

**INTRA-AUTOMATION GmbH**

MESS- UND REGELINSTRUMENTE



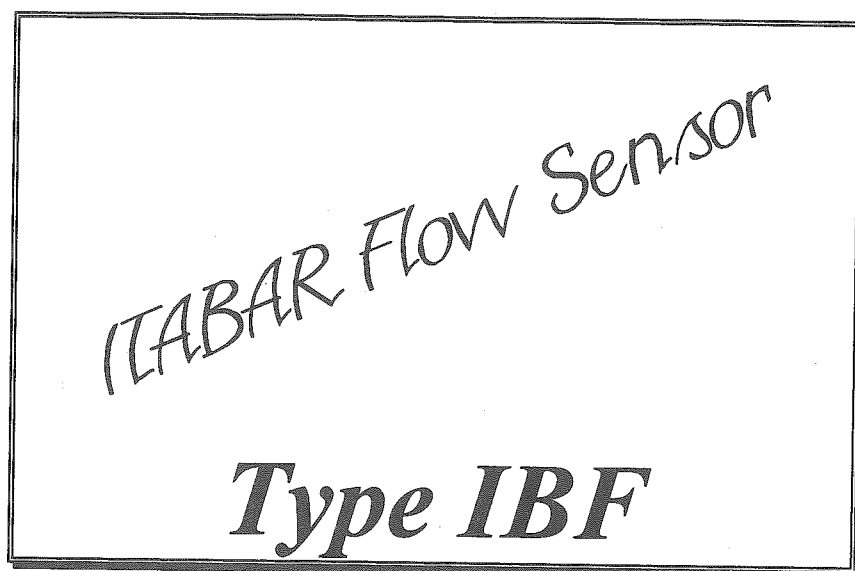
elektronische Meß-  
und Regelinstrumente

ITABAR Flow Sensor Type *IBF*

Operating Manual

ITABAR Flow Sensor

***Type IBF***



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### 1. Principle of flow measuring with ITABAR-Flow-Sensor

If there will be insert a sensor rounded on the face in a parallel stream with velocity  $w$ , damming up of the fluid will be the result. In the middle of this area are streamlines, called damming up streamlines, which will be vertical to the sensor. Velocity of the flow becomes approximately zero at this significant point. Everytime damming up streamlines are laminar. In this case flow measurement can be handle very easy (no friction):

Using the term of Bernoulli, you can calculate:

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

With the patented profil of the ITABAR-Flow-Sensor you can measure the total pressure  $p_{ges}$  upstreams and the static pressure  $p_{stat}$  downstreams. The difference between static and total pressure is:

$$w = (2/\rho p_{dyn})^{1/2}.$$

By knowing the innerside pipe diameter it applies to the term of continuity:

$$V \sim w A.$$

Using a proportional factor, called correction factor  $k$ , you can calculate in accordance with the following formula:

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

This correction factor  $k$  is a value only depending on the ITABAR-Flow-Sensor-Profil. This value has to be find out by INTRA-AUTOMATION empirically.

### 2. Product Description

We congratulate you on your purchase of an ITABAR Flow Sensor type IBF.

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 line is designed to help you with the sensor installation and operation.

### 3. Operating Conditions

ITABAR Flow sensors type IBF can be used under the following conditions:

- Operating pressure: max. 320 bar
- Operating temperature: -50°C to +1000°C
- Nominal Pipe Diameters: DN 40 to DN 12000

The sensor material and the mounting hardware can be specially selected to accommodate special operating conditions. (e.g. corrosive media or extreme temperatures).

### 4. Pre- Installation Checks

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

- ITABAR sensor, type IBF
- Mounting flange with weld stud
- Gasket for mounting flange
- Bolts and nuts
- Sensor end support, closed or with sealing plug (for IBF-21, 26, 36 and IBF-66 only)
- Instrument valve assembly (if ordered)

Compare the specifications on the type identification plate on the sensor with your order form.

The identification plate contains the following information:

- Serial number
- Type name
- Pipe inside diameter
- TAG number  
(Measuring location number - if furnished)
- Material
- Flow range

#### ATTENTION!

You must make sure that the pipe inside diameter given on the identification plate matches your pipe diameter.

### 5. General Installation Notes

In order to obtain optimal measurement results, follow the notes concerning the installation of the ITABAR sensor given below.

#### 5.1 Determination of Pipe Arrangement

For design reasons, the pipe arrangement at the installation location has to be known before the sensor is manufactured.

On sensors for horizontal pipe arrangements the instrument connections are placed in-line with the flow direction. (see figure 1)

For vertical pipe arrangements, the connecting studs for the measurement of the differential pressure are arranged at 90°C angle to the flow direction. (see figure 2)

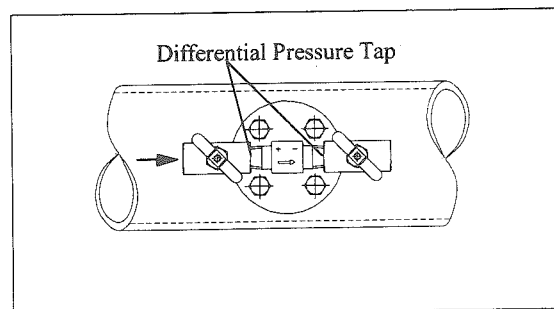


Fig. 1: Horizontal pipe run

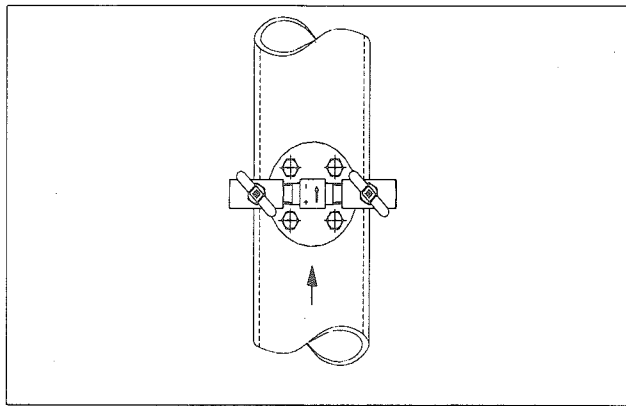


Fig. 2: Vertical pipe run

The flow direction is indicated in each case by the arrow on the sensor head.

### 5.2 Vertical Pipe Arrangement

The ITABAR sensor for flow measurement of liquids and gases can be installed in vertical pipe runs at any location, however, the instrument connections have to be located in the same horizontal plane (see figure 3).

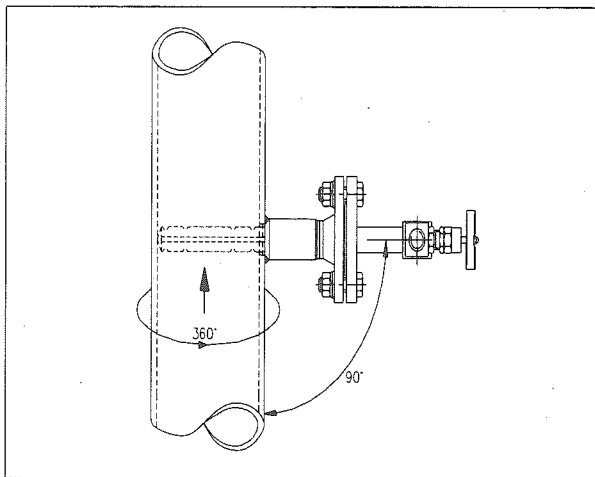


Fig. 3: Installation for vertical pipe run for liquids or gases

### 5.3 Horizontal Pipe Arrangement

#### Liquids:

For flow measurements of liquids, the ITABAR sensor must be installed in the lower half of the pipe circumference; the connections to the instruments have to be located below the pipe axis. This way, gas or air bubbles which may have found their way into the connections or the instruments will return into the flowing liquid. (see figure 4)

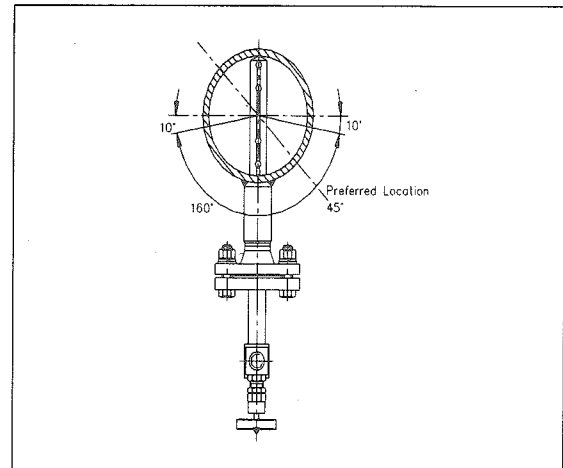


Fig. 4: Installation in horizontal pipe runs for liquids

#### Gases:

For flow measurements of gases, the ITABAR sensor must be installed in the upper portion of the pipe diameter. This will prevent moisture or condensation from entering the instrument connections and altering the measurement. (see figure 5)

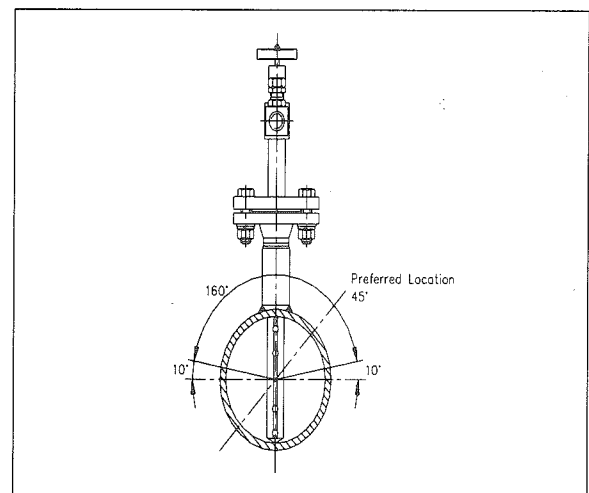


Fig. 5: Installation in horizontal pipe runs for gases

#### 5.4 Misalignment

The ITABAR sensor operates on the basis of simple physical principles.

Its design incorporates no moving parts which are subject to wear.

The sensor is not affected by being slightly out of alignment.

The influence on the accuracy of the measurements is negligible as long as the limits indicated in Figures 6, 7 and 8 are not exceeded.

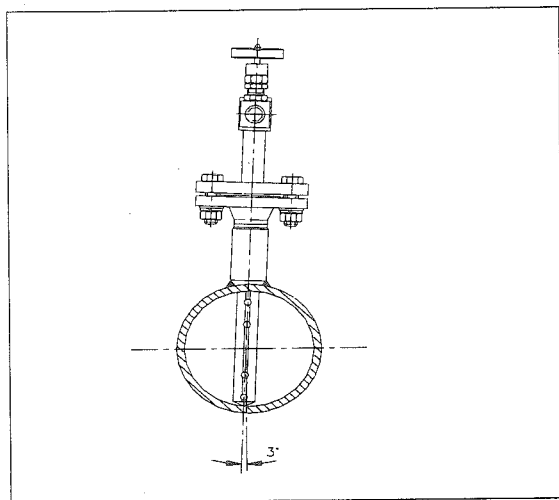


Fig. 6

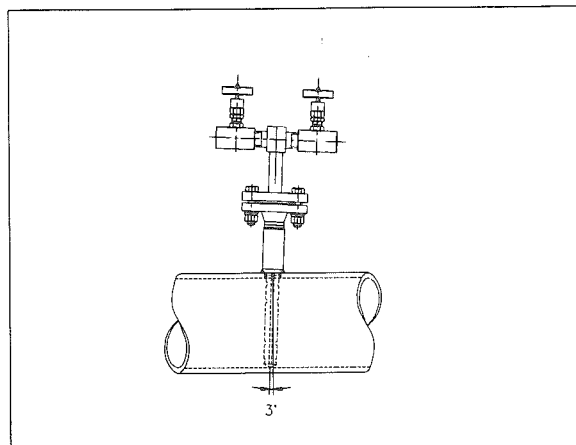


Fig. 7

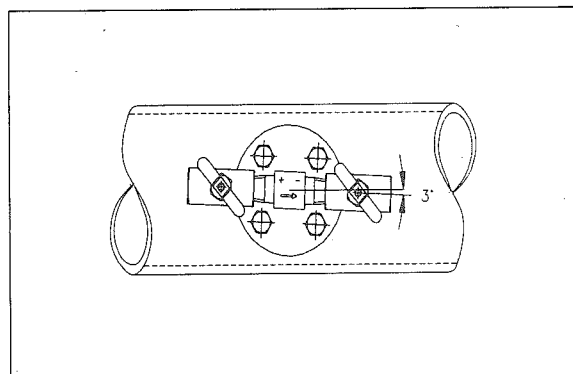


Fig. 8

### 5.5 Required Undisturbed Pipe Run Lengths (in multiples of D)

The accuracy of the measurements of the ITABAR sensor depends on the development of a stream profile which should be as undisturbed as possible. Therefore the selection of the installation location within the pipe run is of considerable importance.

The following tried and true hints regarding the required pipe lengths ahead of and behind the sensor are designed to help you in your selection of the most advantageous installation location.

As a general rule, regulating valves, throttle valves, and gate-type valves should be installed behind the sensor.

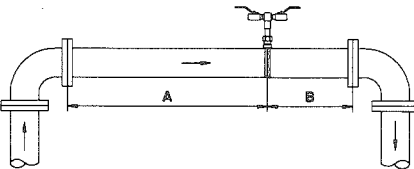
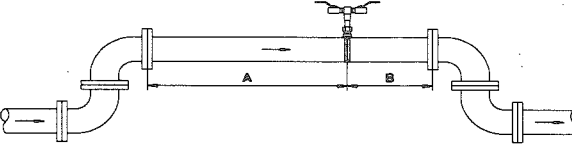
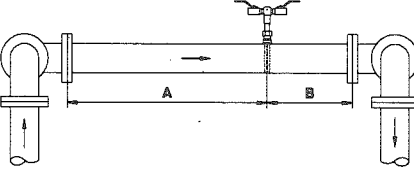
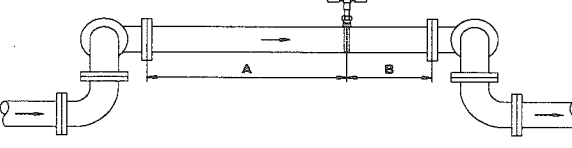
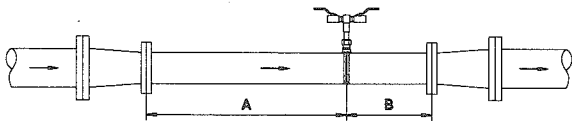
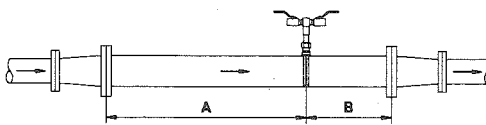
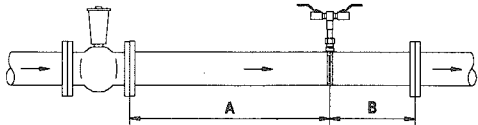
#### NOTE:

If the recommended straight pipe run lengths are not available, the measuring accuracy can be adjusted to the specific conditions of the measuring stretch by conducting a comparison measurement.

The measurement guarantees that the differential pressure corresponds to the true flow velocity, thereby assuring the specified accuracy.

Details can be requested from the manufacturer.

D=Pipe Diameter

	A=Upstream	B=Downstream
	7	3
	9	3
	17	4
	18	4
Restriction in the Pipe Run 	7	3
Widening of the pipe Run 	7	3
Regulating Device 	24	4

## 6. Installation of the ITABAR-Sensor

Observe the general installation notes!

It is particularly important to make sure that the distance from the gasket surface to the pipe agrees with H- dimension you gave in your order (see Fig. 9).

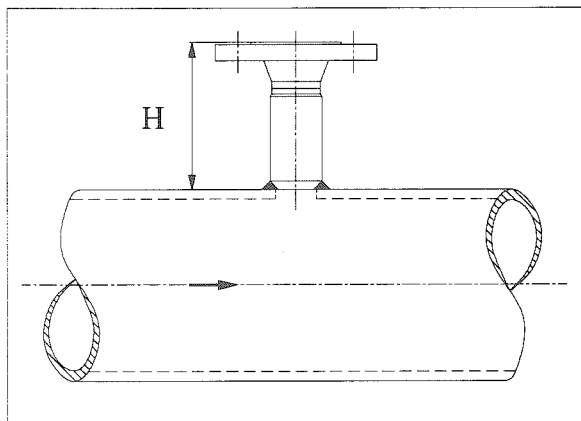


Fig. 9

ITABAR sensors of the type IBF come with the following standard H- dimensions:

IBF-20	80mm
IBF-25/26	127mm
IBF-35/36	150mm
IBF-65/66	146mm

### 6.1. Installation of Type IBF-20

1. Drill a hole of 18mm diameter into the pipe.
2. Tack the mounting stud onto the pipe leaving a clearance of 1-2mm. The bolt holes of the flange must be at 45° angles to the pipe axis (see Fig. 10)

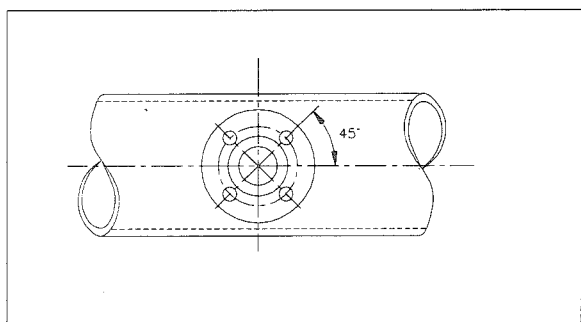


Fig. 10

3. Observe the H- dimension during the welding of the mounting stud (see also Fig. 9).

4. Check the alignment of the mounting stud again. Then the finish weld can be made.

5. Now the ITABAR sensor can be installed into the pipe. Place the included gasket on the gasket surface of the flange. Insert the sensor into the welded stud and make sure that the arrow on the sensor head

point in the flow direction. Tighten the bolts and nuts.

#### Note:

On flanges with eight bolt holes, the welding stud must be welded on, so that the bolt holes in the flange form an angle of 22,5° with the pipe axis (see Fig. 11).

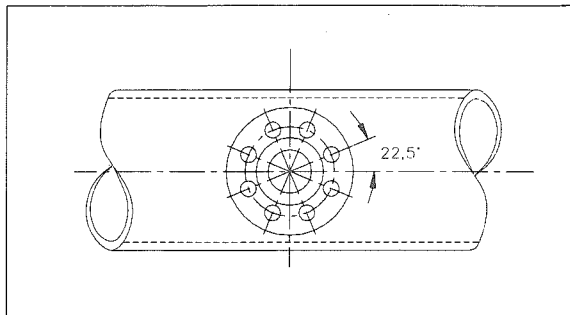


Fig. 11

### 6.2 Installation of Type IBF-21

The design of the ITABAR sensor of the type IBF-21 is almost identical to the type IBF-20. The only difference is the sensor end support (with sealing plug or closed design) on the type IBF-21 (see Fig. 12) which permits higher stream velocities in the pipe.

Except for installation of the sensor end support, the installation steps are identical to those for type IBF-20.

#### Installation of the end support:

1. Install the welded stud as already described under 6.1.
2. Take a cord and tie one end around the existing weld stud. Wrap the other end of the cord around the pipe. Mark the half- way point of the pipe circumference on the pipe.
3. Now drill a second hole of 18mm diameter into the pipe.
4. Remove the sealing plug (if present) of the sensor end support. Tack the sensor end support onto the pipe leaving approximately 2mm 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.

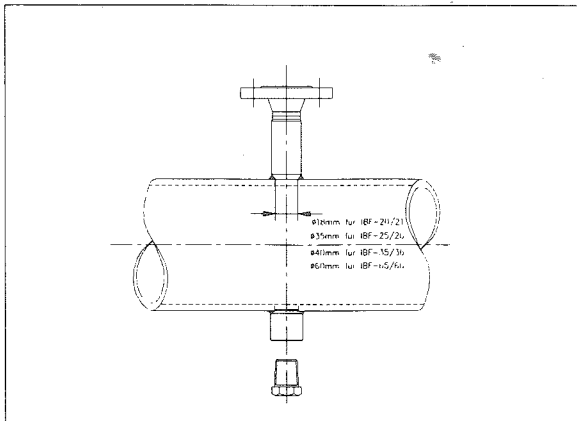


Fig. 12

7. For sensor end support with sealing plug only: Seal the thread of the sealing plug with a suitable sealing compound (e.g. PTFE tape). Screw the sealing plug into the sensor end support and tighten it firmly.

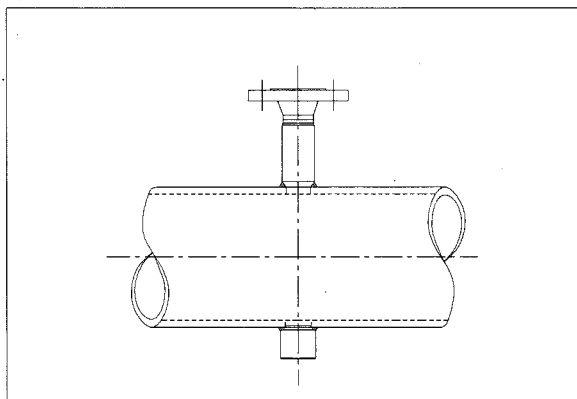


Fig. 12a

8. Perform the installation of the sensor into the pipe according to the instructions given in chapter 6.1.

### 6.3 Installation of Type IBF-25

1. Drill a hole of 35mm diameter into the pipe.

*The subsequent Steps correspond to the installation of the ITABAR sensor type IBF-20 !*

Observe the H- dimension during the welding!  
(see also Fig. 9)

### 6.4 Installation of Type IBF-26

1. Drill a hole of 35mm diameter into the pipe.

*The subsequent Steps correspond to the installation of the ITABAR sensor type IBF-21 !*

Observe the H- dimension during the welding!  
(see also Fig. 9)

### 6.5 Installation of Type IBF-35

1. Drill a hole of 40mm diameter into the pipe.

*The subsequent Steps correspond to the installation of the ITABAR sensor type IBF-20 !*

Observe the H- dimension during the welding!  
(see also Fig. 9)

### 6.6 Installation of Type IBF-36

1. Drill a hole of 40mm diameter into the pipe.

*The subsequent Steps correspond to the installation of the ITABAR sensor type IBF-21 !*

Observe the H- dimension during the welding!  
(see also Fig. 9)

### 6.7 Installation of Type IBF-65

1. Drill a hole of 60mm diameter into the pipe.

*The subsequent Steps correspond to the installation of the ITABAR sensor type IBF-20 !*

Observe the H- dimension during the welding!  
(see also Fig. 9)

### 6.8 Installation of Type IBF-66

The design of the ITABAR sensor of the type IBF-66 is almost identical to the type IBF-21. The only difference is the sensor end support (delivered in two pieces). After successful installation of the end support, the end cap must be weld onto the end support.

1. Drill a hole of 60mm diameter into the pipe.

*The subsequent Steps correspond to the installation of the ITABAR sensor type IBF-21 !*

Observe the H- dimension during the welding!  
(see also Fig. 9)

*Note !*

On long sensors, an installation aid can be screwed into the 1/2" thread of the sensor end (e.g. threaded pipe). This will make it easier to insert the sensor into the opening of the sensor end support and align the sensor.



## 7. Installation of the Attachments and the $\Delta p$ -Transmitter

### 7.1 Instrument valves

The instrument valves for the differential pressure lines are pre-installed by the manufacturer, if it is part of the order.

When installing multi-directional valve block, make sure that all bolts are tightened uniformly and opposite bolts are tightened in sequence.

### 7.2 $\Delta p$ -Transmitter:

For liquid measurements, the differential pressure transmitter should always be installed below the ITABAR sensor in order to avoid the occurrence of air bubbles in the instrument connections (see Fig. 13).

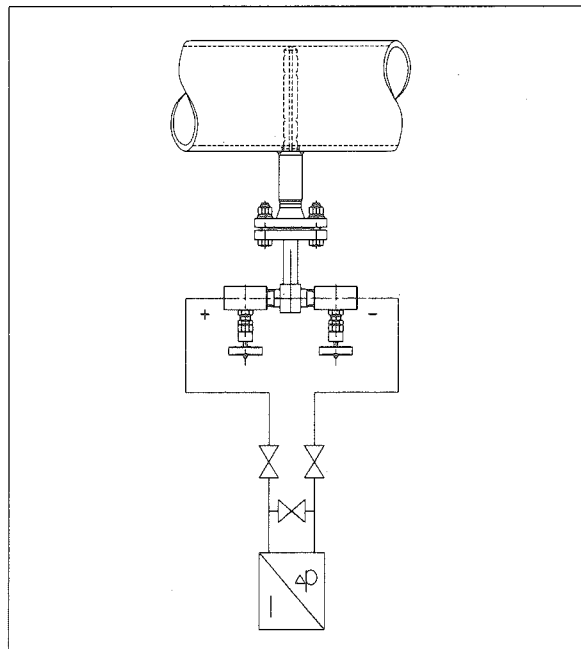


Fig. 13

When measuring dry gases and air, the differential pressure transmitter should always be installed above the ITABAR sensor in order to avoid measurement degradation due to condensation and presence of solid particles (see Fig. 14).

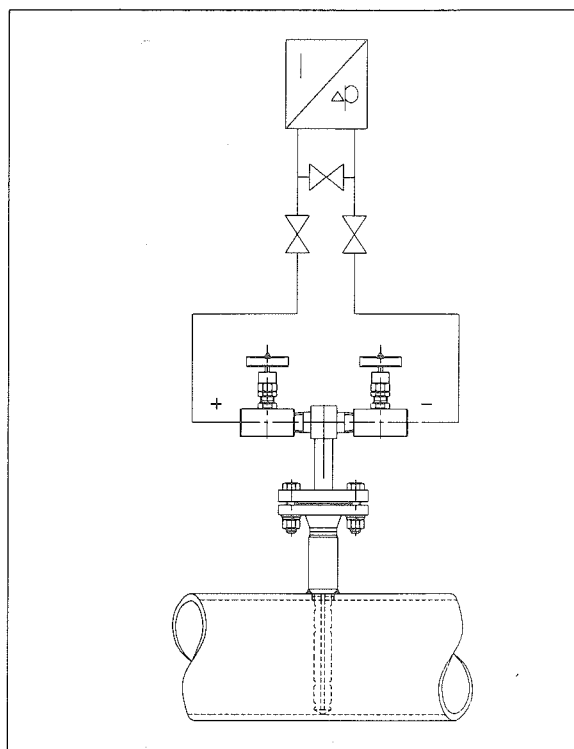


Fig. 14

### 7.3 ITABAR sensor with flange plate

By using of the flange plate version, you can mounting the  $\Delta p$ -transmitters direct onto the flow sensor (s. fig. 15). By this version you don't must install differential pressure lines and screwed connections. In combination with a multi-directional valve block is this version the best solution.

When installing multi-directional valve blocks, make sure that all bolts are tightened uniformly and opposite bolts are tightened in sequence.

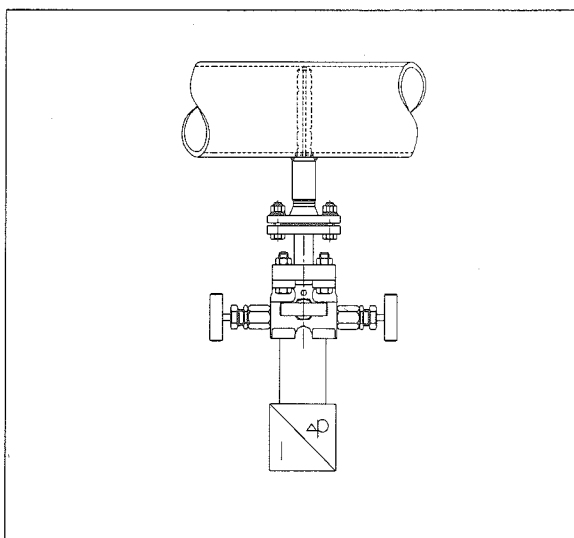


Fig. 15

### 8. Measurement Start-Up

Make sure that:

- all installation openings are closed  
(sensor end support IBF-21 / 26 / 36 / 66).
- all installed parts are securely bolted together.
- all instrument valves are closed.

Now the pipe can be cleared for the appropriate medium

Check all connections, especially the flanges

Then open the instrument valves to the  $\Delta p$ -transmitter.

### 9. Preventive Maintenance of the ITABAR-Sensors

ITABAR sensors are insensitive to dirt and soil build-up and therefore nearly maintenance-free.

### 10. Trouble shooting

If, after the start-up of the ITABAR sensor, any measuring errors occur, they may possibly be corrected quite easily:

*error:*

No differential pressure indication.

*Correction:*

Check whether all instrument valves to the  $\Delta p$  transmitter are opened.

Check the alignment of the sensor with the pipe. The arrow on the sensor must point exactly in the flow direction (downstream).

*Note:*

With highly corrosive media it is possible (if the sensor material has been specifically selected for such operating conditions) that a connection between the plus and minus sides has been formed. This can only be checked after removal of the sensor from the pipe. Close the holes in the sensor rod and blow through both minus and plus connections of the sensor (e.g. with pressurized air). If air emerges from the opposite connection, the sensor is defective. In this case, please notify the manufacturer.