INTRA-AUTOMATION

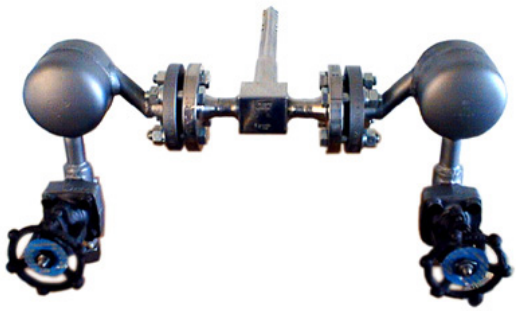
MESS- UND REGELINSTRUMENTE / MEASUREMENT AND CONTROL

TÜVRheinland® CERT ISO 9001

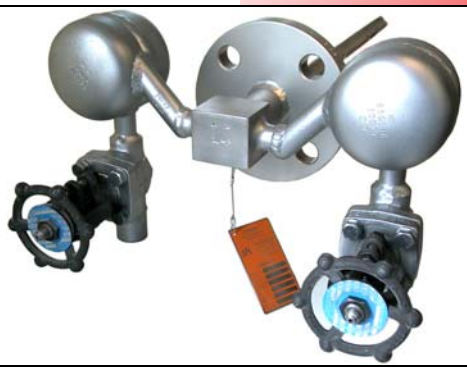
Itabar-Flow-Sensors for Steam Applications

(Fixed Installation)

Series: IBRD and IBFD
IBFD-HT / IBFD-HTG



IBRD



IBFD

IBFD-HT

Installation and Operation Manual

10/2011

FLOW

THE EXPERT IN LEVEL AND FLOW

Thanks for choosing an Instrument from Intra-Automation.

Intra-Automation
Technical Information
10/2011

Technical details subject to be changed without notice.

For comments regarding this brochure, please contact
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Itabar-Flow-Sensors for Steam Applications
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List of Contents:

List of Contents (Continuation):

1. Safety Instructions

In this manual you will find information for your own safety and to prevent any type of damage. The hints are marked with a danger sign described as follows:

DANGER
means, that death, personal injury or high damage to property **will** occur, if there should be taken no precaution.

WARNING
means, that death, personal injury or high damage to property **can** occur, if there should be taken no precaution.

CAUTION
with danger sign means, that only small personal injuries can occur, if there should be taken no precaution.

CAUTION
without danger sign means, that damage to property can occur, if there should be taken no precaution.

ATTENTION
highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

NOTE
Is important information about the product itself, the handling of the product or that part of the manual to which special attention is to be drawn to.

Limited liability

We checked the content of the manual in accordance to the hardware. But we can not guarranty that there will be differences between the manual and the hardware. The manual will be checked regularly to correct the manual in the following versions.

2 General Instructions

NOTE

For reasons of clarity the manual does not contain detailed information about all types of products and cannot take into account every conceivable case of installation, operation or maintenance.

If you require further information or should any problems occur which are not sufficiently explained in the manual, you can consult your local Intra-Automation branch to obtain the necessary information.

May we also draw your attention to the fact that the contents of the manual are not part of a previous or existing agreement, approval or legal relationship or an amendment thereof. All obligations of the Intra-Automation GmbH result from the contract of purchase which also contains the full and solely valid warranty agreement. These contractual warranty conditions are neither extended nor restricted by the contents of the manual.

The contents reflect the technical state at the time of going to print. They are subject to technical modifications in the course of further development.

WARNING

Intrinsically safe devices lose their license as soon as they are operated on circuits which do not meet the requirements of the EC test certificate.

The device may be operated with high pressure and corrosive media. Therefore serious injuries and/ or considerable material damage cannot be ruled out in the event of improper handling of the device.

The perfect and safe operation of this equipment is conditional upon proper transport, proper storage, installation and assembly as well as on careful operation and commissioning.

The equipment may only be used for the purposes specified in this instruction manual.

Exclusion of liability

All modifications to the device require the expressed approval of the manufacturer.

Qualified Personnel

Qualified personnel is persons familiar with installation, commissioning and operation of the product and wo have the appropriate qualifications for their activities, such as:

- training or instruction or authorization to operate and maintain devices/ systems according to the standard of safety technology for high pressures and corrosive media.
- training or instruction according to the standards of safety engineering in the care and use of suitable safety equipment.
- training in first aid.

CAUTION

Modules which are sensitive to electrostatic charge may be destroyed by voltages which are far below the human level of perception. These voltages occur already when you touch a component or electrical connections of a module without first discharging yourself electro-statically. The damage incurred by a module as a result of an overvoltage is not usually immediately perceptible but only becomes noticeable after a long time in operation.

Trade mark

Itabar is a trade mark of Intra-Automation GmbH.

3. Measurement Principle of Itabar-Flow-Sensors

Once a corpus like our patented flow sensor profile is being brought into parallel flow with the velocity of w, the fluid will partly pond while passing the barrier. The streamline flowing in the middle of the ponding area, the ponding flow line, hits the barrier vertically. The fluid will totally calm down at this very point, called the ponding point. As ponding flows are always laminar – at least until they reach the corpus (Ponding point) – and therefore are always certainly calculable (even if the flow friction is involved), which makes them very usable for measurement procedures. Using the energy equation acc. to Bernoulli, the outcome is:

$$p_{ges} = p_{stat} + \frac{1}{2}\rho w^2$$

With the patented sensor profile of the Itabar-sensor it is possible to measure the total pressure p_{ges} on the front side as well as the static pressure p_{stat} on the backside of the sensor. From the difference the flow velocity can be calculated:

$$w = \sqrt{\frac{2 * p_{dyn}}{\rho}}$$

At known pipe inside diameter the following applies acc. to the continuity equation:

$$V \sim wA$$

From that completed by a proportional coefficient (or correction coefficient “k”) the following equations result:

$$V = k * w * A \text{ or } m = k * \rho * w * A$$

The correction coefficient “k” is only related to the patented Itabar-sensor-profile. The coefficient has been determined by empiric methods for all sensor profiles by Intra-Automation GmbH. (For additional information please download the detailed product catalogue from www.intra-automation.com.)

4. Product Description

Congratulations for your choice of an Itabar-Flow-Sensor for steam applications.

When installed properly, the Itabar-Sensor offers an array of advantages over other measurement systems with respect to its accuracy, pressure loss and installation. The following guide is designed to help you with the sensor’s installation and operation.

5. Receipt, Transport and Storing

On receipt of the equipment, the outside packing has to be checked for any damage incurred while shipment. If the packing case is damaged, the local carrier should be notified immediately regarding the liability. Remove the envelope containing the packing list. Carefully remove the equipment from the transport box and inspect for damaged or missing parts. Please check the case to be sure that all parts (e.g. accessories) have been unpacked. For transport or storing please only use the original packing case. Conditions for storing:

- Do not pile up the cases at any time!
- For storage, protect the units against heat frost, humidity, dust of chemical vapour/media.
- Storage temperature: 10°C [50 °F] up to 40 °C [104 °F]

The time of storage is unlimited, but pay attention to the agreed guarantee period.

WARNING

For transport of units with weights higher than 25 kg [55 lbs], only use lifting tools. Please take care of the centre of gravity signed on the packing (without sign if the centre is in the middle of the case). During transport do not enter the area of danger. Wear safety clothes (e.g. shoes) only.

6. Pre-Installation Checks

Before installation, make sure that all of the following parts are included in the sensor kit:

A: Supplied: Itabar-Flow-Sensor type IBRD:
- Itabar-sensor, type IBRD
- Condensation vessels, flanged
- Weld socket with cutting ring and pressure nut
- Gasket for the mounting flange and flanged model of the condensate vessels
- Bolts and nuts
- Sensor end support for IBRD-21/26/36
- Instrument valve assembly (if ordered)

B: Supplied: Itabar-Flow-Sensor type IBFD
- Itabar-sensor, type IBFD
- Condensate vessels, flanged or welded to the sensor head
- Mounting flange with stud
- Gasket for the mounting flange and for the flanged condensate vessels (depends on the purchased model)
- Bolts and nuts
- End support (only IBFD-21/26/36/66)
- Instrument valve assembly (if ordered)

C: Supplied: Itabar-Flow-Sensor type IBFD-HT
- Itabar-sensor, type IBFD-HT
- Condensate vessels, welded to the sensor head
- Mounting flange with stud
- Gasket for the mounting flange
- Bolts and nuts
- End support
- Instrument valve assembly (if ordered)

D: Supplied: Itabar-Flow-Sensor type IBFD-HTG
- Itabar-sensor, type IBFD-HTG
- Condensate vessels, welded to the sensor head
- Welding stud
- End support
- Instrument valve assembly (if ordered)

Compare the specification on the TAG-plate with the given specification of your Purchase order. The TAG-plate contains the following details:

- Serial-no.
- Sensor type
- Pipe inside diameter
- TAG-no. (measurement location number) – if provided
- Material of construction
- Measuring range

fig 1: TAG plate Itabar

NOTE
Make sure that the pipe inside diameter indicated on the TAG-plate matches your pipe diameter!

7. General Instructions for Installation

ATTENTION

All drawings in this manual, which show a top view, are only for better understanding. **Steam sensors have to be installed into the pipe line from sideways!**

To achieve optimal measuring results, please follow the instructions in the following chapters.

7.1 Specification of the Pipe Arrangement

Due to constructional purposes the following data has to be provided prior start of production:

- ♦ pipe arrangement, horizontal or vertical
- ♦ flow direction (for those models, where the condensate vessels have to be welded directly to the sensor head)
- ♦ inside diameter and wall thickness of the pipeline at the place of installation

At both pipe arrangement possibilities, horizontal as well as vertical, the condensate vessels have to be arranged in a horizontal line to the sensor (please see fig. 1+2).

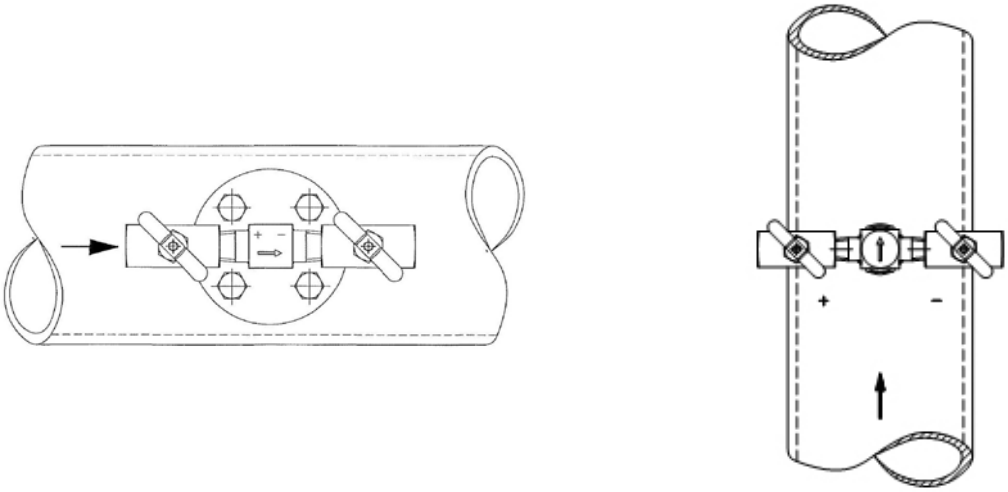


fig. 1+2: Arrangement of pressure tapping in horizontal and vertical pipes

7.2 Vertical Pipe Arrangement

The Itabar-Flow-Sensor for flow measurement of saturated steam and overheated steam can be installed in vertical pipe lines at every place of the pipe's circumference

IBRD:

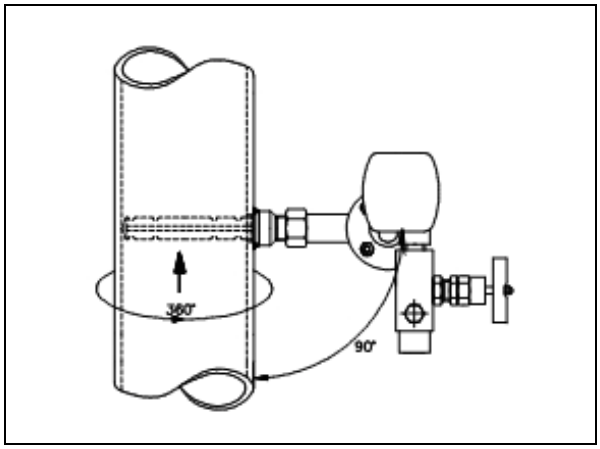


fig. 3: IBRD installed in a vertical pipe

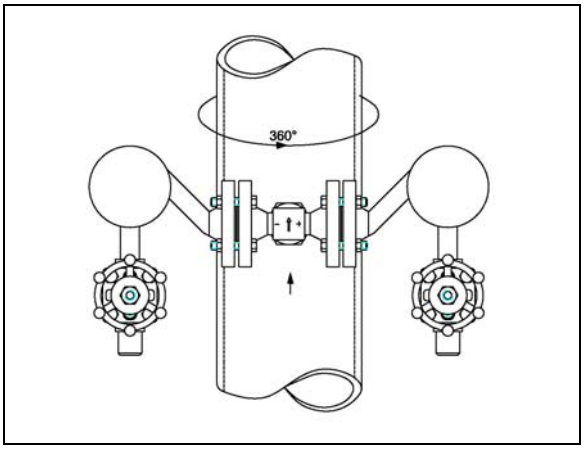


fig. 4: IBRD installed in a vertical pipe

IBFD:

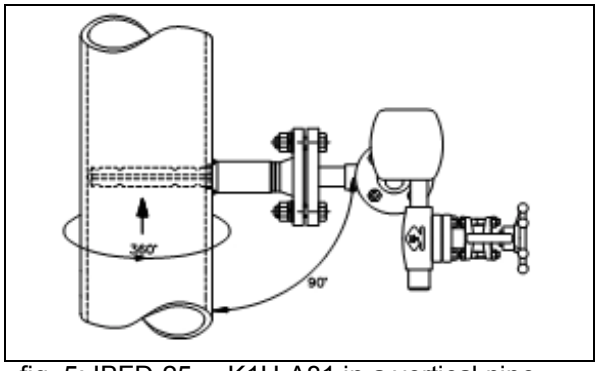


fig. 5: IBFD-25…-K1H-A81 in a vertical pipe

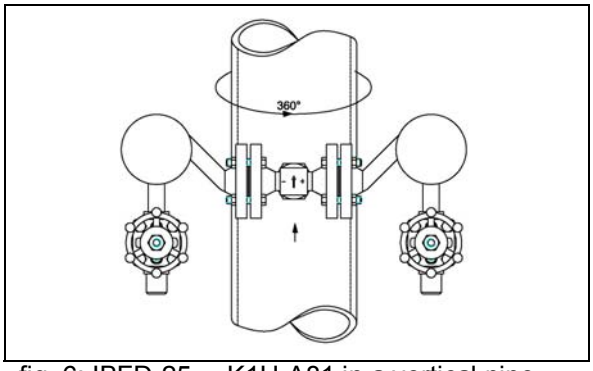


fig. 6: IBFD-25…-K1H-A81 in a vertical pipe

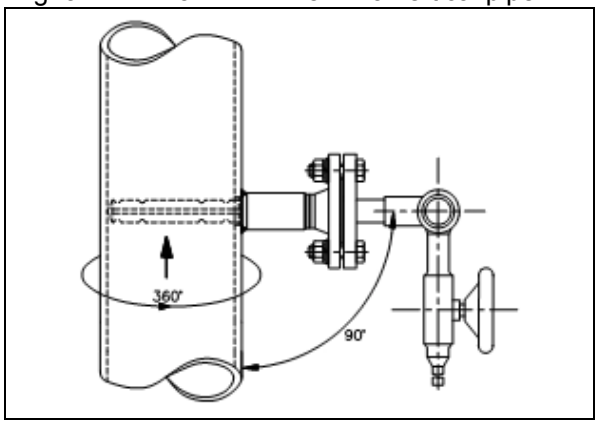


fig. 7: IBFD-25…-K7-A18 in a vertical pipe

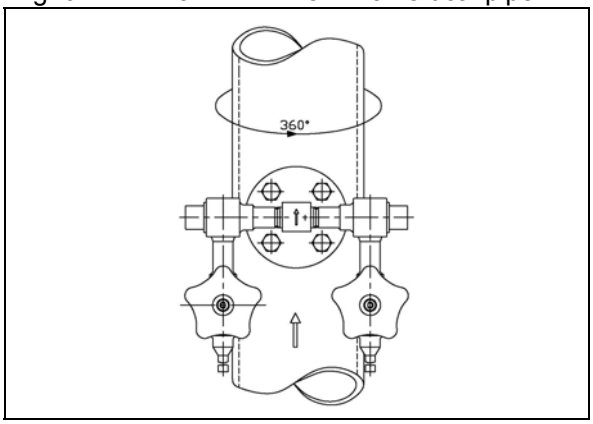


fig. 8: IBFD-25…-K7-A18 in a vertical pipe

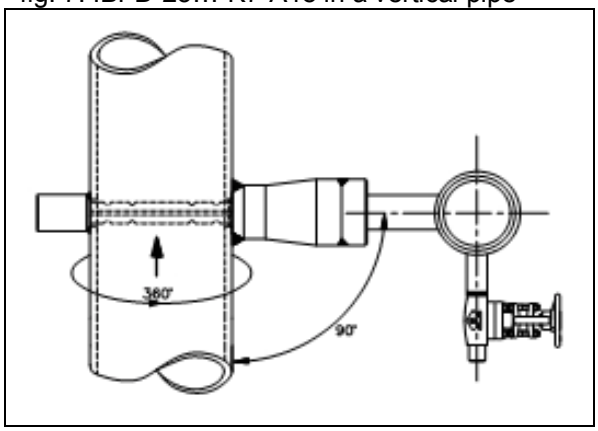


fig. 9: IBFD-26 HTG in a vertical pipe

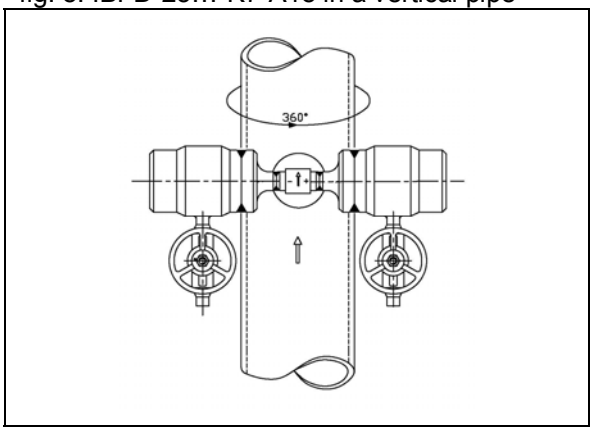


fig. 10: IBFD-26 HTG in a vertical pipe

7.3 Horizontal Pipe Arrangement

At horizontal pipe arrangement, due to its functional principle, **the sensor has to be installed in an angle of 90° to the pipe axis**. The pressure taps are arranged in line with the pipe axis.

IBRD:

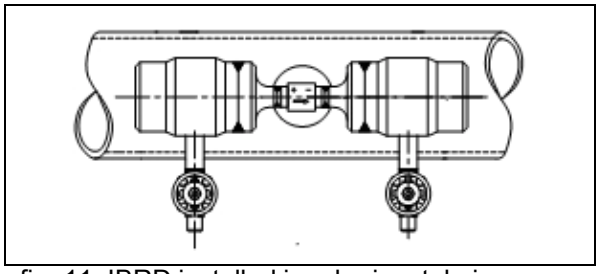


fig. 11: IBRD installed in a horizontal pipe

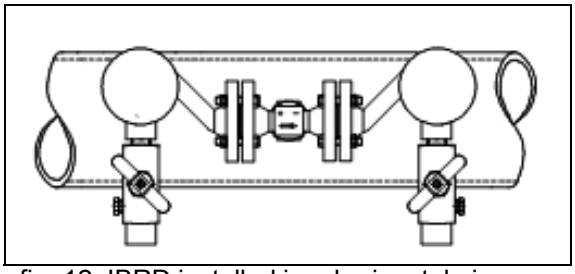


fig. 12: IBRD installed in a horizontal pipe

IBFD:

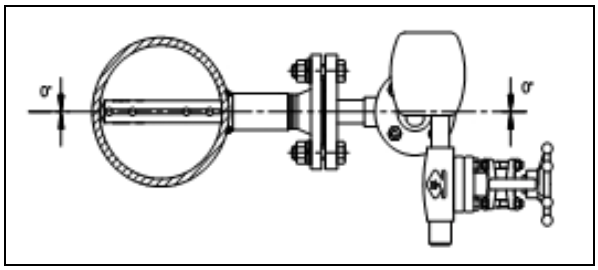


fig. 13: IBFD-25…-K1H-A81 in a horizontal pipe

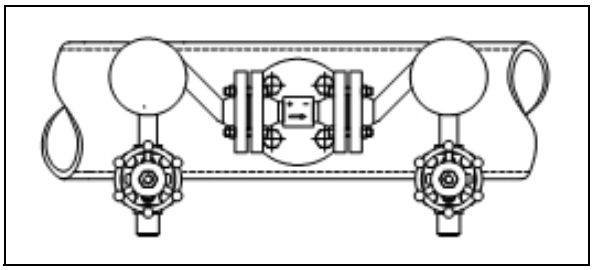


fig. 14: IBFD-25…-K1H-A81 in a horizontal pipe

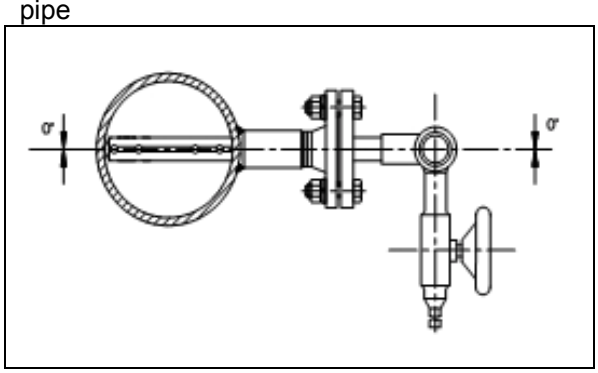


fig. 15: IBFD-25…-K7-A18 in a horizontal pipe

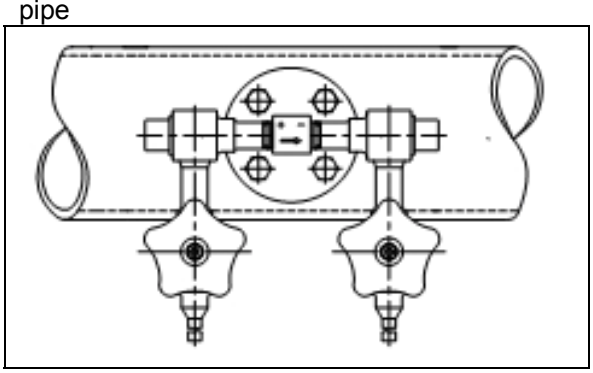


fig. 16: IBFD-25…-K7-A18 in a horizontal pipe

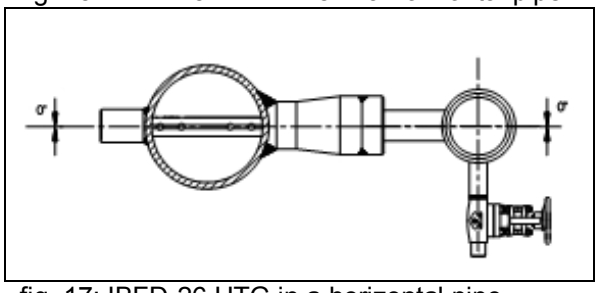


fig. 17: IBFD-26 HTG in a horizontal pipe

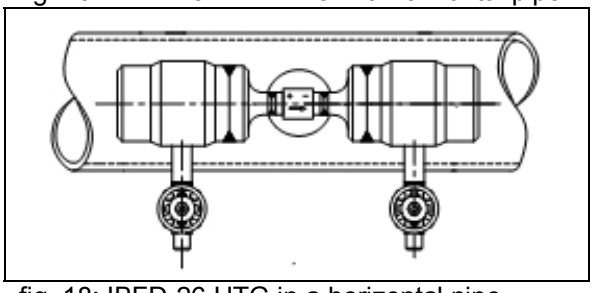


fig. 18: IBFD-26 HTG in a horizontal pipe

7.4 Misalignment

Itabar-Flow-Sensors work on base of simple physical principles. Their construction does not contain moving parts, which can wear out.

The sensor is in-sensitive against slight misalignment. The influence on the accuracy of the measurement is insignificant as long as the tolerances indicate in figures 19 to 24 are being kept.

Only if the the condensate pots deviate by more than 1° from the horizontal line, measurement errors due to the different height of the liquid columns will occur (fig. 23 + 24).

The installation tolerances given in the figures below are valid analogously for vertical pipe arrangements.

IBRD

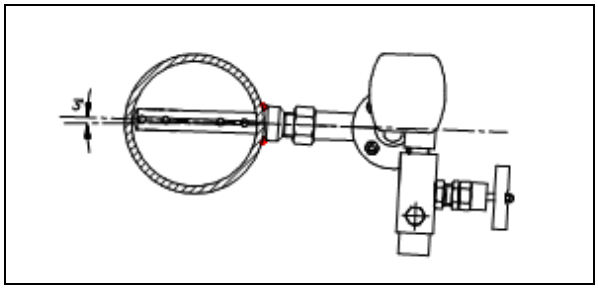


fig. 19

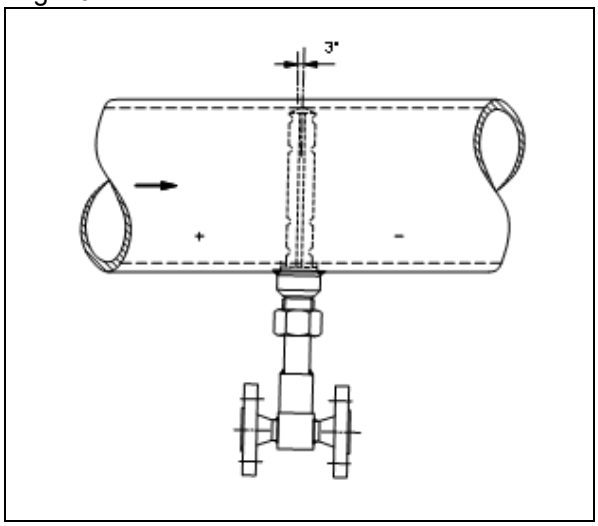


fig. 21

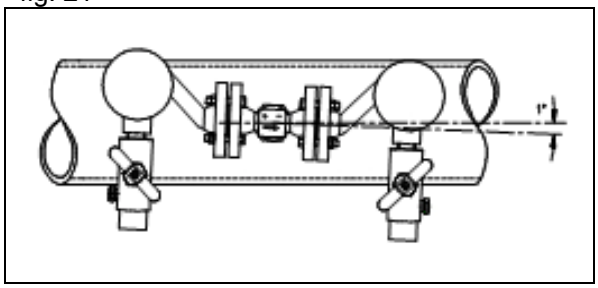


fig. 23

IBFD

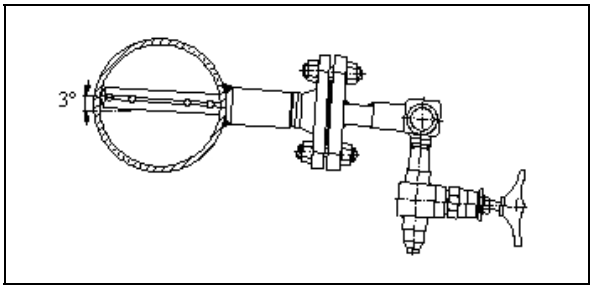


fig. 20

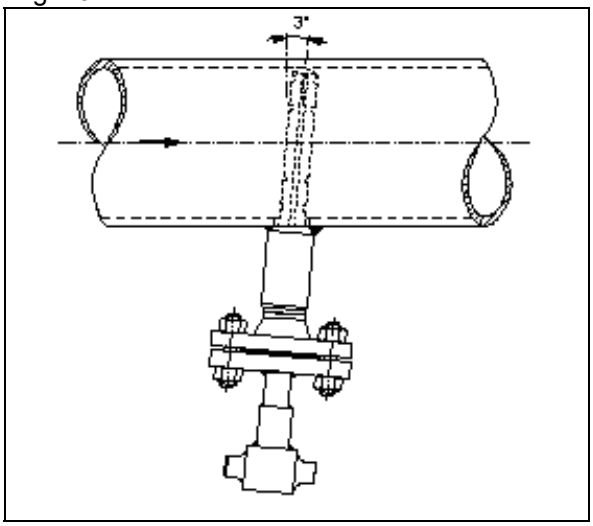


fig. 22

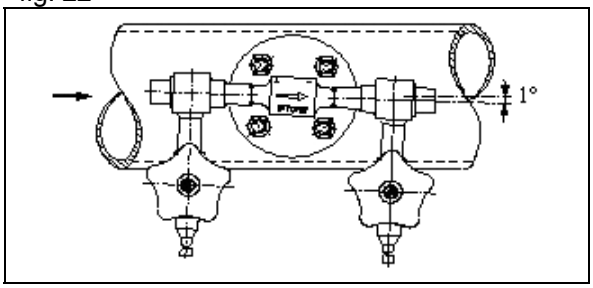
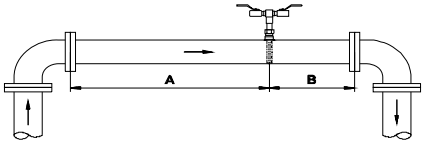
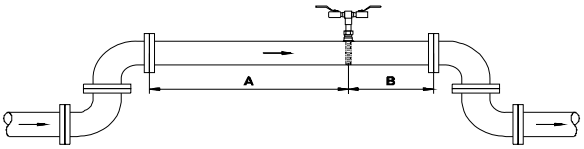
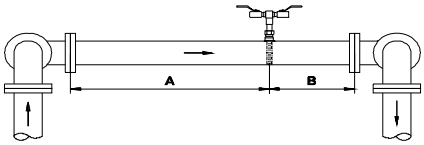
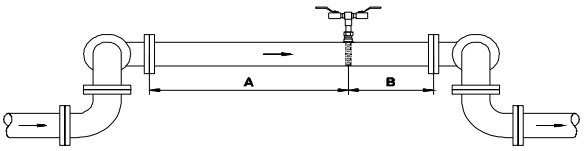
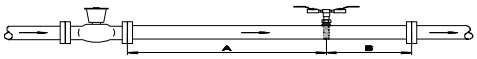


fig. 24

7.5 Required, undisturbed pipe run lengths (in multiples of D)

As the accuracy of the measurement results of the Itabar-Sensor is dependent on a preferably undisturbed flow profile, the choice for an applicable installation spot is very important.
The following in- and outlet pipe runs (tested and proven by practice) shall be halepful for you to chose the right position to install the Itabar.
As a general rule, regulating valves, throttle valves and gate valves should be installed behind ht sensor.
If the given values cannot be fulfilled, the sensor also can be installed behind a pipe elbow, resp. in shorter in- and outlet pipe runs. This, of course, will downgrade the accuracy. In the worst flow conditions it can go down to approx. 3 %.

D= Pipe diameter	A = Inlet	B = Outlet
	7	3
	9	3
	17	4
	18	7
Reduction of pipe **Fehler! Textmarke nicht definiert.**	7	3
Widening of the pipe 	7	3
Control valve 	24	4

NOTE
If the recommended straight pipe lengths are not available, the measurement accuracy can be adapted to the conditions by signal comparison.
Details on request.

ATTENTION!
The illustration of the installation from the topside only is used by means of clearness and understanding. **Steam sensors in general have to be installed horizontally from the side of the pipe.**

7.6 Drill hole size table

Table drill hole size (pipe line):

Sensor Type	Mounting stud	Drill size Installation Sensor (mm)	Drill size End Support (mm)
...-20	DN25PN16 resp. PN 40 or 1“150# resp. 300#	18 mm	
	DN25PN100 resp. PN160 or 1“600#	30 mm	
...-21	DN25PN16 resp. PN 40 or 1“150# resp. 300#	18 mm	15 mm
	DN25PN100 resp. PN160 or 1“600#	30 mm	26 mm
...-25	DN32PN16 resp. PN 40	30 mm	
	DN40, DN50, 1 ½“ and 2“	47 mm	
...-26	DN32PN16 resp. PN 40	30 mm	30 mm
	DN40, DN50, 1 ½“ and 2“	47 mm	36 mm
...-35	DN50 resp. 2“	47 mm	
...-36	DN50 resp. 2“	47 mm	44 mm
...-65	To mount the welding stud, measure the inside diameter of the stud and drill a hole of that size into the pipe line. To mount the end support (...-66) please act analogously.		
...-66			

8. Installation of the Itabar-Flow-Sensor

Differing from other suppliers, the Itabar-Flow-Sensor for steam **always has to be installed horizontally** and also always has condensate pots at the sensor head. Similar to the steam measurement with orifices condensate ports are used to ensure a controlled condensing out. The enlarged fluid surface reduces the influence of continuous condensation and vaporization to a minimum. Excess condensate runs back into the sensor, where it vaporizes again. Of course it has to be strictly observed that the condensate pots are arranged in balance. In that case the condensate columns will not influence the measurement results at all. Looking at the sensors of other suppliers, you will immediately recognize how the installation arrangement and the missing condensate pots lead to the following problems:

- The recommended installation from below the pipe leads to generation of condensate columns up to the lower side of the lowest measuring hole in the profile. the cross section of the fluid's surface is so small that just one drop of condensate leads to considerable fluctuations in the condensate column which is transferred to the transmitter's diaphragm.
- The generated forces on the condensate columns on the + and – side of the profile are different in addition.
- Warm condensate and continuous steam load lead to a bad temperature gradient in the sensor head and, in addition, generate level fluctuations in the condensate columns.
- Slight deviation from the exact vertical installation in case of installation from below the pipe and condensate in the T-piece of the sensor head, the mechanical deviation in the sensor head is transferred to the condensate columns. This inclined position cannot be adjusted anymore, as the sensor is welded onto the pipe

NOTE

Itabar-Flow-Sensors for steam measurements in **no case shall be mounted from top into the pipe!**

When the flow sensor type IBFD will be installed from top of the pipe it is impossible to eliminate all air bubbles from the sensor profile and the condensate pots. So the pressure cannot be transmitted to the diaphragm anymore. On one side the pressure energy gets lost by changing to friction energy. Additionally system energy gets lost by conversion to potential energy – this energy conversion is eliminated by horizontal installation, as all material is located at the same altitude. By the immense energy conversion considerable errors in measurement can be generated. In the worst case, no differential pressure can be registered, even though there is steam flow in the pipe.

WARNING

Follow all general safety and installation instructions strictly! For mounting, wear appropriate safety clothes and shoes in every case.

8.1 Steam Sensors type IBRD (threaded process connection)

8.1.1 Steam Sensors type IBRD-20/21, -25/26

8.1.1.1 Operational Conditions

Itabar-Flow-Sensors type IBRD can be used under the following conditions:

Operating pressure:	max. 16 bar @ 200°C
Nominal pipe diameters:	DN40…DN1000

8.1.1.2 Installation of an Itabar Sensor type IBRD without end support (IBRD-20/25)

1. Drill a hole (diameter according to your type of sensor in relation with “Table Bore diameters (pipe line)” on page 11 of this manual) into the pipe.
2. Before welding, remove the cutting ring (2) from the weld socket (1) in order to protect it from thermal stresses which are generated by welding process. The pressure nut (3) remains threaded onto the weld socket during installation (compare Fig. 9.1a (page 12)), to prevent damage of the thread.
3. Tack the weld socket onto the pipe leaving approx. 2mm clearance. Align the socket (e.g. with a bolt or pin) so that it is exactly perpendicular to the pipe axis.
4. Now the final welding can be carried out. Check the alignment of the weld socket again! For permissible deviations, please see chapter 8.4.
5. Now the Itabar-Sensor can be installed into the pipe. Remove the pressure nut (3) form the weld socket (1) and slip it over the sensor tip (4). Slip the cutting ring (2) over the sensor tip also (The smaller half points upwards!). Then insert the sensor tip together with the pressure nut and the cutting ring into the weld socket until the sensor tip touches the opposite pipe wall.
6. Check the seating of the cutting ring and lightly tighten the pressure nut.

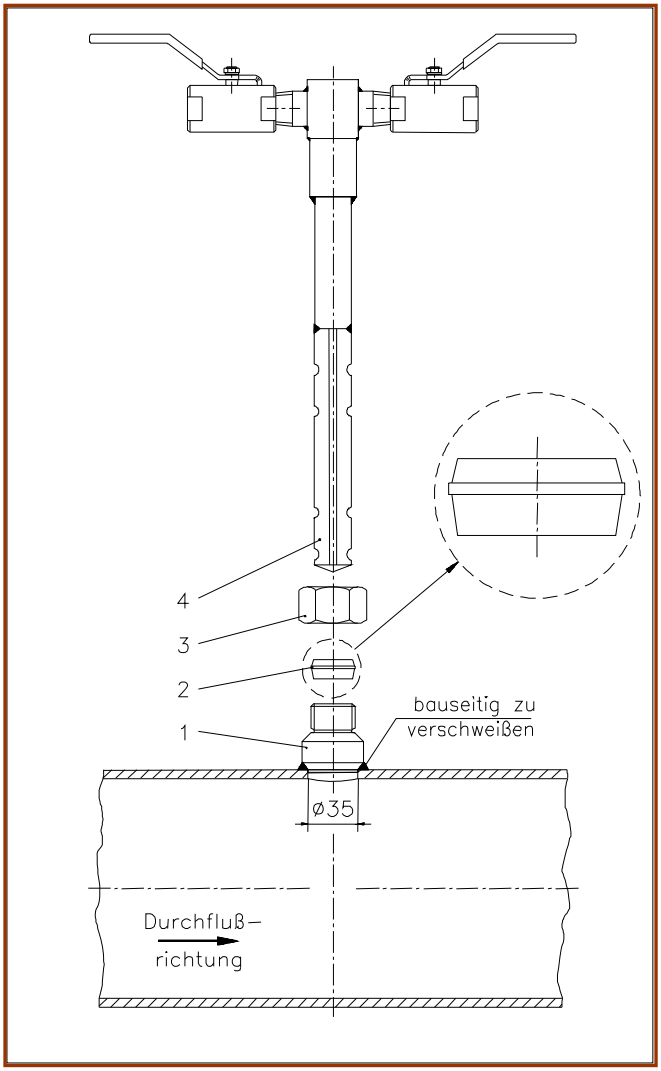


fig. 25

7. Align the Itabar®-Sensor so that the arrow on the sensor exactly points in the flow direction. Tighten the pressure nut. Check the alignment again! Should the sensor be misaligned, loosen the pressure nut and repeat the last installation step.
8. Now the condensate pots can be mounted. Pay attention that the gasket must be mounted centric, so that full passage will be possible.

8.1.1.3 Installation of an Itabar Sensor type IBRD with end support (IBRD-21/26)

The design of the ITABAR sensor types IBRD-21/26 is almost identical to the types IBRD-20/25. The only difference is the end support for types IBRD-21/26/36 (see Fig. 9.1a), which permits higher stream velocities in the pipe. Except for the installation of the sensor end support, the installation steps are identical to those for type IBRD-20/25/35.

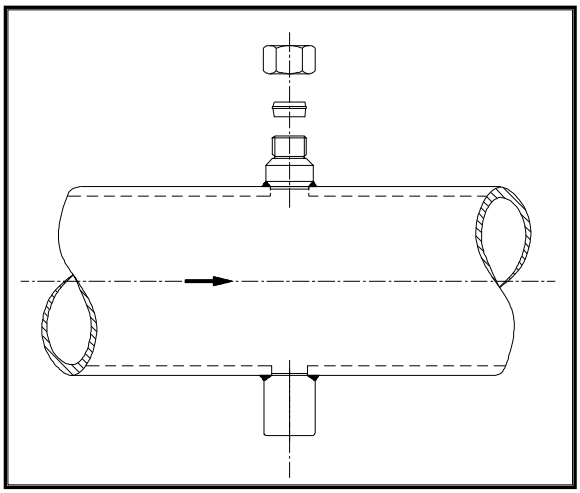


fig. 26

1. Install the weld socket, cutting ring and pressure nut as already described under chapter 8.1.1.2, points 1 to 7.
2. Take a cord and tie one end around the existing welding stud. Wrap the other end around toe pipe so that it forms a loop around the pipe. Mark the half-way point of the pipe circumference on the pipe.
3. Now drill a second hole (diameter: see table on page 11 of this manual) into the pipe.
4. Tack the sensor end support onto the pipe leaving approximately 2 mm clearance.
5. Insert the sensor into the pipe and check the alignment of the sensor end support. If necessary, correct the alignment.
6. Now the finish weld can be performed.
7. Perfom the installation of the sensor into the pipe according to the instructions given in chapter 8.1.1.2, points 5 to 7.

8.2 Steam Sensors type IBFD (flanged process connection)

8.2.1 Steam Sensors type IBFD-20/21, -25/26, -35/36, -65/66

NOTE
Please check carefully that the dimension from the flange gasket surface to the pipe is conforming the H-Dimension given with your purchase order. see fig. 26.

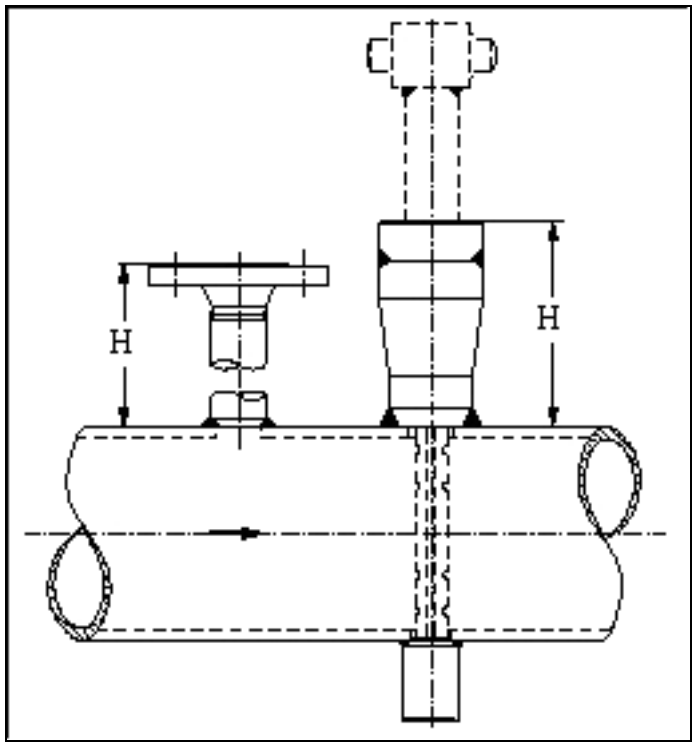


fig. 27

For Itabar-Flow-Sensors type IBFD the following standard H-Dimensions are available:

IBFD-20/21	80 mm	+ ISO (insulation, if existant)
IBFD-25/26	127 mm	
IBFD-35/36	150 mm	
IBFD-HAT	200 mm	

8.2.1.1 Operational Conditions

Itabar-Flow-Sensors type IBFD can be used under the following conditions:

max. operating pressure:	100 bar
max. operating temperature:	450°C
nominal pipe sizes:	DN40…DN1000

8.2.1.2 Installation of an Itabar Sensor type IBFD without end support (IBFD-20/25/35/65)

1. Drill a hole with diameter according to table „Drill hole size“ on page 12 into the pipe.

2. Tack the mounting stud onto the pipe, leaving a clearance of 1-2 mm. The bolting holes of the flange have to be located in an angle of 45° to the pipe axis (see fig. 28). For flanges with 8 bolting holes angle of 22,5° to the pipe axis is neede (see fig. 29). Check the horizontal alignment of the mounting stud.

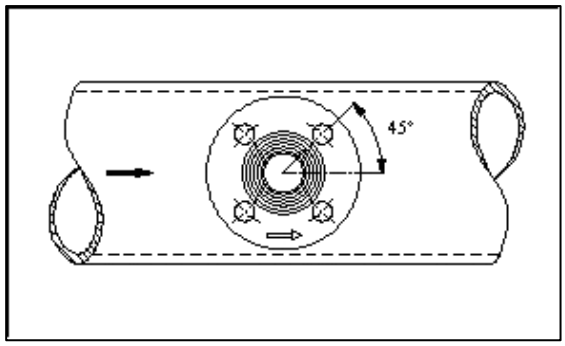


fig 28

3. Pay attention to hte H-dimension while welding the mounting stud.

4. Check again the alignment of the stud – this is very important fort he correct arrangement of the condensate pots. Now, the finish welding can be done.

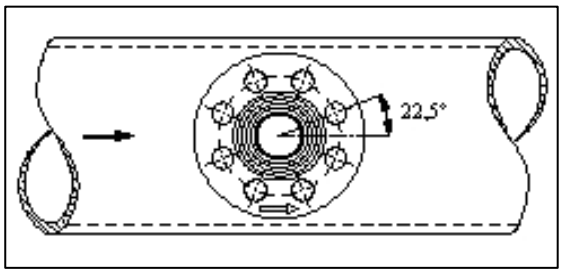


fig 29

5. Now, the installation of the Itabar-Sensor can be done. For that, lay the attached gasket onto the sealing face of the flange. Isert the sensor into the mounting stud and take care that the arrow on the sensor head points to the flow direction. Provisionally fasten the bolts and nuts.

6. Now, the arrangement of the condensate pots has to be checked. The instrument connections have to point downwards. Check by means of a water level, if the pots are aligned in a horizontal line. Correct the alignment by loosening the bolts of the mounting flange. Once oyu have achieved the correct alignment, fasten the bolts with the needed torque according to the below table.

Thread	Torque	max. temperature
M12	2,5 - 3 Mkp	300°C
M12	3,5 - 4 Mkp	>300°C
M16	5,5 - 6 Mkp	300°C
M16	9 - 9,5 Mkp	>300°C
M20	11,5 - 12 Mkp	300°C
M20	18 - 18,5 Mkp	>300°C
M24	19 - 19,5 Mkp	300°C
M24	30 - 31,5 Mkp	>300°C

8.2.1.3 Installation of an Itabar Sensor type IBFD with end support (IBFD-21/26/36/66)

The Itabar-sensors of the types mentioned above are nearly identical in construction with the types described in chapter 8.2.1.2. The only difference is the opposite end support (see fig. 30), which allows higher flow velocities in the pipe.

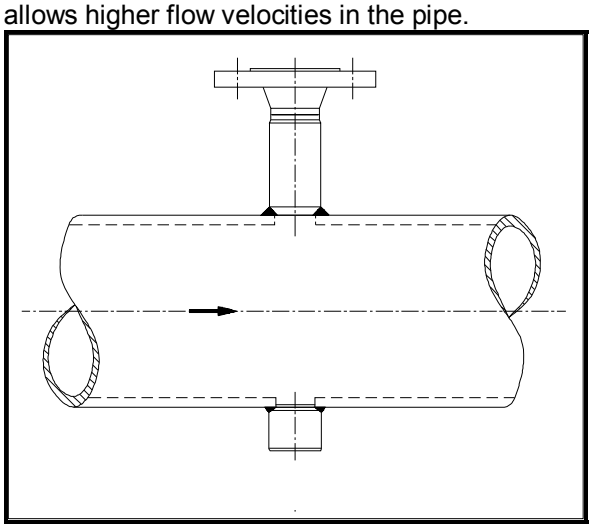


fig. 30 mounting parts sensor IBFD-21/26/36

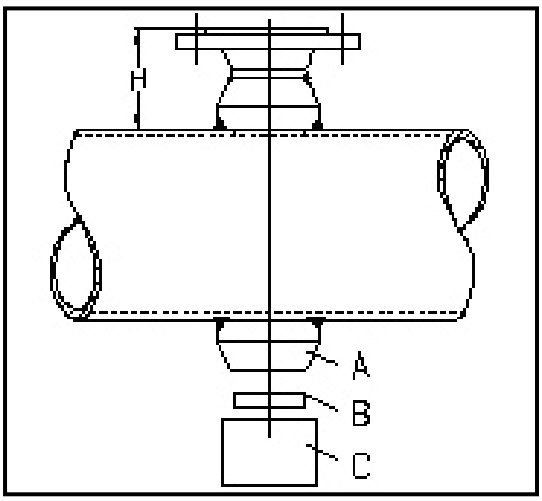


fig. 31 mounting parts sensor IBFD-66

Except the mounting of the opposite end support the steps of the installation are identical to a sensor without end support (chapter 8.2.1.2).

Installation of a sensor with opposite end support:

1. Follow the instructions item 1 to 3 of chapter 8.2.1.2.
2. Take a cord and bend it to the existing mounting stud. Tie the cord around the pipe in a way that a ring around the circumference is generated. Mark the pipe on the half circumference.
3. At the spot of this mark, drill a second hole (diam. acc. to the table on page 13) into the pipe line.
4. Insert the sensor into the pipe and check the alignment. Also check, if the sensor tip sticks 40 mm out ot the second hole. Now put the end support onto the sensor tip.
5. Tack the end support with approx. 1-2 mm clearance onto the pipe line.
6. Extract the sensor.
7. Now, the finish welding of mounting stud and end support can be done.

To mount the sensor, follow the instruction of chapter 8.2.1.2 items 5 & 6.

NOTE

The end support of IBFD-66 a 3-part-construction (fig. 31). For that, act like that: After finish welding of the welding stud mount the sensor again. Now install the ring (item B). If this is not possible, the ring can be machine finished (Tolerance in the welding stud -0,2 mm). After that, you can weld the end cap (item C) onto the welding stud (item A).

8.2.2 Steam sensors IBFD-26/36 HT

Itabar-Flow-Sensors type IBFD-HT are especially applicable for superheated steam with high operational pressures and temperatures due to their design with strengthened sensor head and chosen mounting parts.
In former times the end support was supplied in a one-part-design. Due to this the mounting personnel could not check of the sensor tip fitted free of clearance and without canting in teh end support. So today we supply the end support as a two-part welding construction, containing the welding stud and the end cap. This design guarantees the perfect fitting of the sensor.

NOTE
Please check carefully that the dimension from the flange gasket surface to the pipe is conforming the H-dimension given with your purchase order. (please see fig. 32)

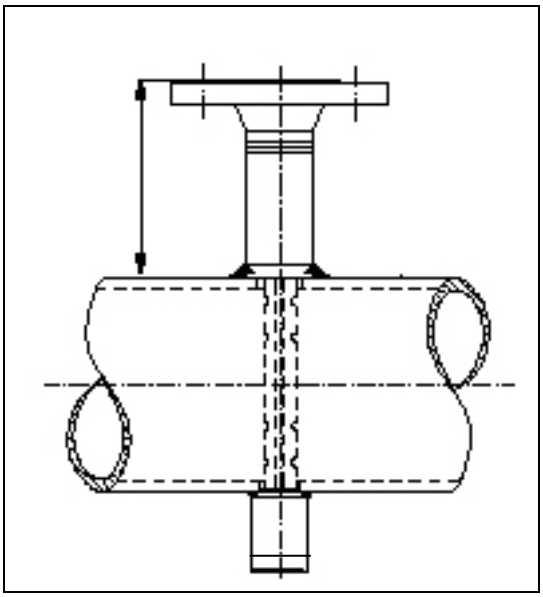


fig. 32: H-dimension for IBFD-HT-sensor

For Itabar-sensors type IBFD-HT the standard H-dimension is 200 mm.

For the needed bore diameters please refer the table on page 13.

8.2.2.1 Operational conditions

Flow sensors of type IBFD-HT can be used under the following conditions:
- max. op. pressure: 400 bar
- max. op. temperature: 650 °C

for nominal pipe sizes DN40 to DN1000.

8.2.2.2 Installation of an Itabar®-Flow-Sensor type IBFD-HT

1. Drill a hole acc. bore diameter table on page 13 into the pipe line.

2. Tack the mounting stud with 4 mm clearance to the pipe. The bolting holes of the flange have to be located in an angle of 45° to the pipe axis (see fig. 9). For flanges with 8 bolting holes an angle of 22,5° to the pipe axis is needed (see fig. 10). Check the horizontal alignment of the mounting stud.

3. Observe the H-dimension while welding the mounting stud.

4. Take a cord and bend it to the existing mounting stud. Tie the cord around the pipe in a way that a ring around the circumference is generated. Mark the pipe on the half circumference.

NOTE
The accurate alignment of the flow sensor is deciding for the accuracy of the later measurement. So please spend considerably much time for step 4.

5. At the spot of this mark, drill a second hole (diam. acc. to the table on page 13) into the pipe line.

6. Tack the end support stud with a 4 mm clearance onto the pipe (opposite to the mounting stud). Insert the sensor into the mounting stud. The sensor tip should slide into the end support. The inserted length (surface pipe to end of the profile) should be 98 mm. **Take good care that the sensor tip neither is canted nor that it is pressing to one side of the end support. It should be cerntered without clearance.** Your can check this by sliding the end cap onto the end-support-stud. This should be possible without big efforts. In case that this is not possible, the alignment of the end-support-stud has to be corrected. Now the final welding of the end-support-stud with the pipe and of the end-cap and the stud can be done.

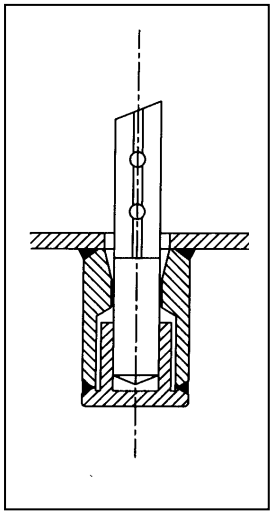


fig. 33: End support IBFD-HT, two-part welding construction

7. Now, the installation of the Itabar®-sensor into the pipe can be done. For that, lay the attached gasket onto the sealing face of the flange. Insert the sensor into the mounting stud and take care that the arrow on the sensor head points to the flow direction. Provisionally fasten the bolts and nuts.

8. Now, the arrangement of the condensate pots has to be checked. The instrument connections have to target downways. Check by means of a water-level, if the pots are aligned in a horizontal line. Correct the alignment by loosening the bolts of the mounting flange. Once you have reached the correct alignment, fasten the bolts with the needed torque according to the table on page 15.

8.2.3 Steam sensors IBFD-21/26/36/66 HTG

The Itabar®-sensors of the types mentioned above are designed as complete welding constructions for very high pressures and temperatures. The mounting stud and the sensor are made as a complete welding construction, to avoid any leaks. If a dismantling of the senor is needed, just the welding seam between sensor and stud has to be cut (fig. 14). In former times the end support was supplied in a one-part-design. Due to this the mounting personnel could not check of the sensor tip fitted free of clearance and without canting in teh end support. So today we supply the end support as a two-part welding construction, containing the welding stud and the end cap. This design guarantees the perfect fitting of the sensor.

NOTE
Please check carefully that the dimension from the flange gasket surface to the pipe is conforming the H-dimension given with your purchase order. (please see fig. 12)

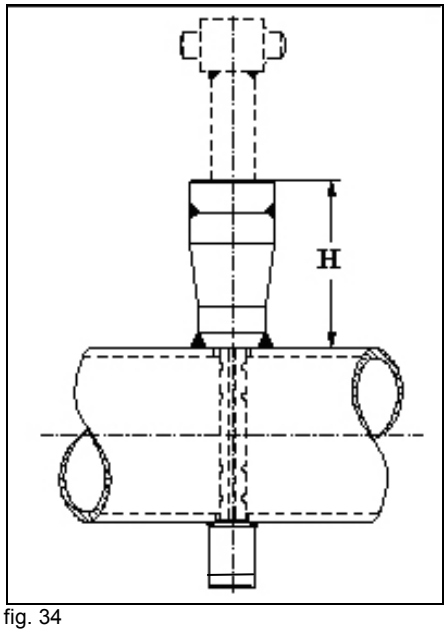


fig. 34

For Itabar®-sensors type IBFD-HT the standard H-dimension is 168 mm.

For the needed bore diameters please refer the table on page 13.

8.2.3.1 Operational conditions

Flow sensors of type IBFD-HT can be used under the following conditions:
- max. op. pressure: 400 bar
- max. op. temperature: 650 °C

for nominal pipe sizes DN40 to DN1000.

8.2.3.2 Installation of an Itabar®-Flow-Sensor type IBFD-HTG

1. Drill a hole acc. bore diameter table on page 13 into the pipe line.

2. Take a cord and bend it to the existing mounting stud. Tie the cord around the pipe in a way that a ring around the circumference is generated. Mark the pipe on the half circumference.

3. At the spot of this mark, drill a second hole (diam. acc. to the table on page 13) into the pipe line.

4. Insert the sensor including the mounting stud into the pipe and tack the mounting stud with a 4 mm clearance to the pipe. Check the alignment of the stud and the H-dimension. Also please check whether the sensor tip sticks out of the hole on the opposite end by 98 mm.

5. Tack the end support stud with a 4 mm clearance onto the pipe (opposite to the mounting stud). Insert the sensor into the mounting stud. The sensor tip should slide into the end support. The inserted length (surface pipe to end of the profile) should be 98 mm. **Take good care that the sensor tip neither is canted nor that it is pressing to one side of the end support. It should be cerntered without clearance.** Your can check this by sliding the end cap onto the end-support-stud. This should be possible without big efforts. In case that this is not possible, the alignment of the end-support-stud has to be corrected. Now the final welding of the end-support-stud with the pipe and of the end-cap and the stud can be done.

6. Now the finish welding between sensor and pipe can be done..

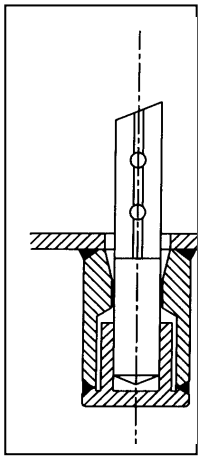


fig. 35 end support HTG-Sensor (two-part welding construction)

8.2.3.3 Dismantling of an Itabar®-Flow-Sensor type IBFD-HTG

If needed, the welding seam between sensor and stud can be cut fro dismantling the sensor.
As the end support has been manufactured with a clearance of only 0,5 mm to the profile, due to an improper welding during the installation it may have occured that the profile was welded to the end support. In this case the end support also has to be cut carefully.

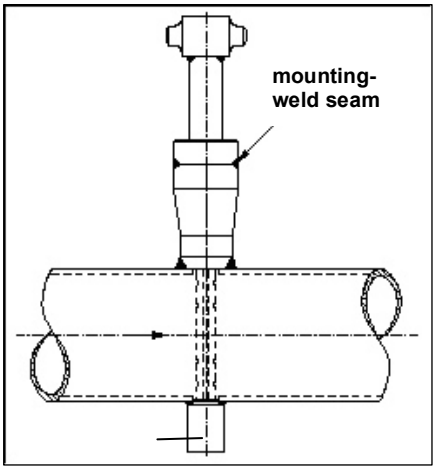


fig. 36 mounting weld seam IBFD-HTG

9. Insulation

One important precondition for a proper function of the Itabar®-sensor is, that the conversion process from steam to condensate only happens in the condensate pots. In the sensor head, there has to be steam. Therefore, all parts out of the pipe line, including the sensor head, have to be insulated with an applicable material. This avoids that due to the high temperature difference between sensor profile and environment the condensation process starts in the sensor and the measuring results are falsified by that.
Prior to insulation make sure that the connections + and – for the pressure lines cannot be mixed up. Also please take care that the TAG-plate stays visible.

NOTE
Never insulate the condensate pots and the pressure lines to the Δp-transmitter. The fluid in the pressure lines and in the transmitter has to be in liquid.state of aggregation.

10. Mounting of the differential pressure lines, of the instrument valves and the Δp-transmitter

10.1 Differential pressure lines

The pressure lines must, whereever possible, lead vertical from the condensate pots to the transmitter. Here a minimum length of 1 m is recommended, as the condensate shall cool down in the pressure lines to avoid a too high temperature load for the transmitter. Also the pressure lines should be as short as possible, therefore they should not be longer than 1,5 m. The pressure lines should have a minimum inside diameter of 12 mm.

10.2 Manifold on transmitter

For steam measurements a 5 way-manifold should be applicated. The valves have the following fuctions:

- valves C and D for shut-off at transmitter
- valve E for zero point adjustment
- valves F and G for drain and vent

see fig. 37 and 38

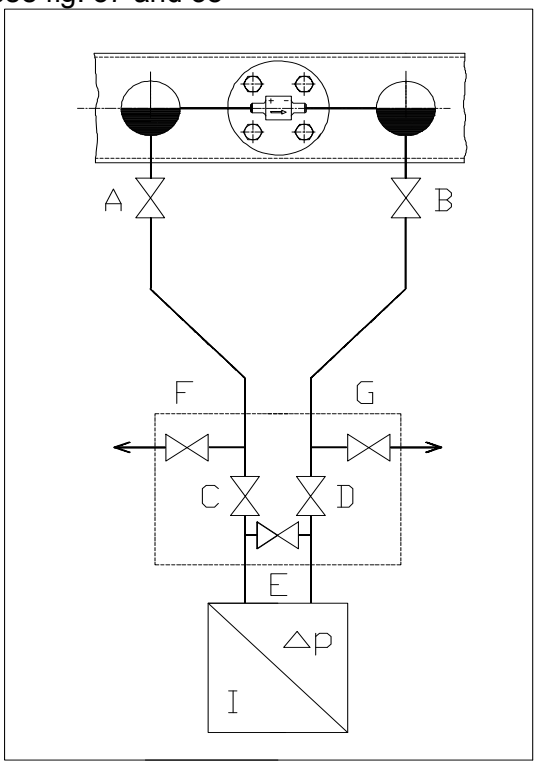


fig. 37 Sensor with condensate vessels K1

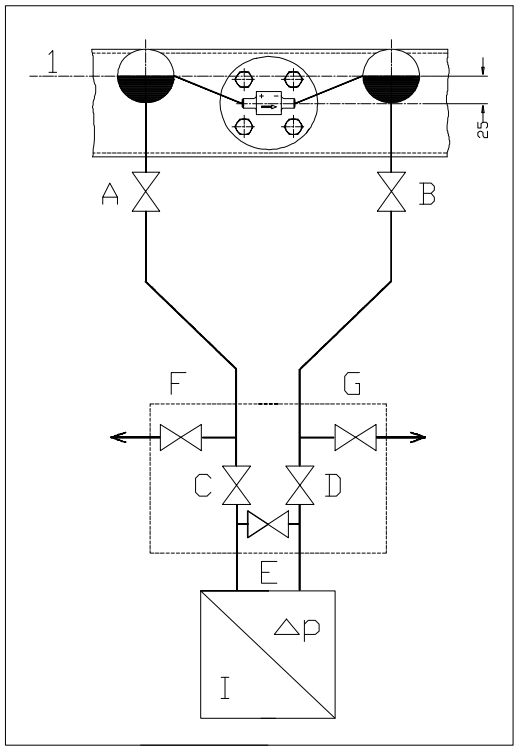


fig. 38 Sensor with condensate vessels K1

10.3 ∆p-transmitter

For steam measurements the differential pressure (∆p) transmitter always has to be installed below the Itabar®-senor, to avoid gas bubbles in the instrument connections. Take care that the transmitter is installed as horizontal as possible. Already a slight deviation from the horizontal line leads to a zero point drift.
It is recommended to arrange the pressure lines from the sensor to the transmitter near to each other resp. to connect + and – line heat conductive with each other.

NOTE
Only apply pressure lines with a minimum inside diameter of 12 mm, as water can generate a max. drop diameter of 6,5 mm (Prandtl, L. „Führer durch Strömungslehre“).

11. Start-up

ATTENTION
Please convince yourself that
- all mounting holes are sealed,
- all mounting parts are fastended completely,
- all instrument valves are closed and
- all valves of the manifold are closed.

1. Fill the transmitter chambers with water after closing of the vent valves of the transmitter.
2. Mount the manifold.
3. Close valves A and B.
4. Loosen Ermeto-threads, pressure threads at the condensate pots.
5. Open all valves of the manifold.
6. Fill in water with a bottle by means of a feed hopper into the pressure lines, until it overflows on the other side. After that, the transmitter, the manifold and the pressure lines are free of air. Possible contingents of trapped air at the upper end of these lines will be pressed out up through the condensate pots, when the pressure lines are connected and the valves A and B will be opened.
7. Connect the pressure lines to the shut-off-valves and close all valves at the manifold.. (Instructions 4-6 cannot be executed on the HTG-design due to it’s construction. Therefore it can be needful to repeat step 21 6 to 8 times)
8. Open both shut-off-valves (A and B) at the pressure taps.
9. Open the equalization valve (E).
10. Wait until the steam in the pressure lines and the condensate pots has condensated.
11. Open slightly pressure valve (C) and vent valve at the “+” chamber of the transmitter until bubble-free condensate comes out.
12. Close vent valve.
13. Open slightly vent valve at “-“ chamber of the transmitter, until bubble-free condensate comes out.
14. Close pressure valve (C)
15. Open slightly pressure valve (D) until bubble-free condensate comes out, then close valve again.
16. Close vent valve at “-“ chamber of the transmitter.
17. Open pressure valve (C) by half a turn.
18. At measurement start 0 mbar check the zero point (4 mA) and, if necessary, correct it.
19. Close equalization valve (E).
20. Open completely pressure valves (C and D).
21. Repeat instructions 8 to 20 2 to 4 times. Make sure that the condensate was generated in the condensate pots and no hot condensate can enter the measuring chambers.

The result of the measurement is only correct when the water columns in the pressure lines have the same level and temperature. The zero point adjustment has to be repeated, when there conditions have been achieved.

ATTENTION
When opening the equalization valve (E) while the shut-off-valves (A and B) and the pressure valves (C and D) are open, too, the transmitter can ce seriously damaged be streaming steam.

12. Preventive maintenance of the Itabar®-Flow-Sensor

Itabar® sensors are insensitive to dirt and soil build-up and therefore nearly maintenance-free. However, if cleaning is required:
- remove the sensor
- flush completely
- hand clean with a soft wire brush

13. Troubleshooting

In case that after start-up of the Itabar®-sensor measuring mistakes may occur, these mistakes can probably be eliminated easily:

Mistake:	***Corrective:***
No differential pressure indication	Check if all shut-off-valves to the Δp-Transmitter are opened. Valve E has to be closed (zero point). Check the alignment of the sensor. The arrow on the sensor head has to point exactly in flow direction.
Unsteady differential pressure	Check if the mounting stud and sensor head have been insulated. If necessary, insulate. Check if the condensate pots have been insulated, too. If necessery, take off the insulation.

NOTE
Itabar-sensors are not applicable for the mass flow measurement of 2-phase-fluids.

Besides the products covered by this brochure, Intra-Automation GmbH also manufactures other high-quality and high precision instruments for industrial measurement tasks. For more information, please contact us (contact details on the backside of this brochure).

Flow measurement

Itabar®-Flow Sensor

IntraSonic IS210 Ultrasonic Flow Meter

Level measurement

ITA-mag. Level Gauge

MAGLINK Level Indicator

Other Measurement Tasks:

DigiFlow Flow and Level Computers

IntraCon Digital Controllers

IntraDigit Digital Indicators / Meters

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