	2567 177											
R7	1.7335		3379 233	3147 217	2988 206	2828 195	2756 190	2147 148	1740 120	1537 106	1378 95	1189 82						
S7	1.7380		3539 244	3307 228	3162 218	3017 208	2843 196	2234 154	1827 126	1653 114	1450 100	1276 88	1102 76	986 68				
V7	1.4903		3640 251	3394 234	3249 224	3104 214	2930 202	2335 161	1929 133	1755 121	1552 107	1378 95	1189 82	1088 75				
R8	1.7335	PN400 / 2500 lbs	4395 303	4105 283	3931 271	3742 258	3466 239	2756 190	2147 148	1973 136	1668 115	1523 105						
S8	1.7380		4424 305	4134 285	3945 272	3771 260	3553 245	2828 195	2277 157	2060 142	1813 125	1595 110	1378 95	1233 85				
V8	1.4903		4525 312	4235 292	4047 279	3873 267	3655 252	2930 202	2379 164	2161 149	1915 132	1697 117	1479 102	1334 92	1233 85	1160 80	1030 71	870 60

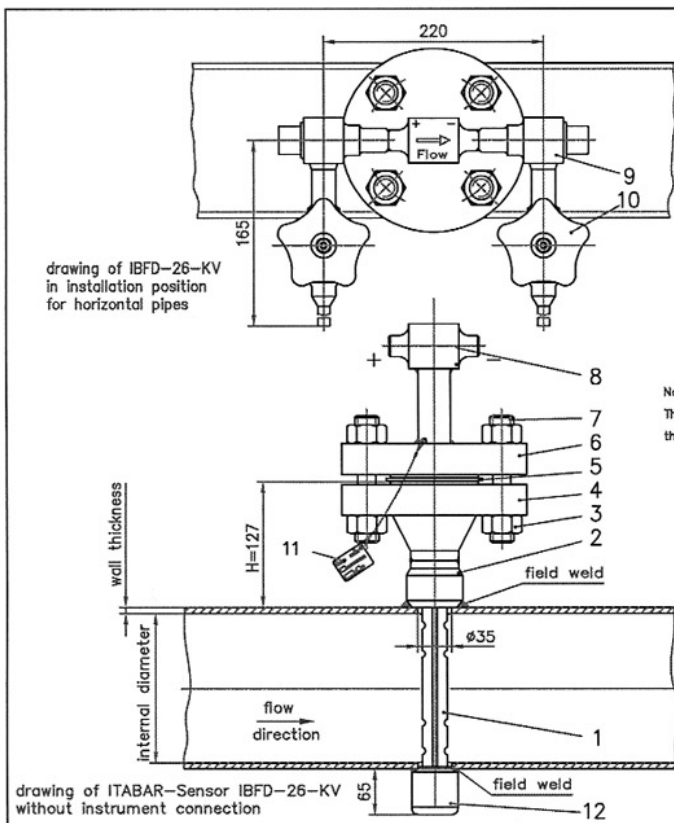
Combination Condensate Potts / Shut-Off Valves

Basically it is possible to use a combination of condensate pots and shut-off valves for sensor types IBFD-/IBFD-21 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 (bar)	@ T °F (°C)
	Combination of condensate pot and shut-off valve process connection: welding boss 21 mm with graphite packing	16 Mo 3 1.5415	KV02	3625 (250)	248 (120)
				1764 (121)	932 (500)
		13 CrMo 4 4 1.7335	KV03	3625 (250)	248 (120)
				1837 (129)	1022 (550)
		10 CrMo 910 1.7380	KV04	1160 (80)	986 (530)



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

pipe line

horizontal ☐ vertical ☐

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 and support	1	13CrMo44
11 TAG plate	1	316SS
10 shut-off valve	2	13CrMo44
9 condensation vessel	2	13CrMo44
8 sensor head with weld ends	1	13CrMo44
7 bolts M24	4	21 CrMo 57
6 Sensor flange DN40 PN250	1	13CrMo44
5 gasket, spiral wound	1	13CrMo44/Grafit
4 WN-flange DN40 PN250	1	DIN 2828 13CrMo44
3 nuts M24	8	DIN 2510 21 CrMo 57
2 mounting stud	1	13CrMo44
1 Sensor profile #25	1	13CrMo44

item description p.c. standard/desig material

Benennung: ITABAR-Flow-Sensor for steam type IBFD-26-KV

Datum: 02.08.99 Name: N. Evers Material: A4

Gepr.: INTRA-AUTOMATION GmbH Otto-Hahn-Straße 20 41515 Grevenbroich

Zeichnungs-Nr.: ZSON/KZIBFD/PS049e00 Rev.: 0 Blatt: 1/1

index/revision id/date name: Ursprung: PS279e00 Erreicht: Erreichte:

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.



Condensate pots, Dimensions \varnothing 3.54 x 0.69 inches (90 x 17.5 mm) with weld sockets 0.84 inches (21.3 mm)

The following table gives the pressure rating of the condensate pots

		Operating temperature																
	° F ° C	572 300	662 350	752 400	842 450	932 500	950 510	968 520	986 530	1004 540	1022 550	1040 560	1058 570	1076 580	1112 600	1148 620	1202 650	
Material	Wall thick- ness [mm]	Max Operating pressure (PSIG) Max Operating pressure (bar)																
st steel																		
1.5415	4	1682 116	1479 102	1392 96	1305 90	1262 87	1247 86	1247 86	1233 85									
1.7335	4	1885 130	1769 122	1653 114	1566 108	1508 104	1494 103	1494 103	1479 102	1465 101	1450 100							
1.7335	12,5				7252 500	6324 436	5279 364	4177 288	3408 235	2741 189	2147 148							
1.7380	15				7252 500	6469 446	5656 390	4902 338	4250 293	3669 253	3118 215	2698 186	2321 160					
1.4903	15								7977 550	7977 550	7977 550	7339 506	6570 453	5889 406	5207 359	4076 281	3075 212	1987 137

Pressure- Temperature Table for Shut-Off Valves

Code	Description	Pressure PSIG (PN)	Enclosure material abbrev name / DIN		Connections Inches	Packing	Used for
A13	Shut-off valves	5802 (PN400)	16 Mo 3	1.5415	0.85 x 0.13	graphite	IBFD-HT, IBFD-HTG
A14		5802 (PN400)	13 CrMo 4 4	1.7335	0.85 x 0.13	graphite	
A15		5802 (PN400)	10 CrMo 9 10	1.7380	0.85 x 0.13	graphite	
A16	Shut-off valve (component test to TRD 110, TRB 801 Nr. 45)	4641 (PN320)	16 Mo 3	1.5415	0.85 x 0.13	graphite	IBFD-HT, IBFD-HTG
A17		4641 (PN320)	13 CrMo 44	1.7335	0.85 x 0.13	graphite	
A18		4641 (PN320)	10 CrMo 9 10	1.7380	0.85 x 0.13	graphite	
A19		5802 (PN500)	16 Mo 3	1.5415	1.06 x 0.2	graphite	
A20		5802 (PN500)	13 CrMo 44	1.7335	1.06 x 0.2	graphite	
A21		5802(PN500)	10 CrMo 9 10	1.7380	1.06 x 0.2	graphite	
A22		5802 (PN500)	X10 CrMoVNB9-1	1.4903	1.06 x 0.2	graphite	

operating temperature																	
° F	302	392	482	572	662	752	797	842	887	932	950	968	986	1004	1022	1040	1058
° C	150	200	250	300	350	400	425	450	475	500	510	520	530	540	550	560	570
Code	Maximum operating pressure PSIG (bar)																
A13	5352	4917	4467	4032	3582	3147	2930	2698	2480	2248	2161	2074	1987	1900	1813		
	369	339	308	278	247	217	202	186	171	155	149	143	137	131	125		
A14	5352	4917	4467	4032	3582	3147	2930	2698	2480	2248	2161	2074	1987	1900	1813		
	369	339	308	278	247	217	202	186	171	155	149	143	137	131	125		
A15	5802	5802	5802	5802	5439	5076	4714	4351	3989	3626	3481	3336	3191	3046	2901		
	400	400	400	400	375	350	325	300	275	250	240	230	220	210	200		

operating temperature																						
° F	572	662	752	797	842	887	932	950	968	986	1004	1022	1040	1058	1076	1094	1112	1130	1148	1166	1184	1202
° C	300	350	400	425	450	475	500	510	520	530	540	550	560	570	580	690	600	610	620	630	640	650
Code	Maxiumum operating pressure PSIG (bar)																					
A16	4641	4612	4322	4250	4177	4105	2596	1973	1552	1247												
	320	318	298	293	288	283	179	136	107	86												
A17	4641	4641	4641	4641	4641	4569	3974	3321	2625	2147	1726	1349										
	320	320	320	320	320	315	274	229	181	148	119	93										
A18	4641	4641	4641	4641	4641	4641	4148	3626	3147	2727	2350	2002	2002	1479	1276							
	320	320	320	320	320	320	286	250	217	188	162	138	138	102	88							
A19	5569	5105	4670	4670	4670	4583	3989	3350	2669	2045												
	384	352	322	322	322	316	275	231	184	141												
A20	7252	6527	6251	6019	5802	5700	4757	3800	2799	2074	1305	769										
	500	450	431	415	400	393	328	262	193	143	90	53										
A21	7252	6527	6527	6527	6469	6251	6106	5337	4656	4076	3524	3075	2625	2306	1987							
	500	450	450	450	446	431	421	368	321	281	243	212	181	159	137							
A22	7252	6527	6527	6527	6527	6527	6527	6527	6527	6527	5889	5120	4438	3756	3161	2625	2074	1624	1175	856	537	
	500	450	450	450	450	450	450	450	450	450	406	353	306	259	218	181	143	112	81	59	37	



Fig. 8.14:
Design of shut-off valves

materials:
16 Mo 3
13 CrMo 44
10 CrMo 910



Fig. 8.15:
Design of shut-off valves

materials:
16 Mo 3
13 CrMo 44
10 CrMo 910
X10 CrMoVNB9-1

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

condensate vessel		short name	material case material no. DIN / ANSI
K0	without condensate vessel		
K5	condensate vessel with welding stud 21,3mm size: ø 90 x 17,5 mm	16 Mo 3	1.5415 A335 Grade P1
K6	condensate vessel with welding stud 21,3mm size: ø 90 x 17,5 mm	13 CrMo 4 4	1.7335 A335 Grade P11
K7	condensate vessel with welding stud 21,3mm size: ø 90 x 17,5 mm	10 CrMo 9 10	1.7380 A335 Grade P22
K8	condensate vessel with welding stud 21,3mm size: ø 90 x 17,5 mm	X10 CrMoVNb 91	1.4903; not weld together with A14, A20 A335 Grade P91

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 short name	material DIN/ANSI	connection	packing
A00	without shut-off valve				
A13	shut-off valve, nominal pressure: PN400	16 Mo 3	1.5415 A335GP1	21,3 x 3,2 mm	graphite
A14	shut-off valve, nominal pressure: PN400	13 CrMo 4 4	1.7335 A335GP11	21,3 x 3,2 mm	graphite
A15	shut-off valve, nominal pressure: PN400	10 CrMo 9 10	1.7380 A335GP22	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 No.45	16 Mo 3	1.5415 A335GP1	21,3 x 3,2 mm	graphite
A17	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 No.45	13 CrMo 4 4	1.7335 A335GP11	21,3 x 3,2 mm	graphite
A18	shut-off valve, nominal pressure: PN320 Component test acc. TRD 110, TRB 801 No.45	10 CrMo 9 10	1.7380 A335GP22	21,3 x 3,2 mm	graphite
A19	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	16 Mo 3	1.5415 A335GP1	21,3 x 3,2 mm	graphite
A20	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	13 CrMo 4 4	1.7335 A335GP11	21,3 x 3,2 mm	graphite
A21	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	10 CrMo 9 10	1.7380 A335GP22	21,3 x 3,2 mm	graphite
A22	shut-off valve, nominal pressure: PN500 Component test acc. TRD 110, TRB 801 No.45	X10 CrMoVNb 91	1.4903 A33GP91	21,3 x 3,2 mm	graphite

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

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

shut-off device for effect pressure pipe		material case short name	DIN/ANSI material no.	packing
KV02	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	16 Mo 3	1.5415 A335GP1	graphite
KV03	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	13 CrMo 4 4	1.7335 A335GP11	graphite
KV04	condensate vessel and shut-off valve as weld unit, welding stud 21,3 mm	10 CrMo 9 10	1.7380 A335GP22	graphite

12.0 Model Series FTMD to 232 psi (16 bar)

Description

The ITABAR-Sensor series FTMD is designed to measure volumetric flow of saturated steam up to an operating pressure of $p_{\max} = 232$ psi (16 bar) and a operating temperature of $T_{\max} = 572$ °F (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.

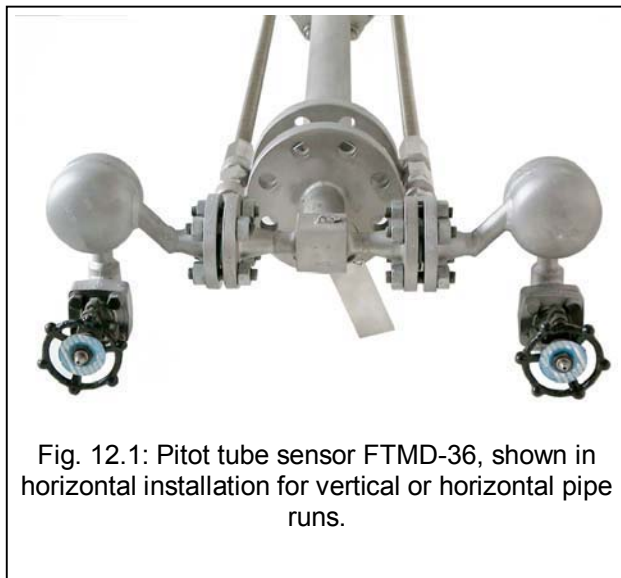
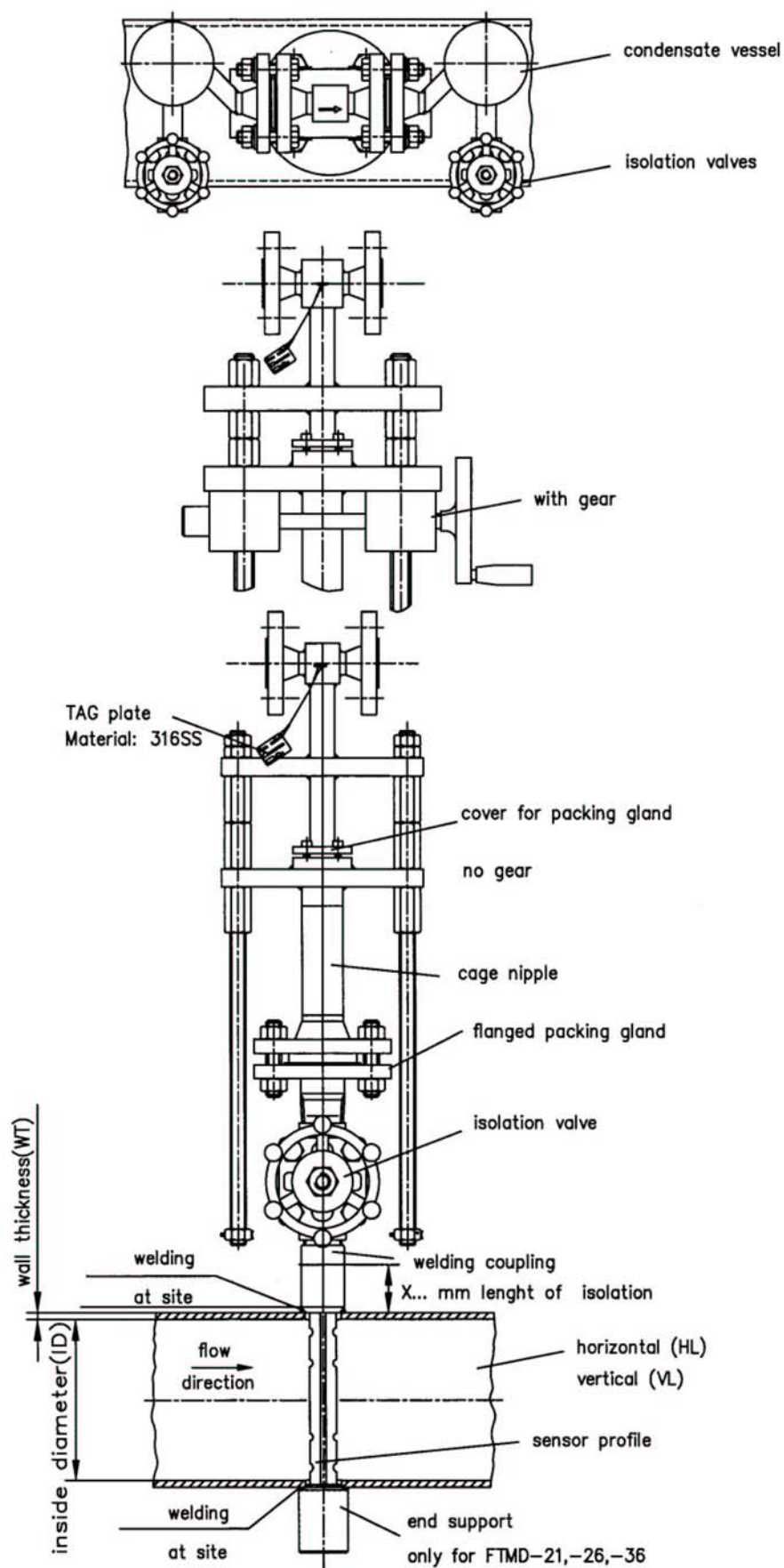


Fig. 12.1: Pitot tube sensor FTMD-36, shown in horizontal installation for vertical or horizontal pipe runs.



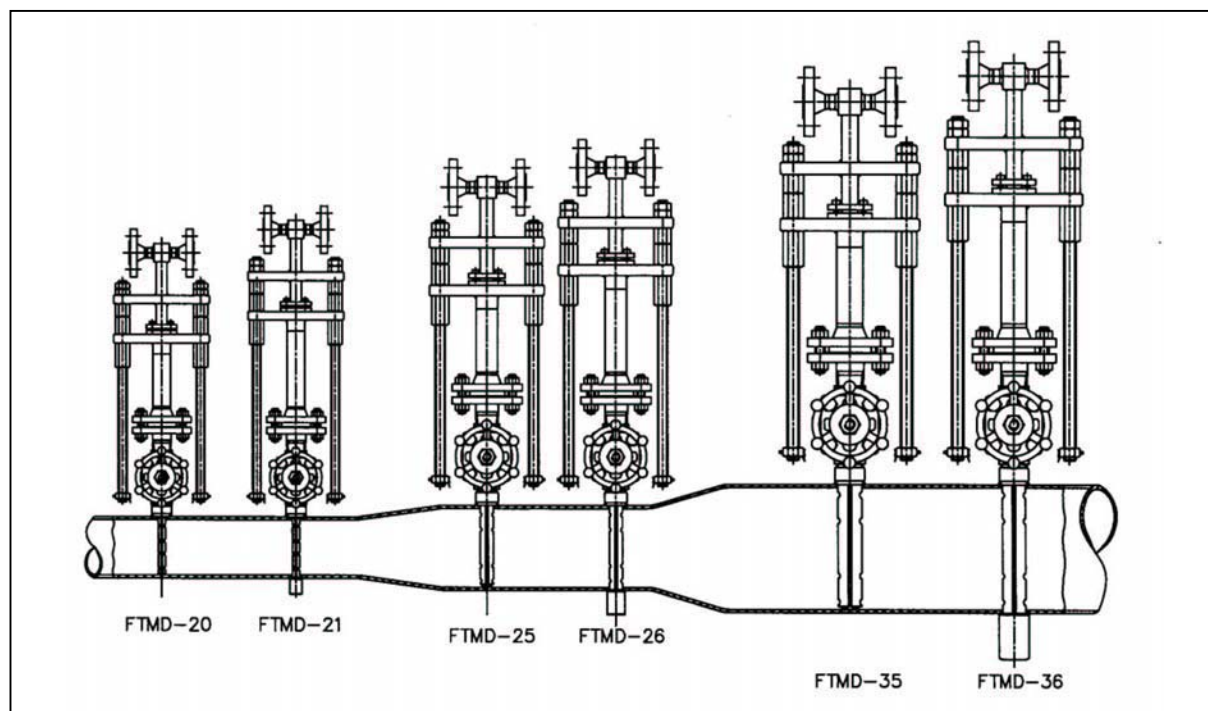
Fig. 12.2: Pitot tube sensor FTMD-36 made of st. steel for pipe size ID= 336.5 mm

Drawings of ITABAR Series FTMD



Ordering Data for ITABAR Series FTMD-20/21/25/26/35/36

1. Sensor Type



Pipe size (inches)	Maxium allowable volumetric flow in GPM ^(water see below)					
	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	---	---	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 $T = 68^\circ\text{F}$ (20°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	316Ti (1.4571)
4. welding coupling	
00	without
07	material: C.S.
08	material: 316Ti (1.4571)
5. end support (only FTMD-21)	
Y	without end support
C	end support material: C.S.
S	end support material: 316Ti (1.4571)
6. isolation valve for the sensor profile	
AS1	gate valve 1", material: C.S. PN16 / 150 lbs
AS2	gate valve 1", material: A182-F316H (1.4401) PN16 / 150 lbs
7. flanged packing gland	
S	material: 316Ti (1.4571)
8. cage nipple	
PC	material: C.S.
PS	material: 316Ti (1.4571)
9. packing material for the flanged and welded packing gland	
2	packing material: graphite, max 400°C
10. condensate vessel	
11. thermal isolation	
KI	without
X..	thermal isolation in inches or mm, please specify, each 10mm
12. piping run	
HL	horizontal
VL	vertical
13. gears mat. of gearbox	
0	without gears --
1	with gears die-cast-aluminium
2	with gears stainless steel
14. process connect	

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 316Ti (1.4571)

4. welding coupling

00 without

07 material: C.S.

08 material: 316Ti (1.4571)

5. end support (only FTMD-26)

Y without end support

C end support material: C.S.

S end support material: 316Ti (1.4571)

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: A182-F316H (1.4401) PN16 / 150 lbs

7. flanged packing gland

S material: 316Ti (1.4571)

8. cage nipple

PC material: C.S.

PS material: 316Ti (1.4571)

9. packing material for the flanged and welded packing gland

2 packing material: graphite, max 400°C

10. condensate vessel

11. thermal isolation

KI without

X.. thermal isolation in inches or mm, please specify, each 10mm

12. piping run

HL horizontal

VL vertical

13. gears mat. of gearbox

0 without gears --

1 with gears die-cast-aluminium

2 with gears stainless steel

14. integ. RTD resit. thermocouple

T0 without

TA 3-wire

TB 2-wire, with ex-approval

15. transmitter f. thermocouple

16. process connection

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		316Ti (1.4571)												
4. welding coupling														
00		without												
07		material: C.S.												
08		material: 316Ti (1.4571)												
5. end support (only FTMD-36)														
Y		without end support												
C		end support material: C.S.												
S		end support material: 316Ti (1.4571)												
6. isolation valve for the sensor profile														
AS3		gate valve 2", material: C.S.										PN16 / 150 lbs		
AS4		gate valve 2", material: A182-F316H (1.4401)										PN16 / 150 lbs		
7. flanged packing gland														
S		material: 316Ti (1.4571)												
8. cage nipple														
PC		material: C.S.												
PS		material: 316Ti (1.4571)												
9. packing material for the flanged and welded packing gland														
2		packing material: graphite, max 400°C												
10. condensate vessel														
11. thermal isolation														
KI		without												
X..		thermal isolation in inches or mm, please specify, each 10mm												
12. piping run														
HL		horizontal												
VL		vertical												
13. gears														
0		without gears										mat. of gearbox		
1		with gears										die-cast-aluminium		
2		with gears										stainless steel		
14. integ. RTD resit. thermocouple														
T0		without												
TA		3-wire												
TB		2-wire, with ex-approval												
15. transmitter f. thermocouple														
16. process connection														

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

Order specification condensate vessel**type FTMD 20, 21, 25, 26, 35, 36****flanged joint at sensor head (1 pair)**

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	A 285 (P 265 GH) "heavy boiler plate HII"	size Ø 88,9 x 5 mm
S	316Ti (1.4571)	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 (1 pair)**

A00	without gate valve
A81	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material case: A105 (C22), packing: graphite glas-fibre
A82	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT, material case: 316L (1.4404), packing: 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	A 285 (P 265 GH) "heavy boiler plate HII"	size: Ø 88,9 x 5 mm
	S	316Ti (1.4571)	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 plate for 3-way manifold	material: 316Ti (1.4571)
A07	flanged plate for 5-way manifold	material: 316Ti (1.4571)

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, A182-F316H (1.4401) / packing: graphite
A71	mounted 5-way manifold, PN400, A182-F316H (1.4401) / packing: graphite

12.1 Model Series FTHD to 580 PSIG (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 580 psig (40 bar) and an operating temperature of up to 752 °F (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.

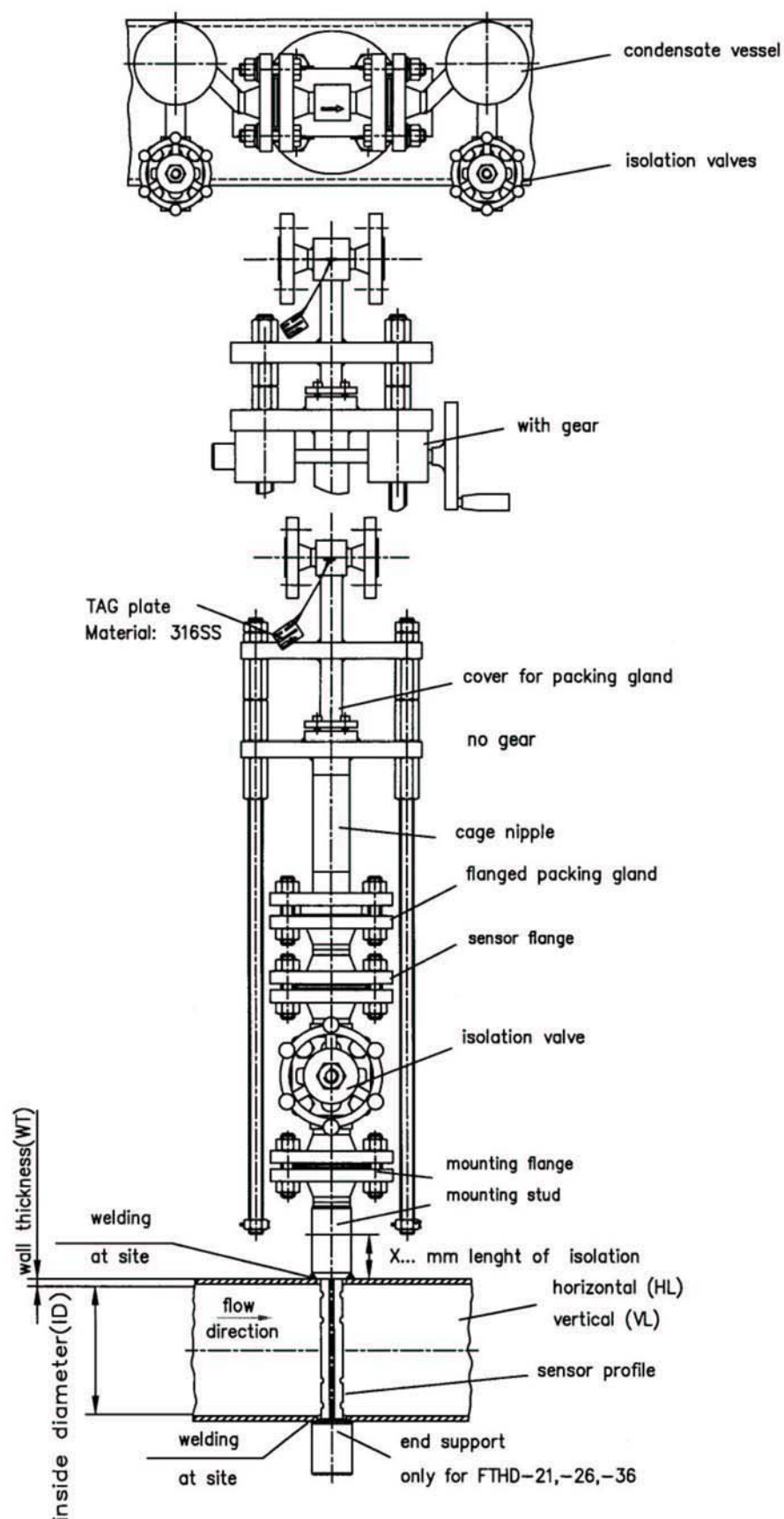


Fig. 12.3: : Pitot tube sensor FTHD-36 made of st. steel for a pipe with ID = 336.5 mm



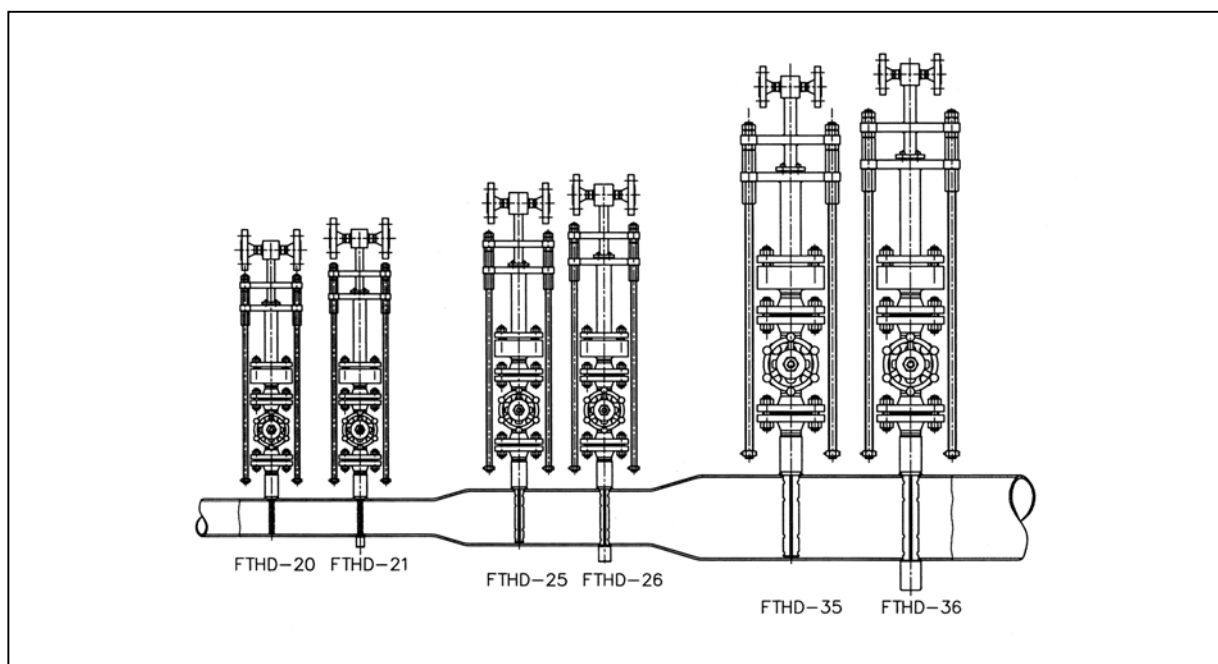
Fig. 12.4: Pitot tube sensor FTHD-36, shown in a horizontal installation for horizontal or vertical pipe runs.

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 <small>(for water with 0.999SGU @67°F)</small>					
	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	---	---	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

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	316Ti (1.4571) -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 and DN of Sensor flange																
1	PN16 / 150 lbs										DN25	1"				
2	PN40 / 300 lbs										DN25	1"				
7. design assembly connecting pieces																
0	without															
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															
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.																
0	without															
C1	C.S.										PN16 / 150 lbs	DN25	1"			
S1	316Ti (1.4571)										PN16 / 150 lbs	DN25	1"			
C2	C.S.										PN40 / 300 lbs	DN25	1"			
S2	316Ti (1.4571)										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: 316Ti (1.4571)															
11. isolation valve for the sensor profile identically to sensor flange.																
12. flanged packing gland																
S	material: 316Ti (1.4571)															
13. cage nipple																
PC	material; C.S.															
PS	material: 316Ti (1.4571)															
14. packing material for the flanged and welded packing gland																
1	packing material: PTFE, max 200°C															
2	packing material: Graphite, max 400°C															
15. gears mat. of gearbox																
0	without gears --															
1	with gears die-cast-aluminium															
2	with gears stainless steel															
16. condensate vessel																
17. thermal isolation																
KI	without															
X..	thermal isol. in inches or mm, please specify, each 10mm															
18. piping run																
HL	horizontal															
VL	vertical															
19. shut-off device																

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: A182-F316H (1.4401)
MF03	ball valve DN25 / PN40, material: C.S.
MF04	ball valve DN25 / PN40, material: A182-F316H (1.4401)
MS01	gate valve DN25 / PN100, material: C.S.
MS02	gate valve DN25 / PN100, material: A182-F316H (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: A182-F316H (1.4401)
AF03	ball valve, 1" ANSI 300 lbs, material: C.S.
AF04	ball valve, 1" ANSI 300 lbs, material: A182-F316H (1.4401)
AS01	gate valve, 1" ANSI / 600lbs, material: C.S.
AS02	gate valve, 1" ANSI / 600lbs, material: A182-F316H (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 316Ti (1.4571) -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 and DN of Sensor flange

- 1 PN16 / 150 lbs DN32 1 1/2"
- 2 PN40 / 300 lbs DN32 1 1/2"

7. design assembly connecting pieces

- 0 without
- 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
- 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.

- 0 without
- C1 C.S. PN16 / 150 lbs DN32 1 1/2"
- S1 316Ti (1.4571) PN16 / 150 lbs DN32 1 1/2"
- C2 C.S. PN40 / 300 lbs DN32 1 1/2"
- S2 316Ti (1.4571) PN40 / 300 lbs DN32 1 1/2"

10. end support (only FTHD-26)

- Y without end support
- C end support, material: C.S.
- S end support, material: 316Ti (1.4571)

11. isolation valve for the sensor profile

12. flanged packing gland

S material: 316 SS

13. cage nipple

PC material: C.S.

PS material: 316Ti (1.4571)

14. packing material for the flanged and welded packing gland

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

15. gears mat. of gearbox

- 0 without gears --
- 1 with gears die-cast-aluminium
- 2 with gears stainless steel

16. thermal isolation

- KI without
- X.. thermal isolation in inches or mm,
please specify, each 10mm

17. condensate vessel

18. piping run

- HL horizontal
- VL vertical

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

[illegible]

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

shut-off device for type FTHD-25/26

isolation valve for the sensor profile, DIN

MF08	ball valve, DN32 / PN16, material: C.S.
MF09	ball valve, DN32 / PN16, material: A182-F316H (1.4401)
MF13	ball valve, DN32 / PN40, material: C.S.
MF14	ball valve, DN32 / PN40, material: A182-F316H (1.4401)
MF18	ball valve, DN40 / PN63, material C.S.
MF19	ball valve, DN40 / PN63, material: A182-F316H (1.4401)
MS10	gate valve DN40 / PN100, material: C.S.
MS11	gate valve DN40 / PN100, material: A182-F316H (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: A182-F316H (1.4401)
AF10	ball valve, 1 1/2" ANSI 300 lbs, material: C.S.
AF11	ball valve, 1 1/2" ANSI 300 lbs, material: A182-F316H (1.4401)
AS10	gate valve 1 1/2" ANSI 600 lbs, material: C.S.
AS11	gate valve, 1 1/2" ANSI 600 lbs, material: A182-F316H (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	316Ti (1.4571) -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 and DN of Sensor flange			
1	PN16 / 150 lbs	DN50	2"
2	PN40 / 300 lbs	DN50	2"
7. design assembly connecting pieces			
0	without		
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		
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) allways identically to sensor flange.			
0	without		
C1	C.S.	PN16 / 150 lbs	DN50 2"
S1	316Ti (1.4571)	PN16 / 150 lbs	DN50 2"
C2	C.S.	PN40 / 300 lbs	DN50 2"
S2	316Ti (1.4571)	PN40 / 300 lbs	DN50 2"
10. end support (only FTHD-36)			
Y	without end support		
C	end support, material: C.S.		
S	end support, material: 316Ti (1.4571)		
11. isolation valve for the sensor profile			
12. flanged packing gland			
S	material: 316Ti (1.4571)		
13. cage nipple			
PC	material; C.S.		
PS	material: 316Ti (1.4571)		
14. packing material for the flanged and welded packing gland			
1	packing material: PTFE, max 200°C		
2	packing material: Graphite, max 400°C		
15. gears mat. of gearbox			
0	without gears --		
1	with gears die-cast-aluminium		
2	with gears stainless steel		
16. thermal isolation			
KI	without		
X..	thermal isolation in inches or mm, please specify, each 10mm		
17. condensate vessel			
18. piping run			
HL	horizontal		
VL	vertical		

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

type of sensor	
inside diameter and wall thickness.	
sensor material	
sensor flange	
gasket	
PN 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	

19. integ. RTD resit. thermocouple	
T0	without
TA	3-wire
TB	2-wire, with ex-approval
20. transm. f. thermocouple	
21. shut-off device	

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: A182-F316H (1.4401)
MF35	ball valve DN50 / PN40, material: C.S.
MF36	ball valve DN50 / PN40, material: A182-F316H (1.4401)
MF40	ball valve DN50 / PN63, material: C.S.
MF41	ball valve DN50 / PN63, material: A182-F316H (1.4401)
MS20	gate valve, DN50 / PN100, material: C.S.
MS21	gate valve DN50 / PN100, material: A182-F316H (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: A182-F316H (1.4401)
AF35	ball valve 2" ANSI 300 lbs, material: C.S.
AF36	ball valve, 2" ANSI 300 lbs, Werkstoff: A182-F316H (1.4401)
AS20	gate valve 2" ANSI 600 lbs, material: C.S.
AS21	gate valve 2" ANSI 600 lbs, material: A182-F316H (1.4401)

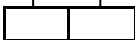


Order specification condensate vessel**FTHD 20, 21, 25, 26, 35, 36****flanged joint at sensor head**

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	A 285 (P 265 GH) "heavy boiler plate HII"	size Ø 88,9 x 5 mm
S	316Ti (1.4571)	size Ø 88,9 x 3,2 mm

**Order specification connections 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 shut-off device
A81	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT material case: A105 (C22), packing: graphite-glas-fibre
A82	ANSI small gate valve, nominal pressure 800 lbs connection: 1/2"-NPT material case 316L (1.4404), packing: graphite-glas-fibre

**Order specification condensate vessel (only compact construction)****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
----	--

material and size condensate vessel

H	A 285 (P 265 GH) "heavy boiler plate HII"	size: Ø 88,9 x 5 mm
S	316Ti (1.4571)	size: Ø 88,9 x 3,2 mm

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

A06	flanged plate for 3-way manifold	material: 316Ti (1.4571)
A07	flanged plate for 5-way manifold	material: 316Ti (1.4571)

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

A00	without shut-off device
A66	mounted 3-way manifold, PN400, A182-F316L (1.4401) / packing: graphite
A71	mounted 5-way manifold, PN400, A182-F316L (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 oder 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	Mistaking check (PMI-check)
Y27	Certificate about ferrit particles in welding seam

Ordering 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 a direct measurement of a fluid's density is principally possible, it is often too cumbersome to accomplish.

Most of the time 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 pitotube 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.
- For calculation of steam density a formular 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 measurement of volumetric flow, fluid temperature and pressure and calculation of mass flow value



Abb. 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.

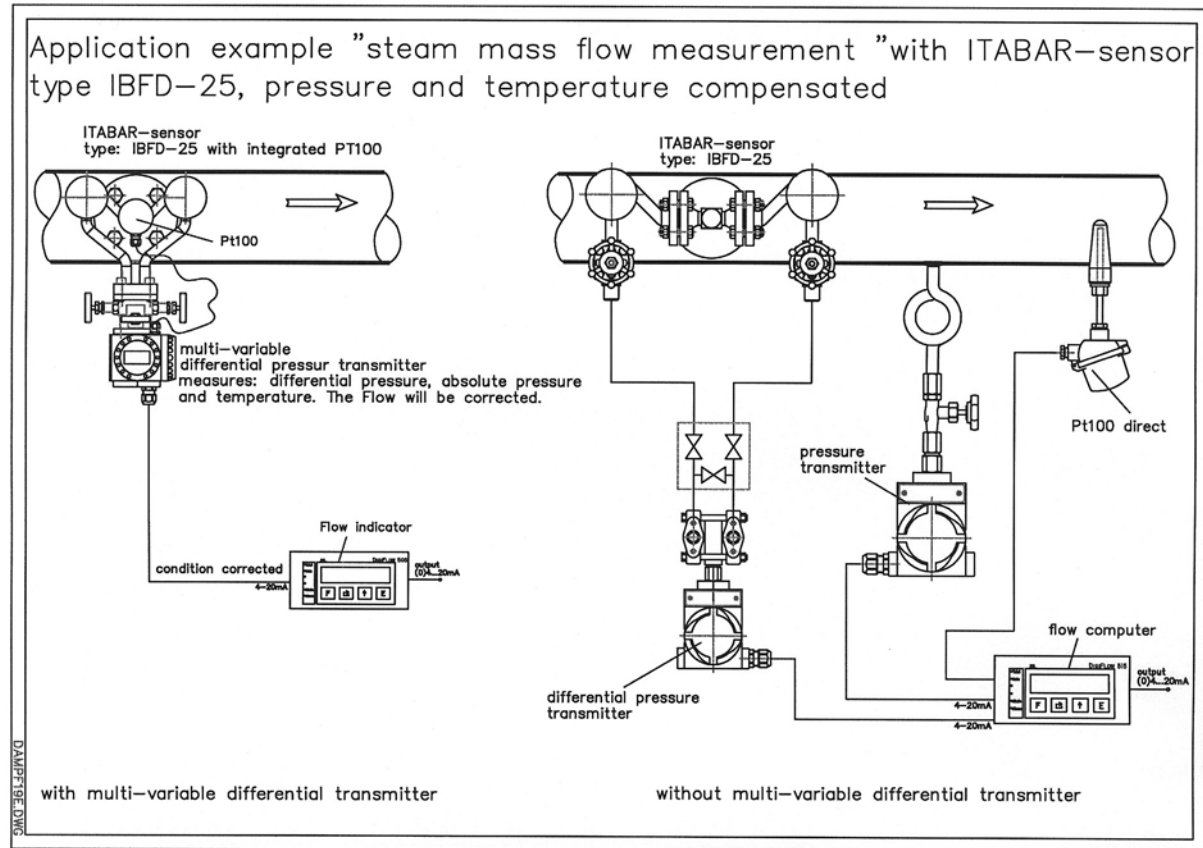


Fig. 3: Mass flow instrumentation of conventional transmitters vs multivariable transmitters

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 specification headtransmitter for integrated RTD

transmitter		ex-approval	connection head
0	without	----	form B
1	4..20 mA	without	form BUZH
2	4..20 mA / Hart	without	form BUZH
3	Profibus PA	without	form BUZH
4	Foundation Fieldbus	without	special
5	4..20 mA	Atex EEX ia	form BUZH
6	4..20 mA / Hart	Atex EEX ia	form BUZH
7	Profibus PA	Atex EEX ia	form BUZH
8	Foundation Fieldbus	Atex EEX ia	special
Y	others, please specify		

Pressure Transmitter Series 2600T

Multivariable Transmitter model 267CS, for mass flow

span limits: 0,05 kPa up to 2000 kPa, static pressure: up to 41 MPa, 410 bar, 5945 psi

267CS	Multivariable Transmitter for mass flow base accuracy: 0,075%		
	SENSOR-span limits		
	A	0,05 up to 1 kPa	0,5 up to 10 mbar 0,2 up to 4 inch H2O
	C	0,2 up to 6 kPa	2 up to 60 mbar 0,8 up to 24 inch H2O
	F	0,4 up to 40 kPa	4 up to 400 mbar 1,6 up to 160 inch H2O
	L	2,5 up to 250 kPa	25 up to 2500 mbar 10 up to 1000 inch H2O
	N	20 up to 2000 kPa	0,2 up to 20 bar 2,9 up to 290 psi
	Static pressure range		
	1	0 up to 0,6 MPa	0 up to 6 bar 0 up to 87 psi
	2	0 up to 2 MPa	0 up to 20 bar 0 up to 290 psi
	3	0 up to 10 MPa	0 up to 100 bar 0 up to 1450 psi
	4	0 up to 41 MPa	0 up to 410 bar 0 up to 5945 psi
	Diaphragm material / Fill fluid (wetted parts)		
	S	AISI 316L	silicon oil
	K	Hastelloy C276™	silicon oil
	M	Monel 400™	silicon oil
	V	Monel 400™ gold plated	silicon oil
	T	Tantalum	silicon oil
	A	AISI 316L ss	inert fluid
	F	Hastelloy C276™	inert fluid
	C	Monel 400™	inert fluid
	Y	Monel 400™ gold plated	inert fluid
	D	Tantalum	inert fluid
	Process flanges-/ adapters material and connection (wetted parts)		
	horizontal		
	A	AISI 316L	1/4 - 18 inch NPT-f direct (7/16" UNF U.S. drilling)
	C	AISI 316L	1/4 - 18 inch NPT-f direct (DIN 19213)
	B	AISI 316L	1/2 - 14 inch NPT-f through adapter (7/16" UNF U.S. drilling)
	D	Hastelloy C276™	1/4 - 18 inch NPT-f direct (7/16" UNF U.S. drilling)
	E	Hastelloy C276™	1/2 - 14 inch NPT-f through adapter
	F	Hastelloy C276™	1/4 - 18 inch NPT-f direct (DIN 19213) (7/16" UNF U.S. drilling)
	G	Monel 400™	1/4 - 18 inch NPT-f direct (7/16" UNF U.S. drilling)
	L	Monel 400™	1/4 - 18 inch NPT-f direct (DIN 19213)
H	Monel 400™	1/2 - 14 inch NPT-f through adapter (7/16" UNF U.S. drilling)	
P	Kynar (PVDF) (PN = 1MPa, 10 bar)	1/4 - 18 inch NPT-f direct (7/16" UNF U.S. drilling)	
Bolts/ Gasket (wetted parts)			
3	stainless steel	(NACE) Viton™	
4	stainless steel	(NACE) PTFE (max. PN 10 MPa)	
5	stainless steel	(NACE) EPDM	
6	stainless steel	Perbunan	
Housing material and electrical connection			
Housing material		electrical connection	
A	Aluminium alloy (Barrel ver.)	1/2-14 NPT	
B	Aluminium alloy (Barrel ver.)	M20x1.5 (NV: FM, CSA)	
E	Aluminium alloy (Barrel ver.)	Harting HAN-connector (NV: ATEX EExd, FM, CSA/ 4)	
G	Aluminium alloy (Barrel ver.)	Fieldbus-connector (NV: ATEX EExd, FM, CSA/ 4)	
S	rostfreier Stahl (Barrel ver.)	1/2-14 NPT	
T	rostfreier Stahl (Barrel ver.)	M20x1.5 (NV: FM, CSA)	
J	Aluminium alloy (DIN-type)	M20x1.5 (NV: FM, CSA)	
K	Aluminium alloy (DIN-type)	Harting HAN-connector (NV: ATEX EExd, FM, CSA/ 4)	
W	Aluminium alloy (DIN-type)	Fieldbus-connector (NV: ATEX EExd, FM, CSA/ 4)	
Output/ Additional options			
H	4...20 mA/ HART	no additional options	
1	4...20 mA/ HART	Options requested (to be ordered by "Additional ordering code")	
P	PROFIBUS PA	no additional options	
2	PROFIBUS PA	Options requested (to be ordered by "Additional ordering code")	
F	FOUNDATION-Fieldbus	no additional options	
3	FOUNDATION-Fieldbus	Options requested (to be ordered by "Additional ordering code")	
M	Modbus RS 485	no additional options	
5	Modbus RS 485	Options requested (to be ordered by "Additional ordering code")	
N	Modbus RS 232	no additional options	
6	Modbus RS 232	Options requested (to be ordered by "Additional ordering code")	

NV-not available

additional ordering information for model 267CS			
Drain/ vent (material and position) (wetted parts)			
V1	AISI 316L	on process axis	NACE 7)
V2	AISI 316L	on flange side top	NACE 7)
V3	AISI 316L	on flange side bottom	NACE 7)
V4	Hastelloy C276™	on process axis	NACE 8)
V5	Hastelloy C276™	on flange side top	NACE 8)
V6	Hastelloy C276™	on flange side bottom	NACE 8)
V7	Monel 400™	on process axis	NACE 9)
V8	Monel 400™	on flange side top	NACE 9)
V9	Monel 400™	on flange side bottom	NACE 9)
Electrical certification			
E1	ATEX Group II Category 1/2 GD - intrinsic safety EEx ia		
E2	ATEX Group II Category 1/2 G - flameproof EEx d		
E3	ATEX Group II Category 3 GD - type of protection N EEx nL design compliance		
EA	Factory Mutual (FM) - Intrinsically Safe		
EB	Factory Mutual (FM) - Explosion Proof (only with 1/2" NPT electrical connection and stainless steel lable)		
ED	Canadian Standard Association - Intrinsically Safe		
EE	Canadian Standard Association - Explosion Proof		
Integral LCD			
L1	Digital LCD integral display		
L2	Backlit digital LCD integral display		
Mounting brackets (shape and material)			
B2	for pipe mounting AISI 316L (1.4404)		
B4	for wall mounting AISI 316L (1.4404)		
Operating manual			
M1	German		
Labels & tag language			
T1	German in stainless steel (not available with DIN Electronic Housing code J, K, W)		
TA	German and English plastic (not suitable for Factory Mutual - Explosion Proof)		
Additional tag plate			
I1	in stainless steel		
Preparation procedure			
P1	Oxygen service cleaning (only available with inert fill -Pmax=12MPa/120bar/1740psi; Tmax=60°C/140°F)		
P2	Hydrogen service preparation		
Certificates			
C1	Inspection certificate EN 10204-3.1.B of calibration		
C3	Inspection certificate EN 10204-3.1.B of the cleanliness stage according to DIN 25 410		
C4	Inspection certificate EN 10204-3.1.B of helium leakage test of the sensor module		
C5	Inspection certificate EN 10204-3.1.B of the pressure test		
C6	Certificate of compliance 2.1 der Geräteausführung EN 10204		
Material traceability			
H1	Certificate of compliance with the order EN 10204-2.1 of instrument design		
H3	Inspection certificate EN 10204-3.1.B of pressure retaining and process wetted parts		
H4	Test report EN 10204-2.2 of the pressure bearing and process wetted parts		
Connector			
U1	Fieldbus 7/8 (only for FOUNDATION Fielbus, without adapter)		6, 10)
U2	Fieldbus M12x1 (only for PROFIBUS PA, without adapter)		6, 10)
U3	Harting HAN 8U - straight entry		5, 10)
U4	Harting HAN 8U - angle entry		5, 11)

1) not available with sensor code C, F, L, N

2) not available with sensor code A

3) suitable for oxygen service

4) select type in additional ordering code

5) not available with Electronic Housing - Code G, W

6) not available with Electronic Housing - Code E and K

7) not available with Process flanges/ adapters - Code D, E, F, G, H, L, P

8) not not available with Process flanges/ adapters - Code A, B, C, G, H, L, P

9) not available with Process flanges/ adapters - Code A, B, C, D, E, F, P

10) not available with Electronic housing - Code T, S, A, B, J

11) not available with Electronic housing - Code T, S, A, B, J, K

™ Hastelloy is Cabot Corporation trademark

™ Monel is a International Nickel Co. Trademark

™ Viton is a DuPont Dow Elastomers trademark

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. In the case of a calibration at the manufacturer's site the measurements are done per customer specifications and are documented with a manufacturer's test certificate.



Fig. 12.2: 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 to 25 °C (59 to 77 °F).
Pressure: 0.2 – 1.0 bar (2.9 to 14.5 psig).

Selected Application Examples

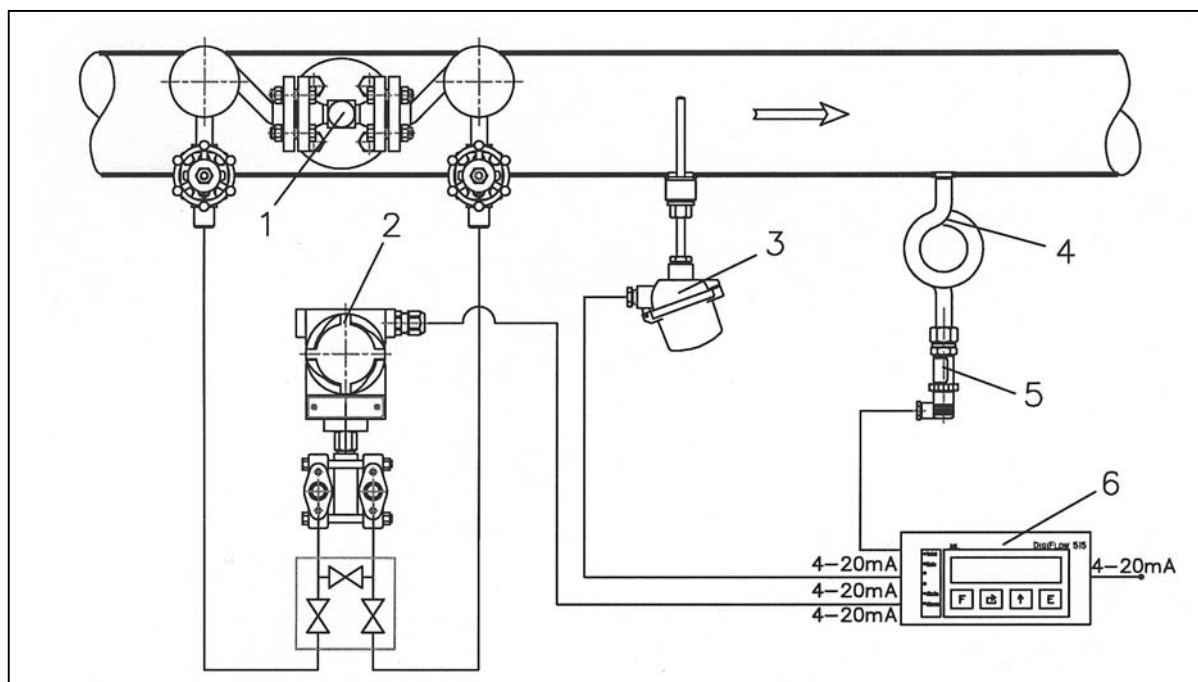


Fig. 8.16: Mass flow and heat measurement of steam with DP sensor type IBRD-26 (1), DP transmitter (2), PT100 temperature sensor (3) with integrated signal converter, contained (4) protected pressure sensor (5) and flow computer (6) type DigiFlow 515.

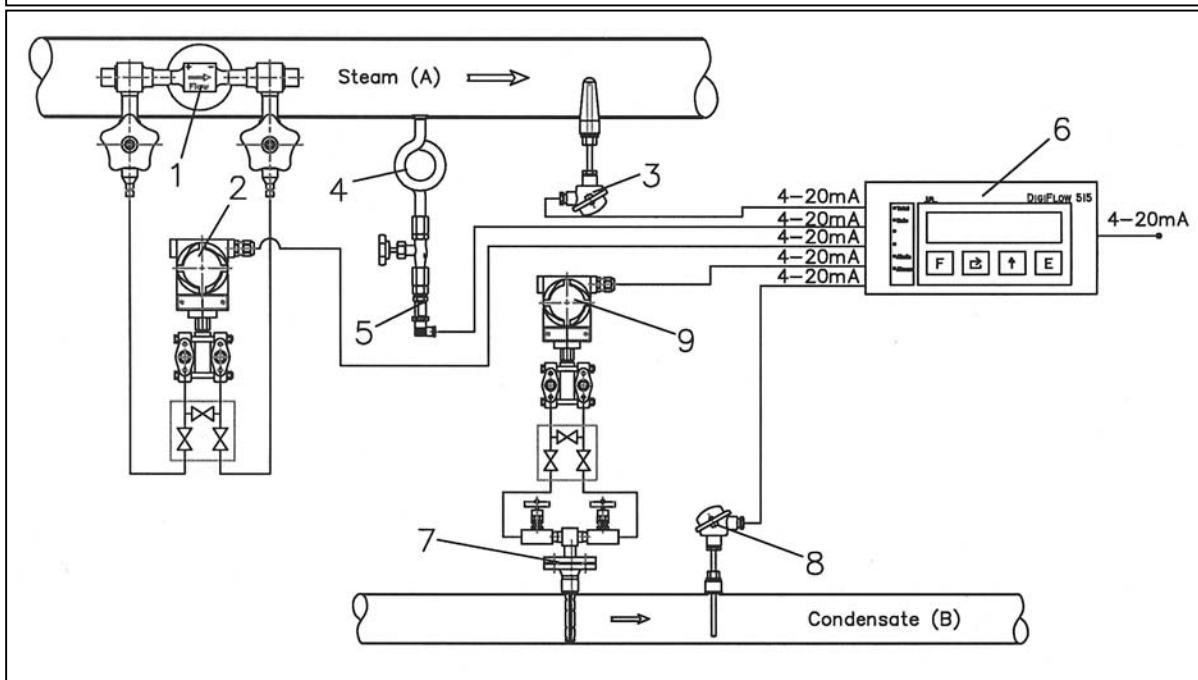


Fig. 8.17: Measurement of expended heat by calculating difference between heat in steam (A) and condensate (B). Components : DP sensor type IBFD-26 (1), DP transmitter (2 and 9), PT100 temperature sensor (3 and 8) with integrated signal converter, water loop (4), pressure sensor (5), DP sensor type IBF-25 (7) and flow computer (6) type DigiFlow 515.

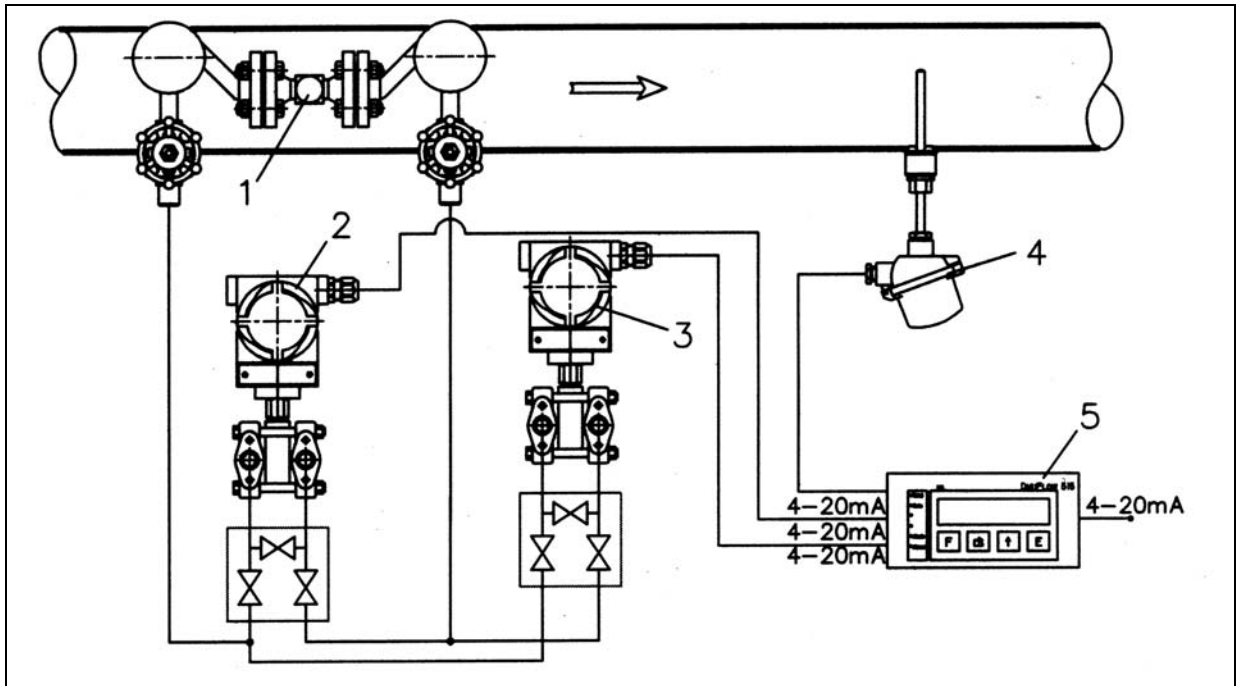


Fig. 8.18: Mass flow measurement of steam with expanded measuring range. The DP flow signal from sensor IBRD-26 (1) is the input to two separate DP transmitters (2 and 3) with different range settings (spl't range). Other components : PT100 temperature sensor (4) with integrated signal converter and flow computer type DigiFlow 515 (5).

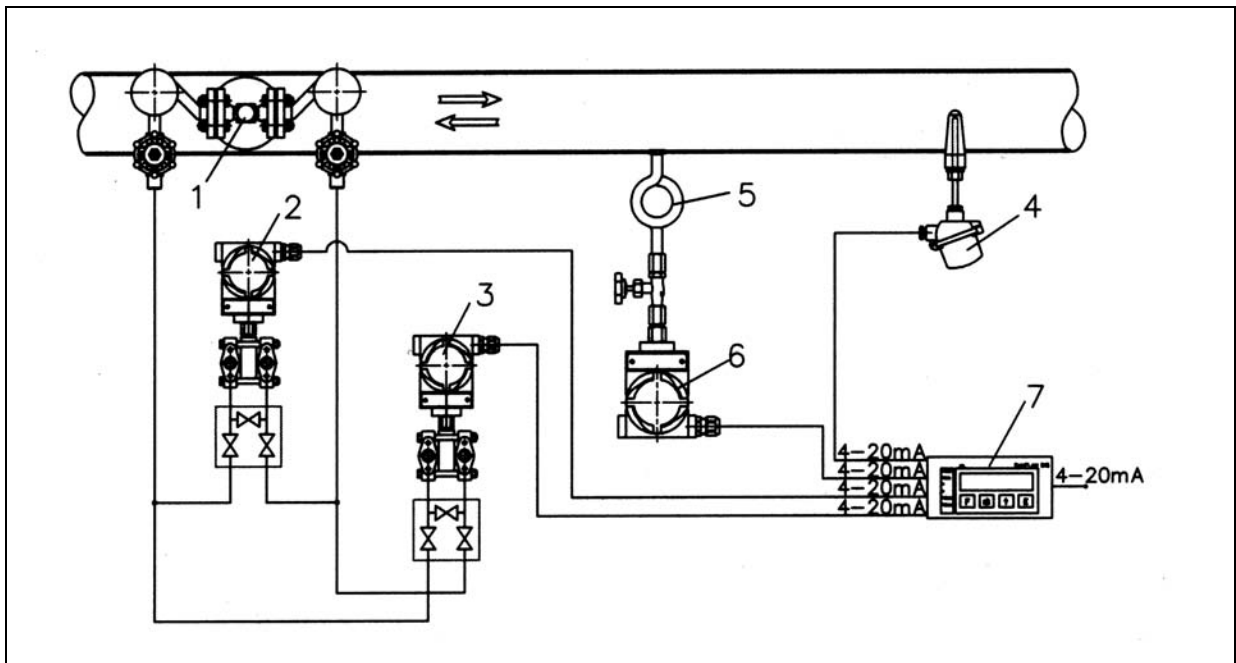
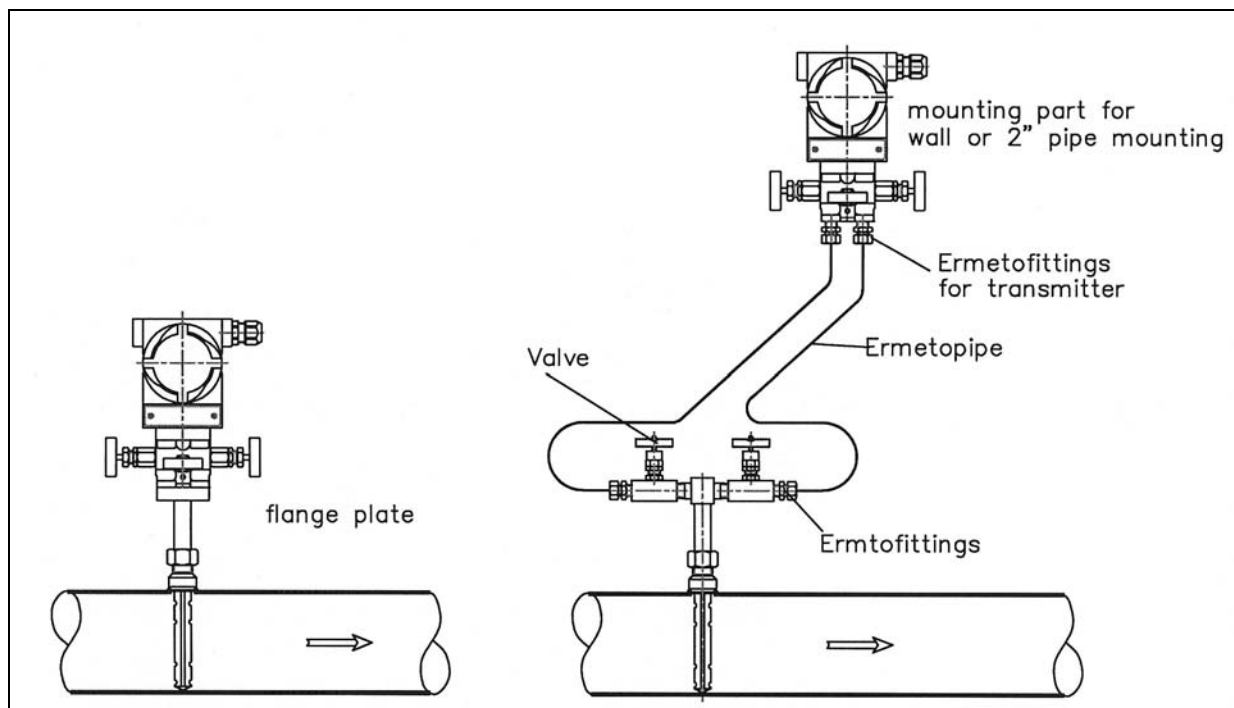


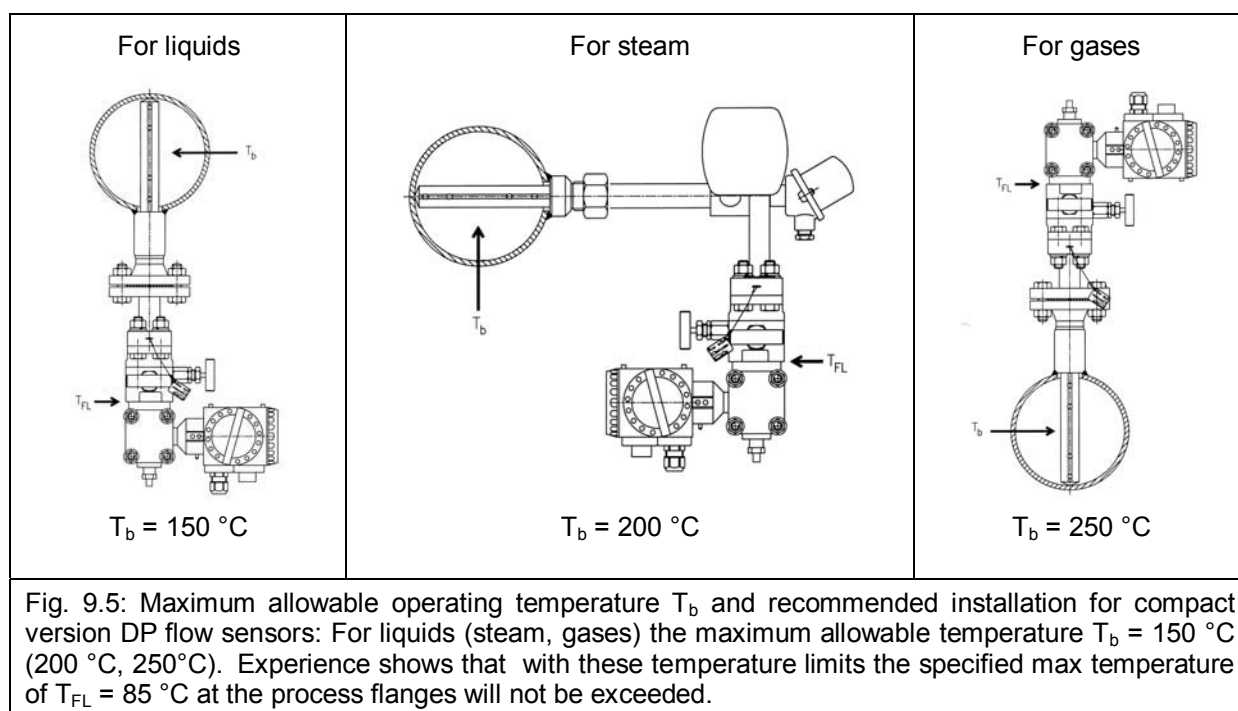
Fig. 8.19: Bi-directional mass flow measurement of steam with increased accuracy. Components: DP flow sensor type IBRD-25 (1), DP transmitter for forward flow (2) and reverse flow (3), PT100 temperature sensor with integrated signal converter (4), water loop (5), pressure sensor (6) and flow calculator (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 $T_{FL} = 85^\circ\text{C}$ at the process flanges.



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 Quadratmeter [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	$2,833 \times 10^{-5}$	0,6721	$2,0885 \times 10^{-2}$
0,001	1	0,01	$0,10197 \times 10^{-3}$	$2,833 \times 10^{-8}$	$0,6721 \times 10^{-3}$	$2,0885 \times 10^{-5}$
0,1	100	1	0,010197	$2,833 \times 10^{-6}$	0,06721	$2,0885 \times 10^{-3}$
9,807	9807	98,07	1	$2,778 \times 10^{-4}$	6,5919	0,20482
$0,35304 \times 10^5$	$0,35304 \times 10^8$	$0,35304 \times 10^6$	3600	1	$2,3730 \times 10^4$	$0,73728 \times 10^3$
1,488	1448,2	14,882	0,1518	$4,214 \times 10^{-5}$	1	0,03108
47,88	47880	478,8	4,882	$1,3558 \times 10^{-3}$	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:

$$\nu = (7,32 E - \frac{6,31}{E}) 10^{-6} \text{ m}^2 / \text{s} \quad (\text{Gl. 14.1})$$

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	$3,875 \times 10^4$
10 ⁻⁴	1	100	0,36	1	100	$1,0764 \times 10^{-3}$	3,875
10 ⁻⁶	10 ⁻²	1	0,0036	0,01	1	$1,0764 \times 10^{-5}$	0,03875
$2,778 \times 10^{-4}$	2,778	277,8	1	2,778	277,8	$29,9 \times 10^{-4}$	10,764
10 ⁻⁴	1	100	0,36	1	100	$1,0764 \times 10^{-3}$	3,875
10 ⁻⁶	10 ⁻²	1	0,0036	0,01	1	$1,0764 \times 10^{-5}$	0,03875
$9,2903 \times 10^{-2}$	929,03	92903	334,45	929,03	92903	1	3600
$0,25806 \times 10^{-4}$	0,25806	25,806	$9,2903 \times 10^{-2}$	0,25806	24,806	$2,778 \times 10^{-4}$	1