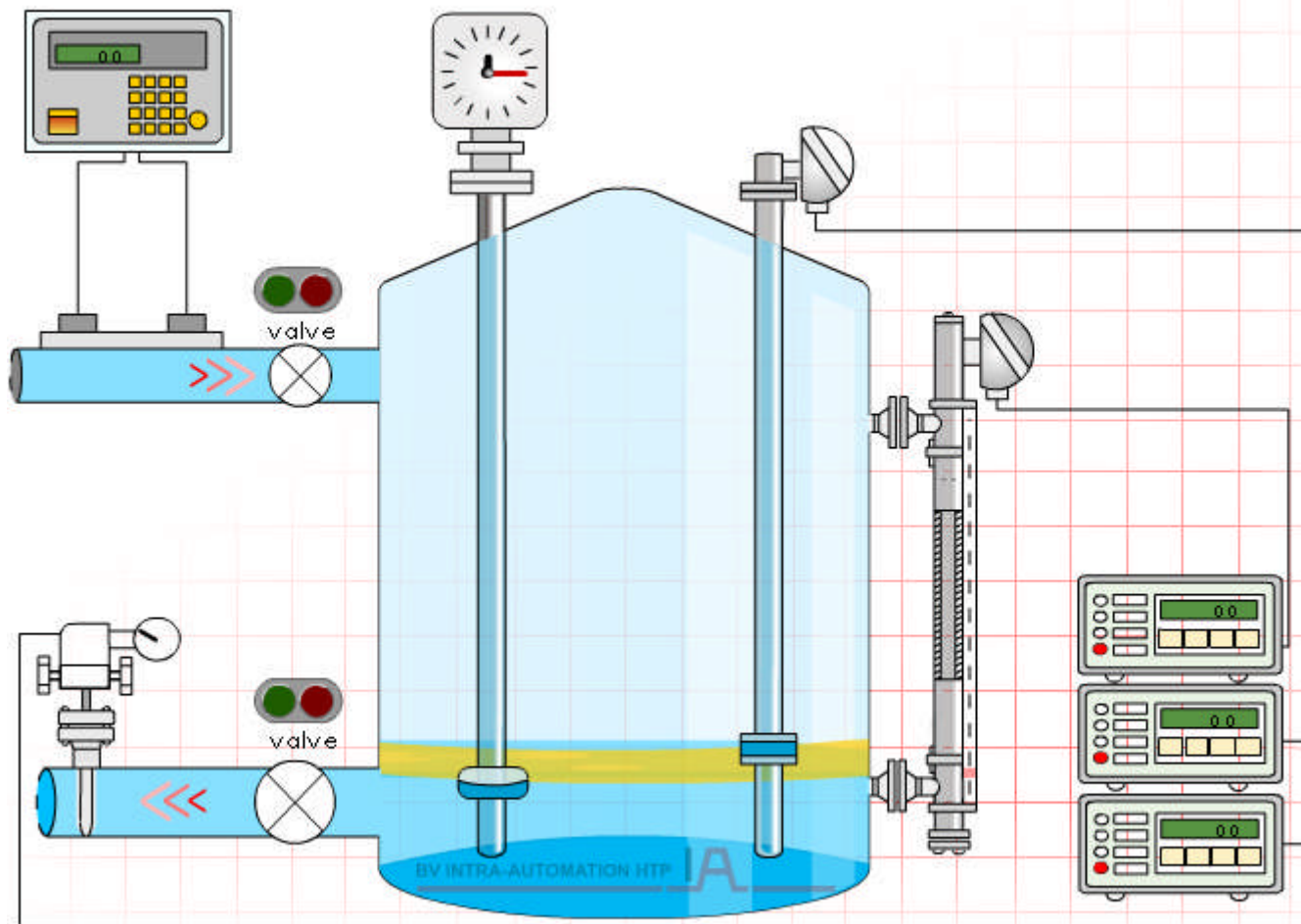


The Company

INTRA AUTOMATION

Quality comes first!



Magnetic Level Gauge ITA

Pitotube ITABAR

Tank Level MAGLINK

Tank Level ITA-T1S

Flowcomputer DiGiFLOW

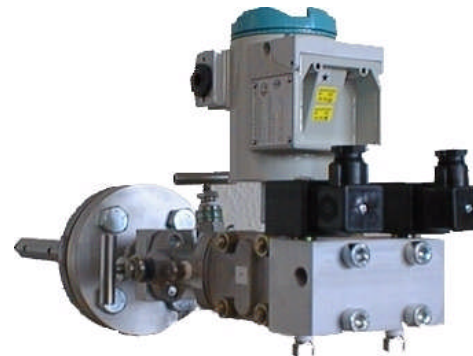
ITABAR[®] : Flow Sensor for Gas, Steam & Liquids

- DP Flow Measurement Operating Principle and Applications
- Pitot Tube vs. Competing Technologies
- ITABAR[®] Design and Performance
- ITABAR[®] Models & Options
- ITABAR[®] Application: Steam Flow Measurement
- ITABAR[®] Flo Tap Versions
- Installation Issues



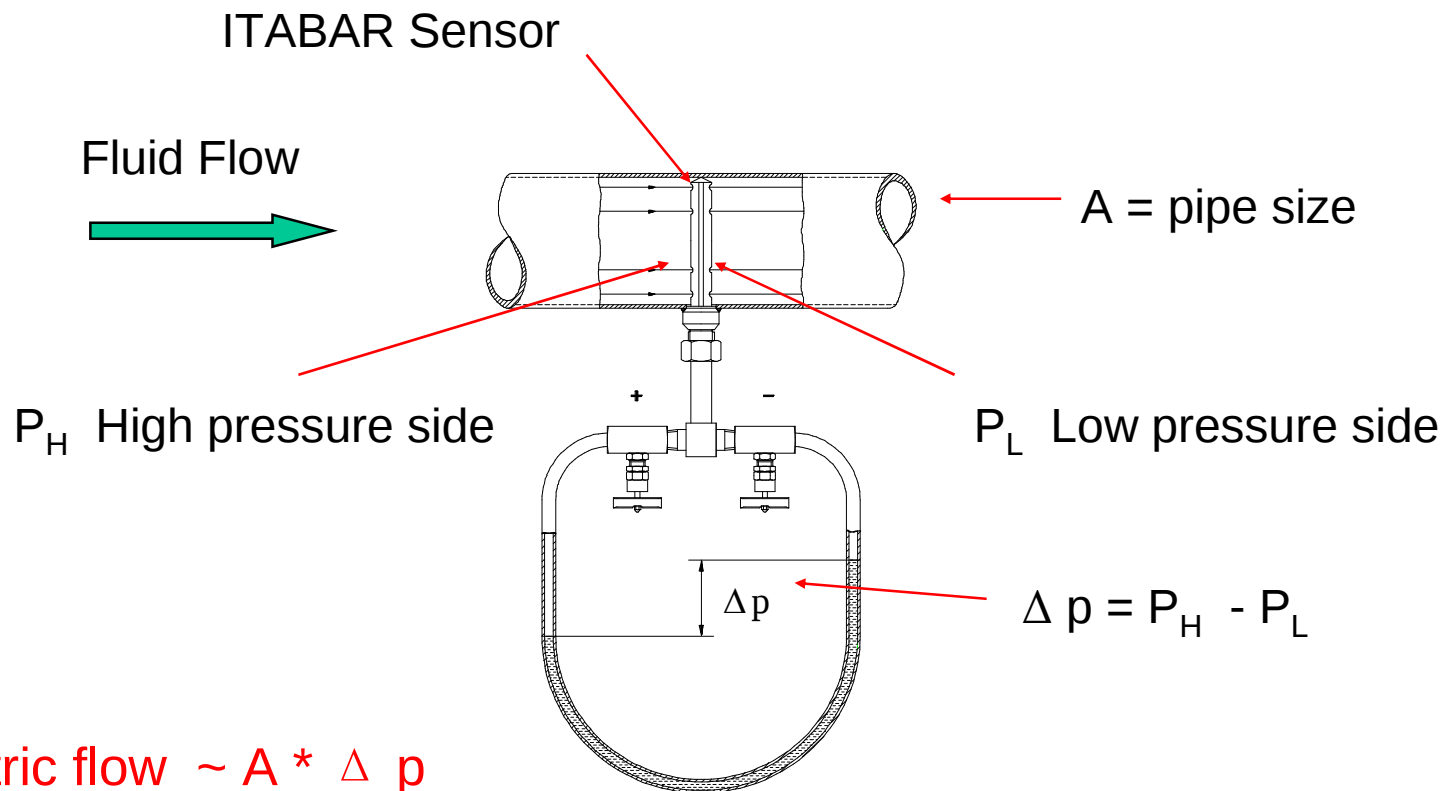


Differential Pressure (DP) Flow Measurement Operating Principle and Applications



ITABAR[®] DP Flow Sensor

Applied Principle: Bernoulli's Equation



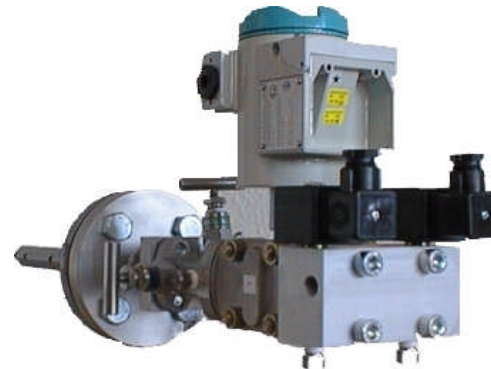
ITABAR[®]

Pitot Tube - Typical Applications

- Energy / Power : gas pipelines, steam boilers, combustion air, cooling water, flue gas, exhaust air, co-gen plants
- Metal Processing Industry: combustion air
- Building Constr./Services : chiller water , air, heating plants
- Chemical Industry : process chemicals, gases
- Pulp & Paper : steam, water, chemicals, boilers, feed water, stack gas emissions, fuel, scrubber balancing
- Petrochemical Industry : gases, process chemicals
- Water : plant water intake, drinking water, municipal water districts, water companies
- Glass Industry : air
- Compressed Air : in any plant



Pitot Tube vs Competing Technologies



INTRA AUTOMATION
MEASUREMENT & CONTROL



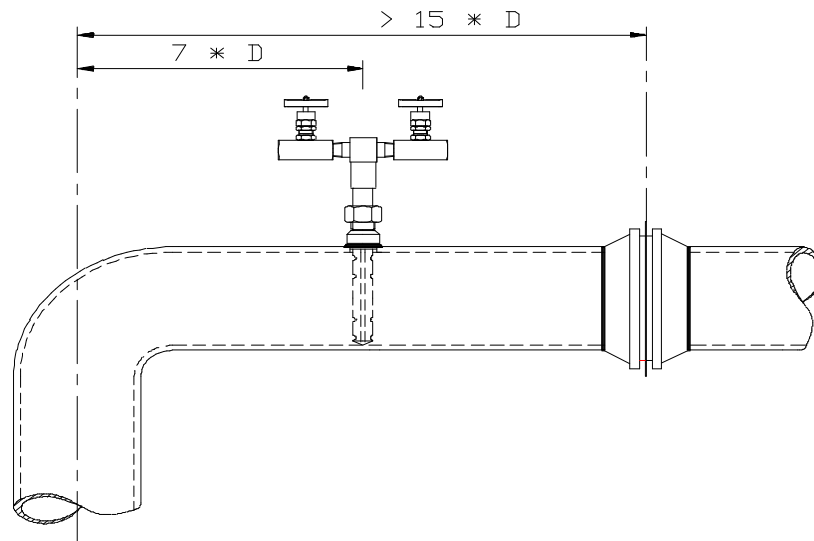
Pitot Tube vs Competing Technologies

	ITABAR DP	Orifice	Venturi	Vortex	Thermal	Turbine	Doppler	Insert Mag
Clean liquids	YES	YES	YES	YES	YES	YES	YES	YES
Dirty liquids	Limited	Limited	Limited	Limited	Limited	NO	YES	Limited
Viscous liquids	NO	Limited	Limited	NO	Limited	NO	Limited	YES
Clean gases	YES	YES	YES	YES	YES	YES	NO	NO
Dirty gases	YES	YES	YES	YES	Limited	NO	NO	NO
Steam	YES	YES	YES	YES	YES	YES	NO	NO
Max pipe size DN	12000	typically < 400		300				

Pitot Tube vs Competing Technologies

	ITABAR Pitot DP	Orifice	Venturi*	Vortex	Thermal
Accuracy % of rate	1%	0.5%	0.25% to 0.5%	0.5% to 1%	1%
Turn down (with single Transmitter)	5 : 1 (split-range: 1 : 27)	5 : 1	10 : 1 (5 : 1)	30 : 1	100 : 1

Pitot Tube vs Orifice Plate: Required Straight Pipe Runs



Example : Required straight runs downstream of elbow

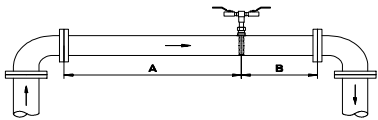
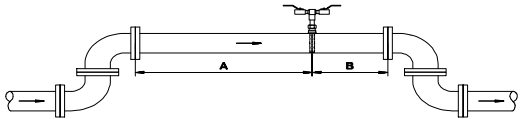
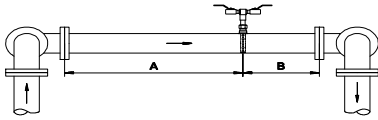
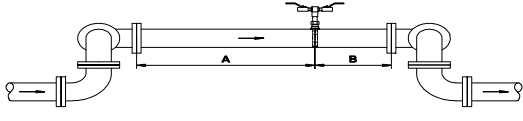
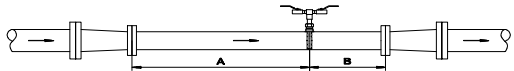
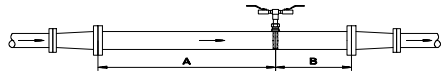
ITABAR: 7 Diam.

Orifice : 15 Diam.

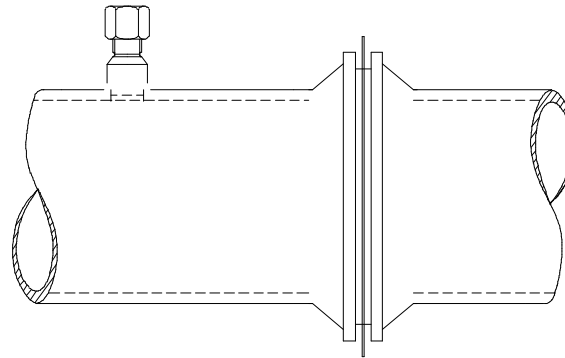
Pitot tube advantage : less straight length

ITABAR[®]

Required Straight Pipe Lengths

D = pipe diameter	A = upstream	B = downstream
	7	3
	9	3
	17	4
	18	4
constriction of the piping 	7	3
expansion of the piping 	7	3

Pitot Tube vs Orifice Plate: Installation Costs



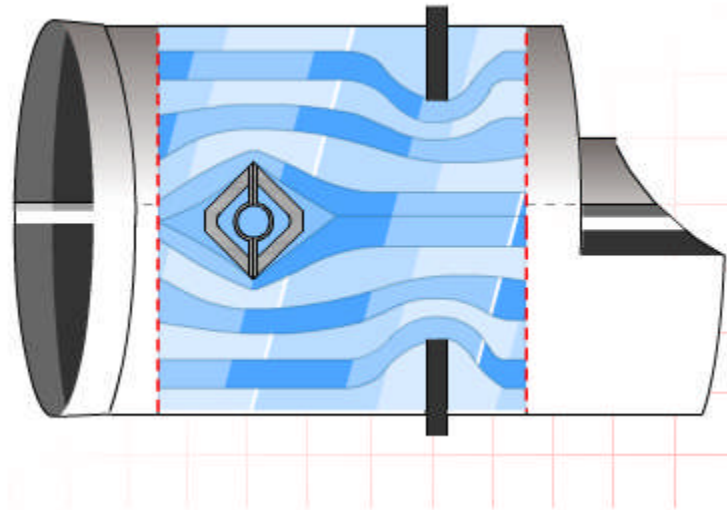
Time required for installation (e.g.: 200 mm pipe)

ITABAR: 1,5 Hrs

Orifice : 12 Hrs

Pitot tube advantage : 80% lower installation costs

Pitot Tube vs Orifice Plate: Pressure Loss



Permanent pressure loss (as % of Δp)

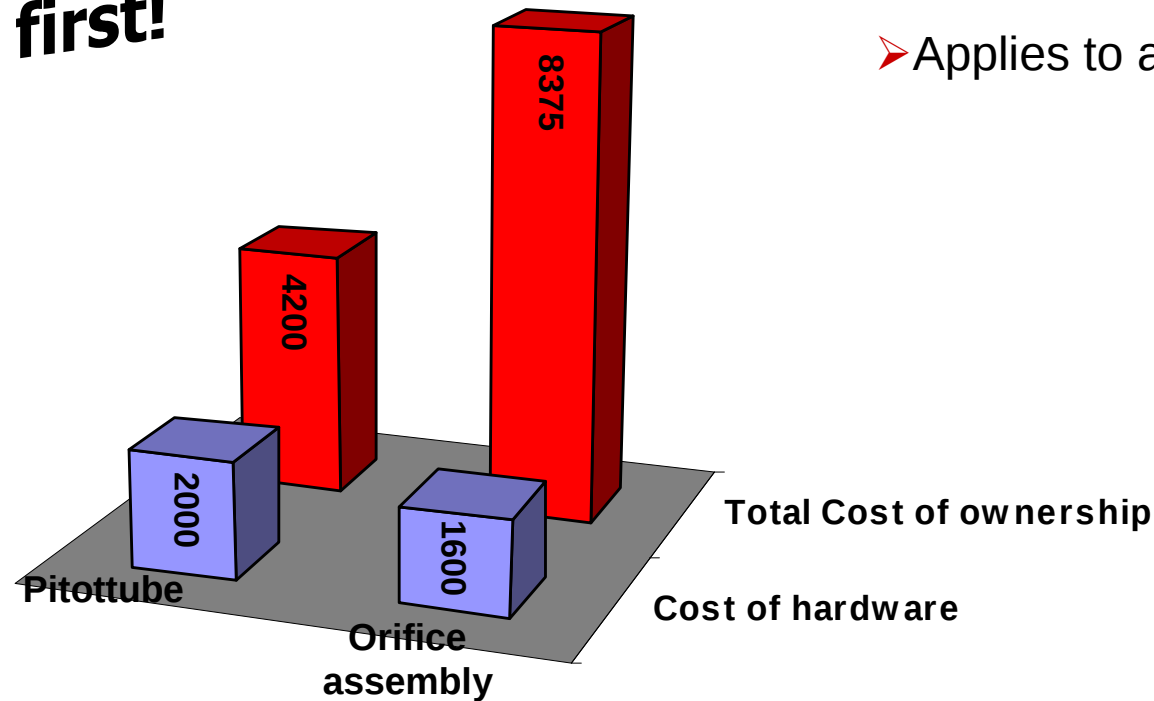
Pitot tube: 5 - 10%

Orifice : 30 - 80%

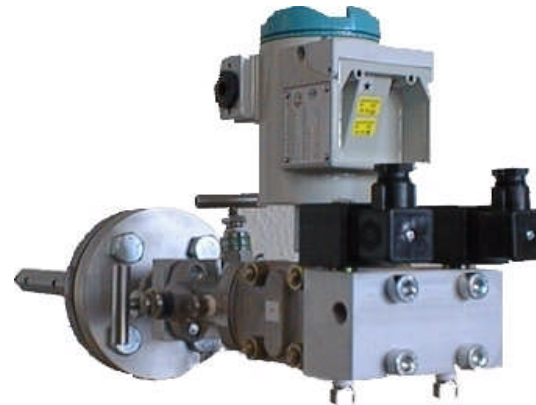
Pitot tube advantage : lower pressure loss = less energy loss

Pitot Tube vs Competing Technologies: Installed Costs

Quality comes first!



➤ Applies to European countries



ITABAR[®]

Differential Pressure Flow Sensor



- Flow measurement for gases, steam & liquids
- In pipe sizes DN 15 through 12000



ITABAR[®]

Special Design Characteristics (1)

Design Feature

- Sensor of single-piece construction :
- Wide sensor profile :
- Multiple pressure sensing holes :
- Wide selection of sensor materials:
- Large diameter sensing ports (8.5 mm):

Advantages

no leakage between hi / lo pressure side

higher delta p (for given flow velocity)

measures across entire flow profile

applicable in aggressive fluids and in high temperature service, mechanical long-term stability

less sensitive to blockage, with purge option

ITABAR[®]

Special Design Characteristics (2)

Design Feature

- Low pressure loss:
- Easy installation assembly :
- Patented double packing support
(for retractables)
- Integral or remote DP transmitter :
- Special application specific sensors:

Advantages

- low energy loss
- via welding sleeves, existing customer
process connections, flow tap options
- better mechanical stability
- flexible and cost saving (no hook-up
required on site)
- best performance for steam & dirty
emissions

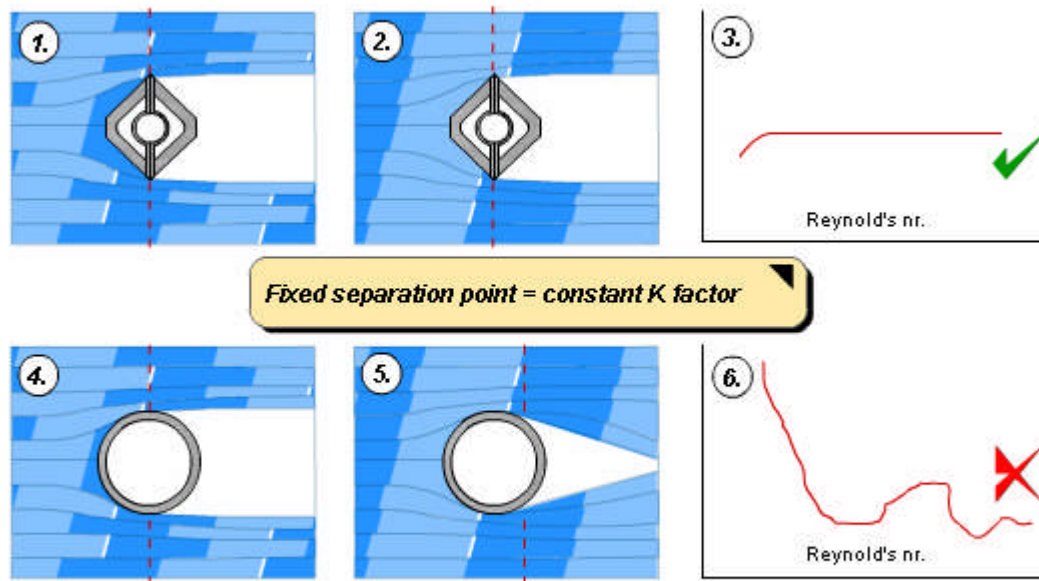
ITABAR[®]

Technical & Performance Characteristics

- Accuracy < $\pm 1\%$ of flow rate
- Repeatability $\pm 0.1\%$
- Pipe sizes : DN 15 to DN 12000
- Operating pressure max. 400 bar
- Operating temperature max. 1200° C
- Max. allowed flow velocity (m/s) : liquids 10, gases 200, steam 60
- Bi-directional use possible
- Sensor materials: St Steel, Hastelloy, Titanium, Incolloy, other to specs
- Optional : integral RTD for mass flow
- Integral or remote mount transmitters

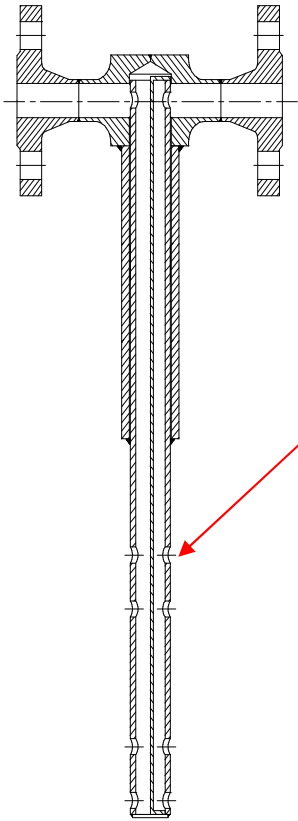
ITABAR[®]

Importance of Sensor Design

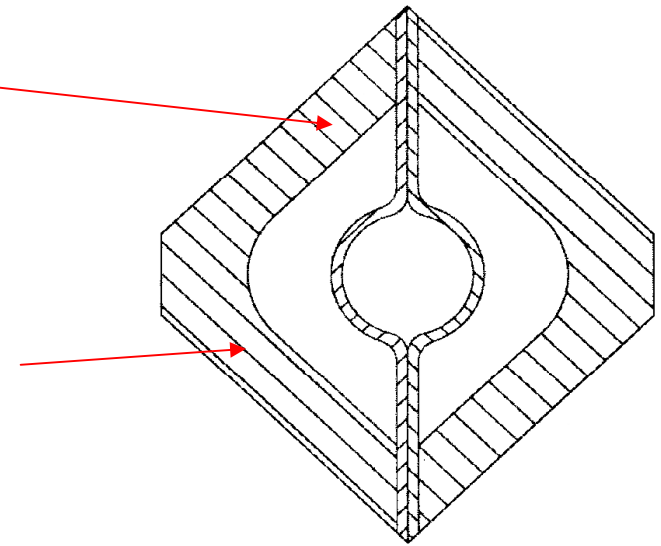


ITABAR[®]

Sensor Design Solution



- Sensor profile
- Symmetrically arranged sensor profile continuous up to instrument connections
- High stability drawn sensor profile, material thickness of up to 5,7mm



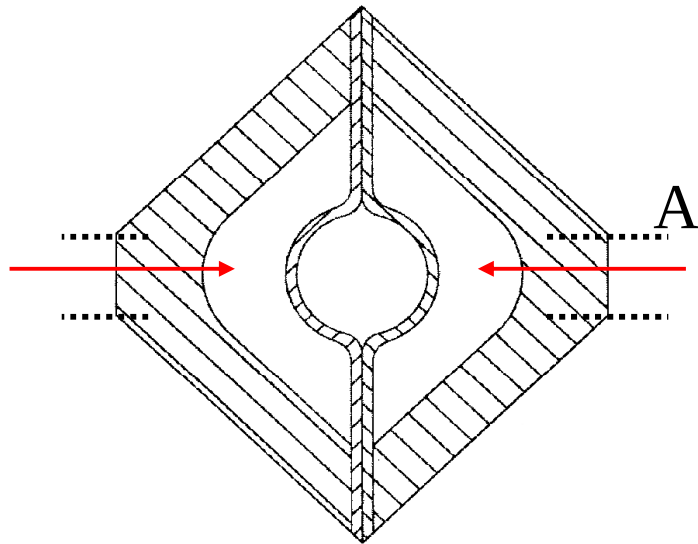
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ITABAR[®]

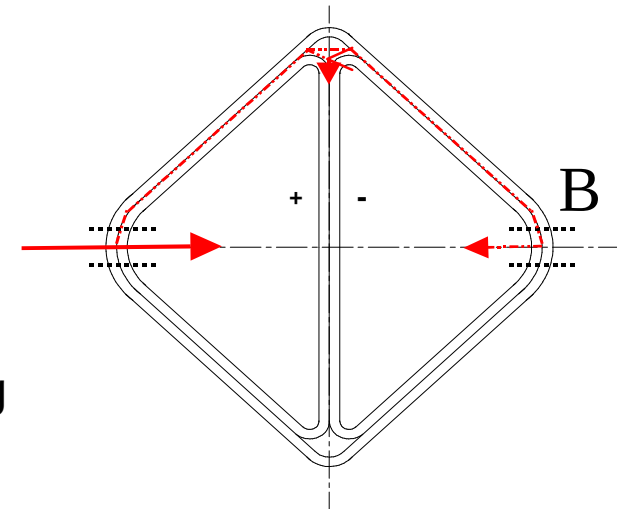
Sensor in Comparison

ITABAR-sensor :
Single-piece welded construction



Changes in temperature have no impact

Annubar* sensor : 3-piece construction



Temperature changes can cause leakages and thus measuring errors

$A \gg B$
larger measurement
entries avoid clogging

ITABAR[®] - profile comparison



	Width of profile	Sharp edge	Defined separation point	RTD in separate thermowell
ITABAR	Large	Yes	Yes	Yes
485 Annubar	Large	No	No	Yes
Diamond	Large	No	No	No
Ellipse	Small	No	No	No
Bullet	Small	No	No	No
Round	Small	No	No	No

ITABAR[®]

Sensor Design Advantage

Fact : ITABAR sensor design delivers higher Delta P

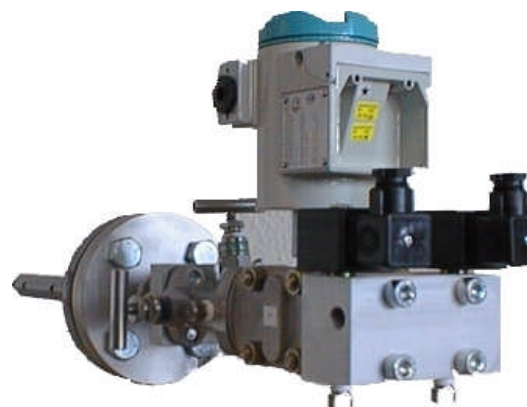
Example : Generated Delta P in 1200 mm line

	<u>ITABAR IBR 25</u>	<u>VERIS V100</u>
Gas flow (m ³ /min) max	27,750	27,750
Delta P (mbar)	0.85	0.68
Performance advantage	24%	

Source : VERIS vs IAA quote 2/21/02



ITABAR[®] Models & Options



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MEASUREMENT & CONTROL



ITABAR[®] Sensor Models

Sensors suited for specific applications

ITABAR[®] Sensor Type Style

Application

IBR
IBF

threaded connection
flanged connection

gas, steam, liquids

FTN
FTM

} flow tap

press.max. 16 / 6 bar g
press.max. 70 / 26 bar g
up to 1200 mm
press.max. 70 / 26 bar g
up to 1800 mm

FTH

IBF-100

double side flanged

special: flue gas emissions

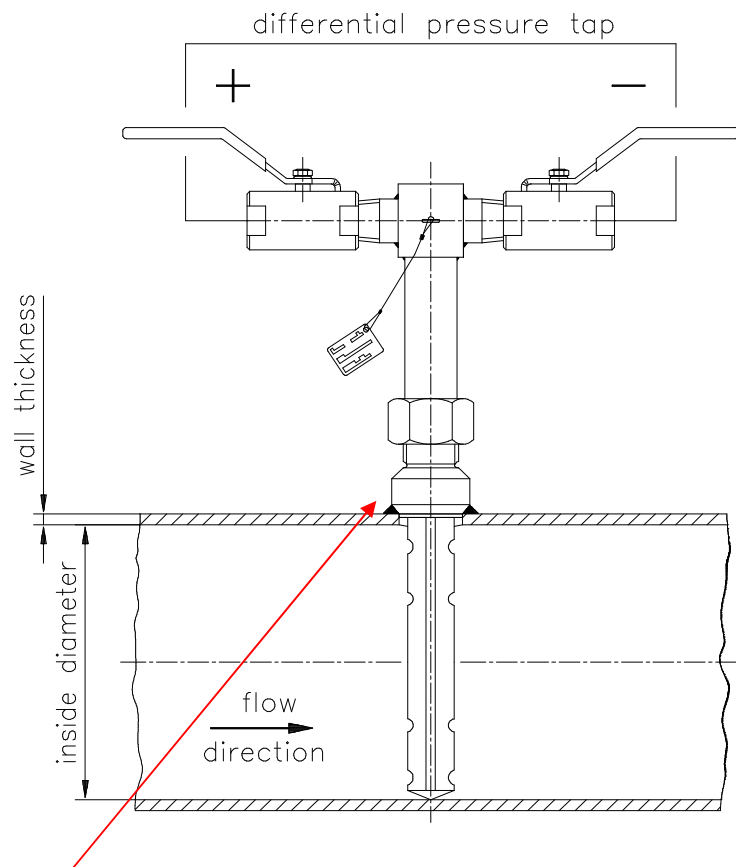
IBRD
IBFD

w/ condensate pots
w/ condensate pots

{ steam up to 750° C
saturated & superheat.steam

ITABAR[®]

Sensor Model IBR

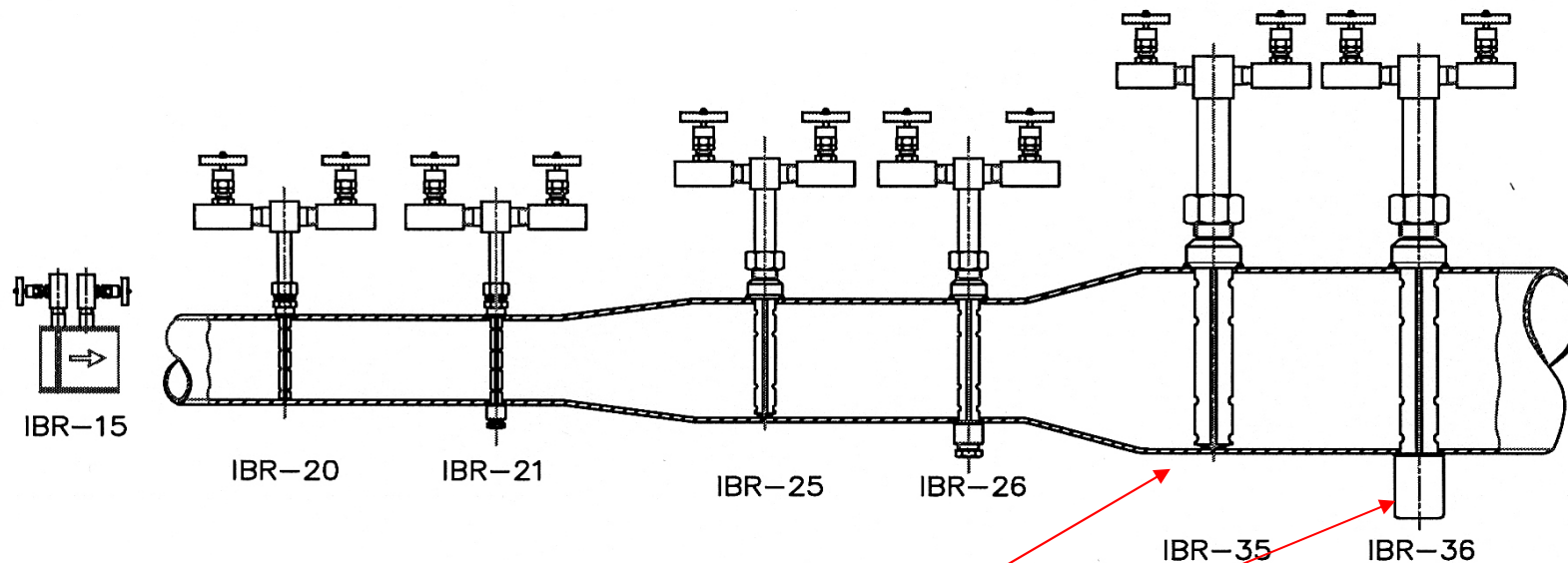


IBR = threaded pipe mount assembly

- standard applications in gases, liquids and steam
- for pipes DN 15 - 1800
- operating pressure: max. 70 bar at 70° C
- operating temperature: -50° C to 400° C
- accuracy: <1% of the actual flow
- repeatability : 0.1% of the measured value
- option : with end support

ITABAR[®]

Model IBR



Model nomenclature :

15 / 20 / 25 / 35 = no end support

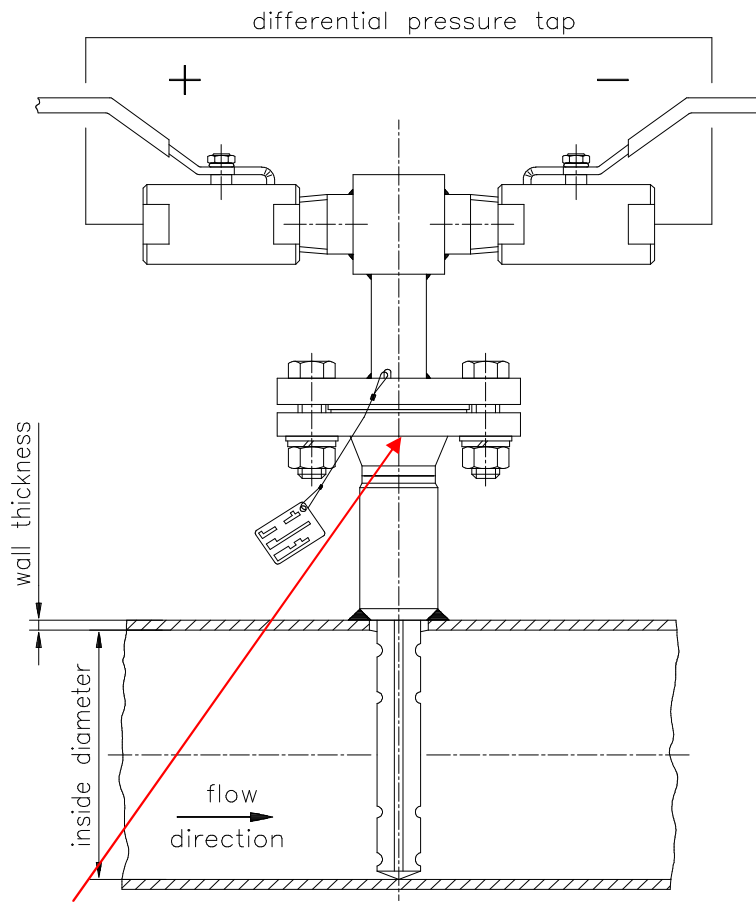
21 / 26 / 36 = with end support

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ITABAR[®]

Sensor Model IBF

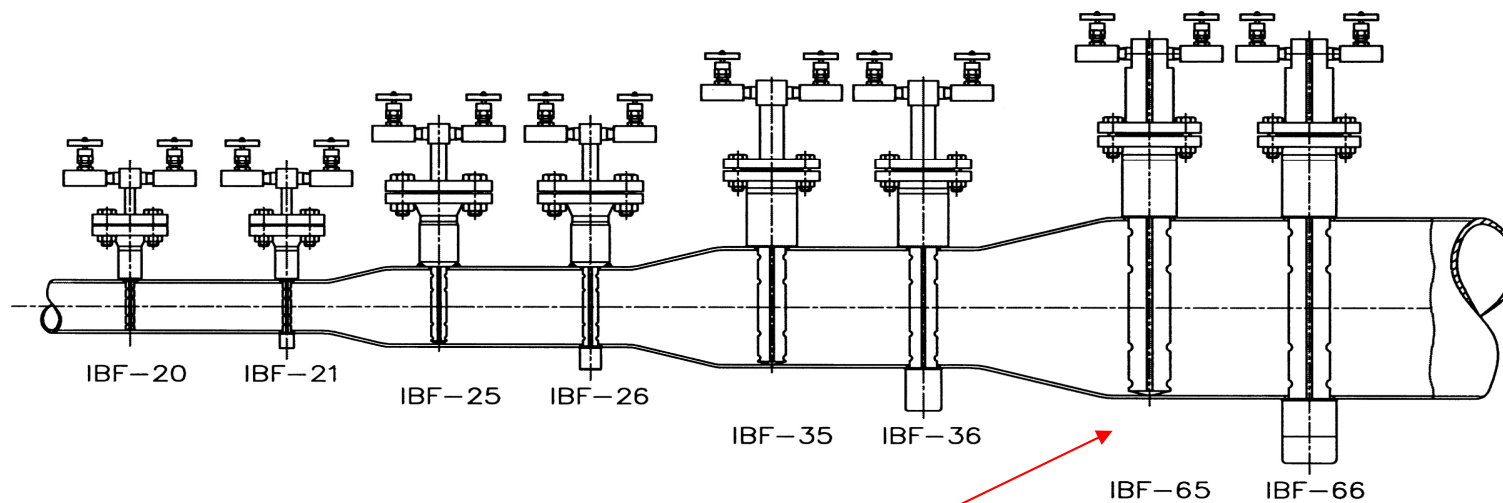


IBF = flanged pipe mount assembly

- standard applications in gases, liquids, steam
- for pipes DN 50 – DN 12000
- operating pressure: max. 400 bar
- operating temperature: -50° C to 1200° C
- accuracy: <1% of the actual flow
- repeatability : 0.1% of the measured value
- option: with end support

ITABAR[®]

Model IBF



Model nomenclature

...35 / 65 = no end support

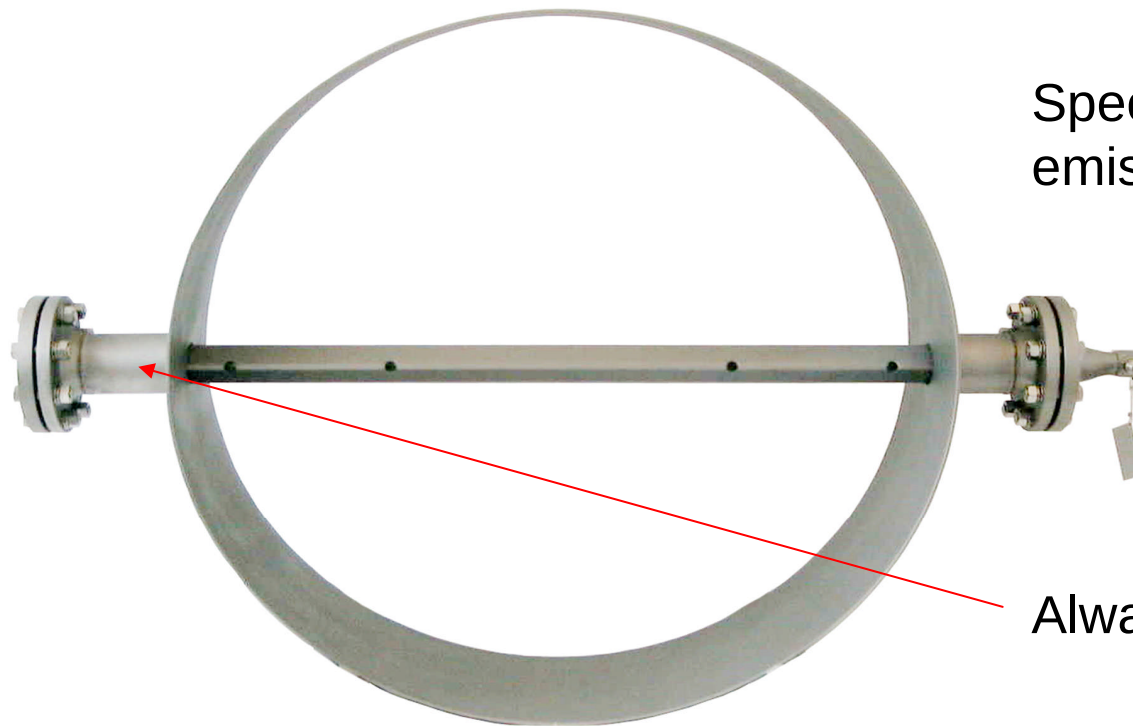
...36 / 66 = with end support

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ITABAR[®]

Sensor Model IBF-100

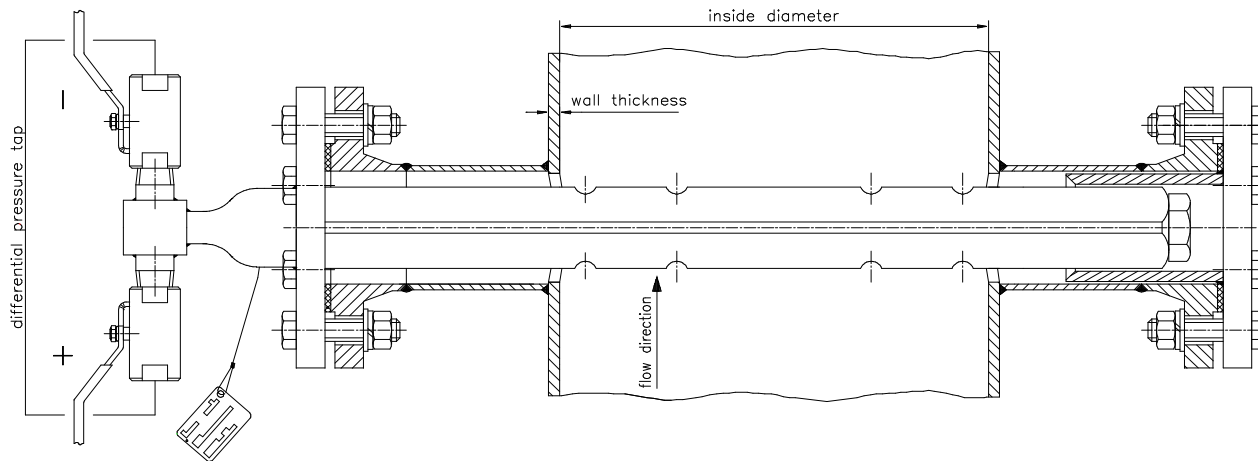


Special design for dirty (flue) gas emissions

Always with end support

ITABAR[®]

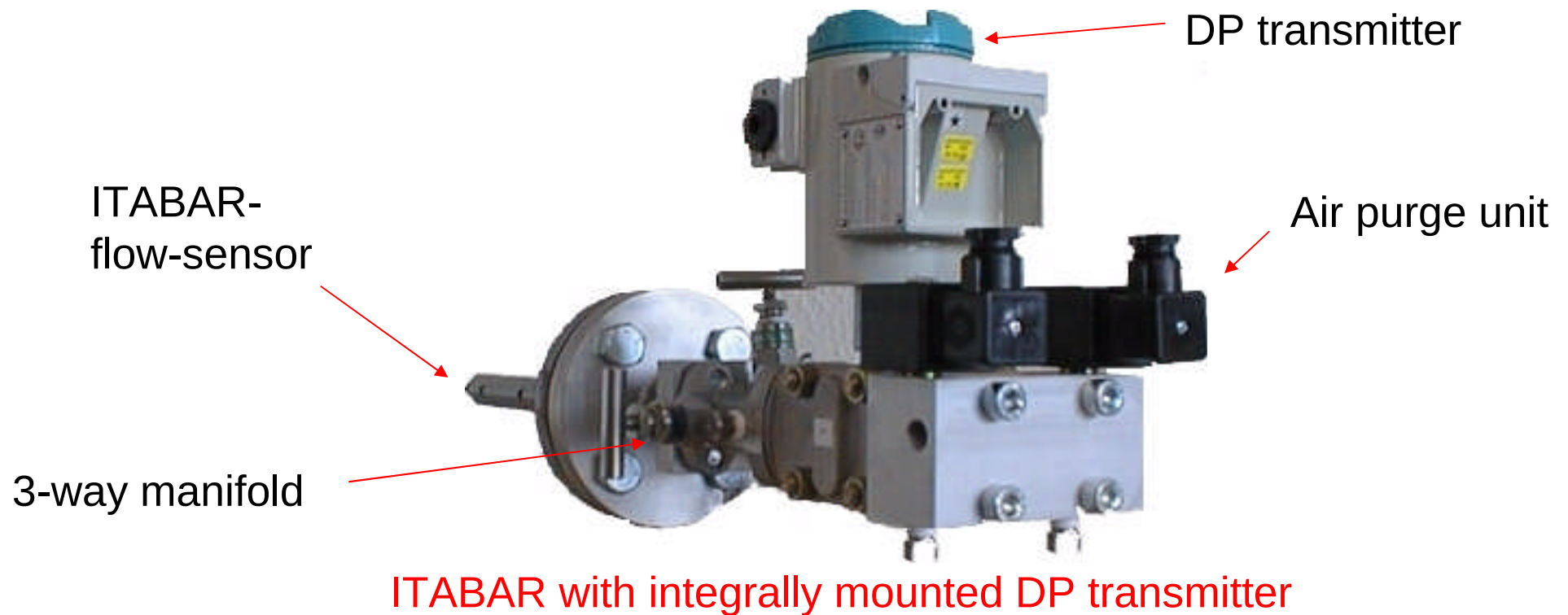
Model IBF-100



- pipe inside diameter: DN 300 – 12000
- operating pressure max. 100 bar
- operating temperature max. 1200° C
- accuracy: <1% of the actual flow
- repeatability: 0.1% of measured value

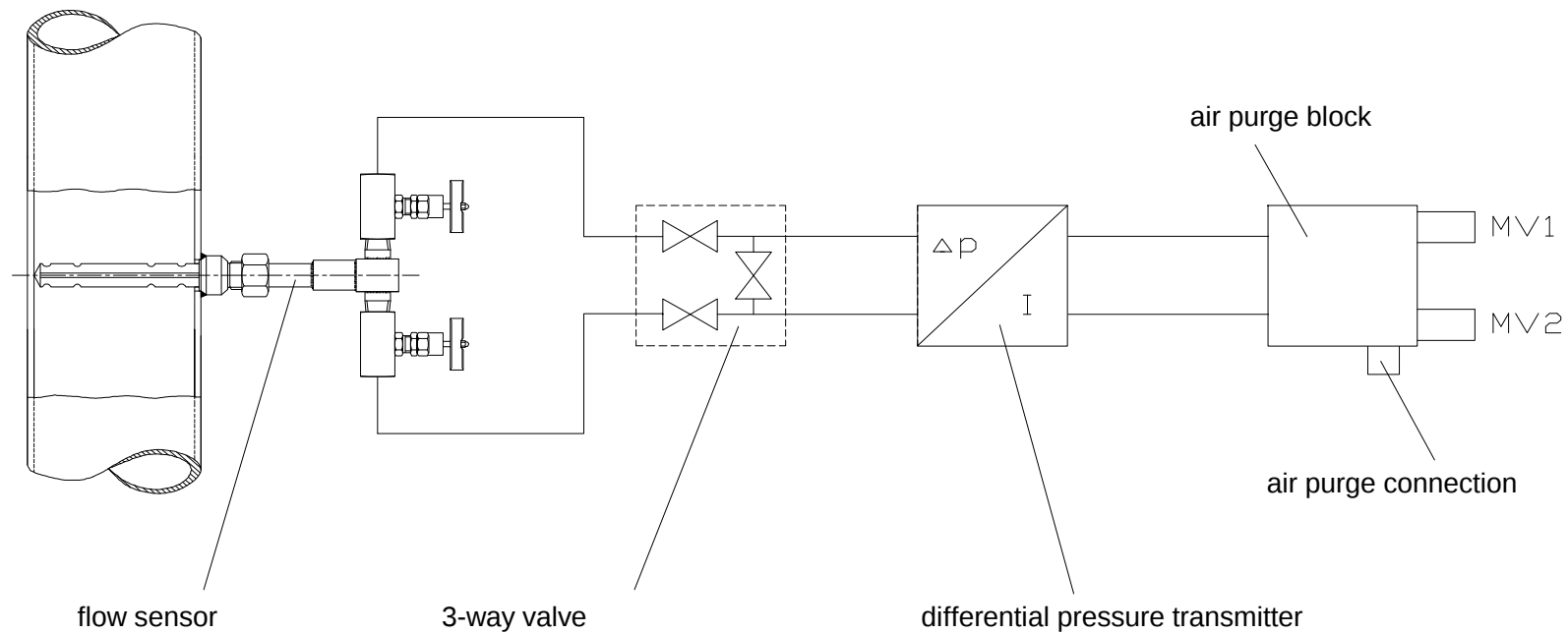
ITABAR[®]

Optional Air / Gas Purge Unit



ITABAR[®]

Air / Gas Purge – Functional Design



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Massflow measurement for steam and gas



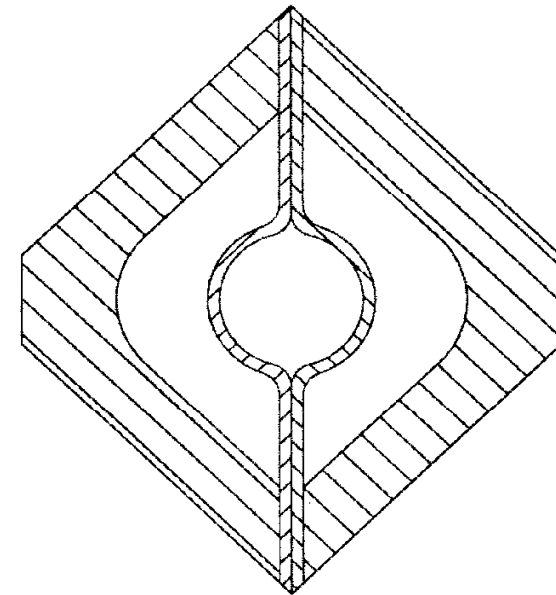
ITABAR[®]

Integral Temperature Sensing

ITABAR with built-in RTD temperature sensor



Sensor profile with RTD sensor



Massflow measurement for gas

- Static pressure, DP and temperature all in one
- ITABAR[®] with integral RTD and multivariable transmitter
- With only a single instrument installation compensated massflow is calculated while constantly compensating for the density
- Installation under pressure with flo tap version possible

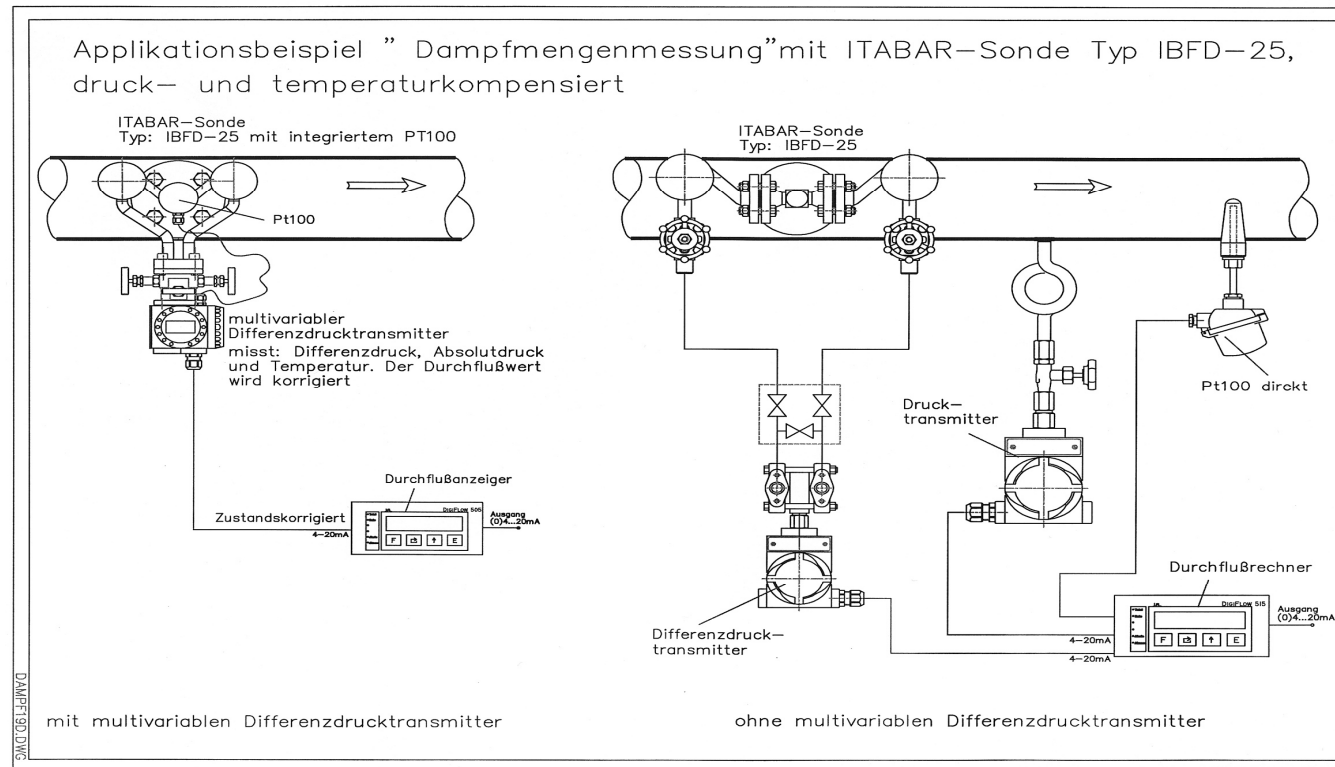


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ITABAR[®]

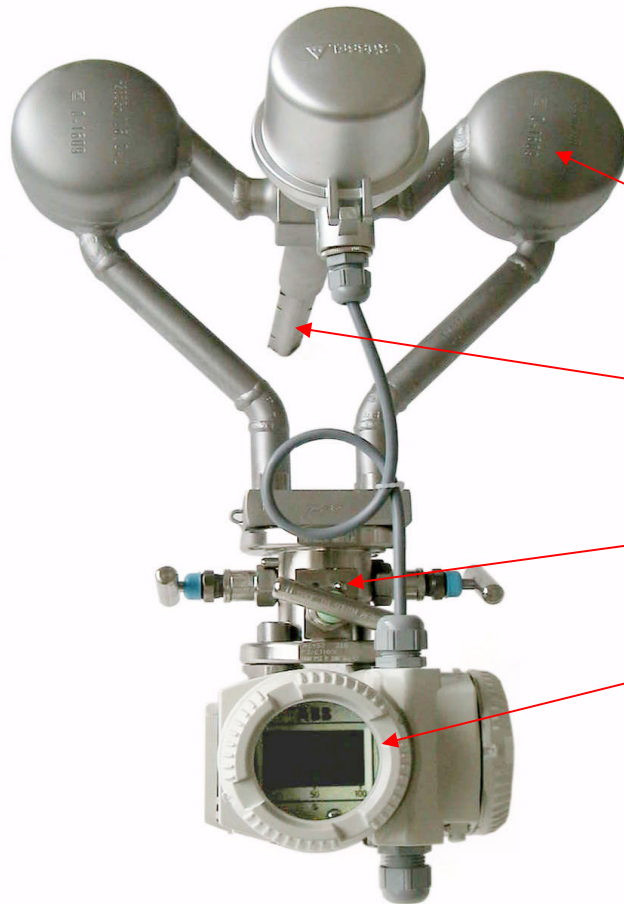
Multivariable Transmitter Savings



Steam mass flow measurement : ITABAR pressure and temperature compensated

ITABAR[®]

DP Transmitter Mounting



Sensor mounted DP transmitter

Condensate pots

ITABAR sensor

3-way manifold

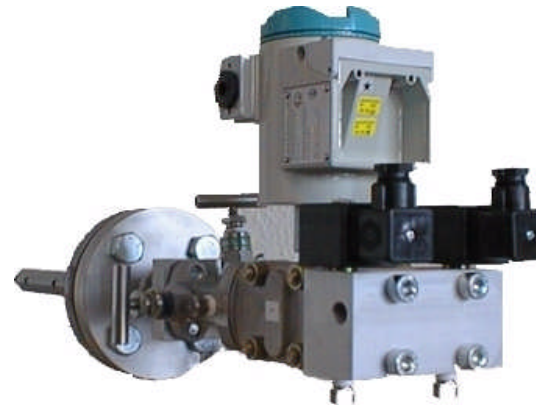
DP transmitter

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ITABAR® Application Steam Flow Measurement



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ITABAR[®]

Steam Flow Measurement

Model Nomenclature :

Sensor Types

Specs

IBRD
C

R = Threaded pipe mount / pipe size: DN 1200 / max temp :200°

IBFD

F = Flanged pipe mount / pipe size: DN 1000 / max temp :590° C

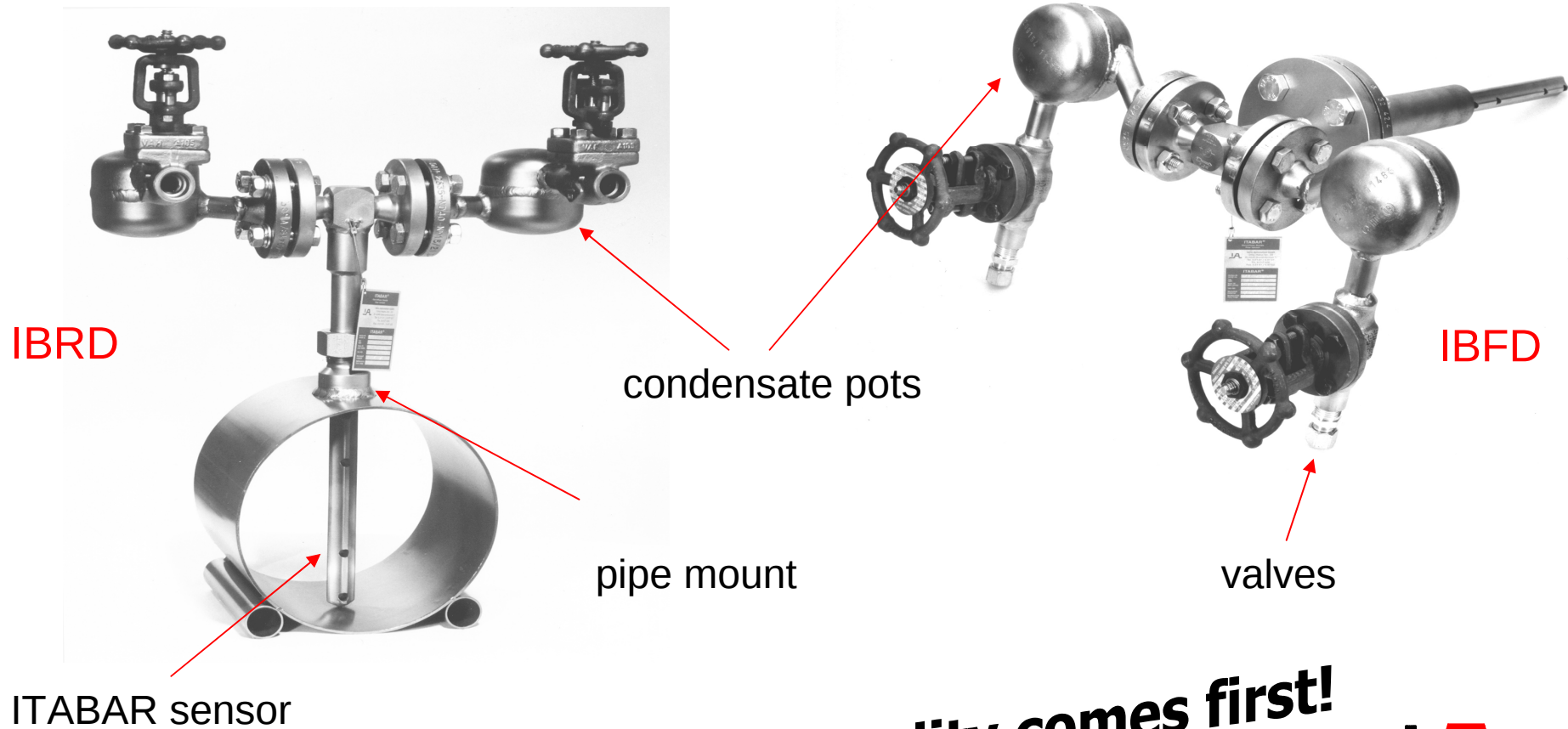
IBFD / HT

F = Flanged / HT = High Temperature / up to DN 600

IBFD / HTG

High Temperature / High Pressure / up to DN 600

ITABAR[®] Steam Flow Models



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ITABAR[®]

Steam Flow Models ... continued



FTMD

Flo Tap Versions



FTHD

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ITABAR[®]

Steam Flow Models ... continued



IBFD – HT

Special material
Strengthened sensor
Max temp 650° C



IBFD – HTG

for superheated steam
Sensor : welded construction for
increased safety

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ITABAR[®]

Steam Flow Models – Condensate Pots



Condensate pots :

- Available in different versions and different materials depending on operating conditions
- Their function:
 - a) localize transition from steam to condensate and vice versa
 - b) condensate to provide temperature buffer between DP transmitter and steam process

Quality comes first!

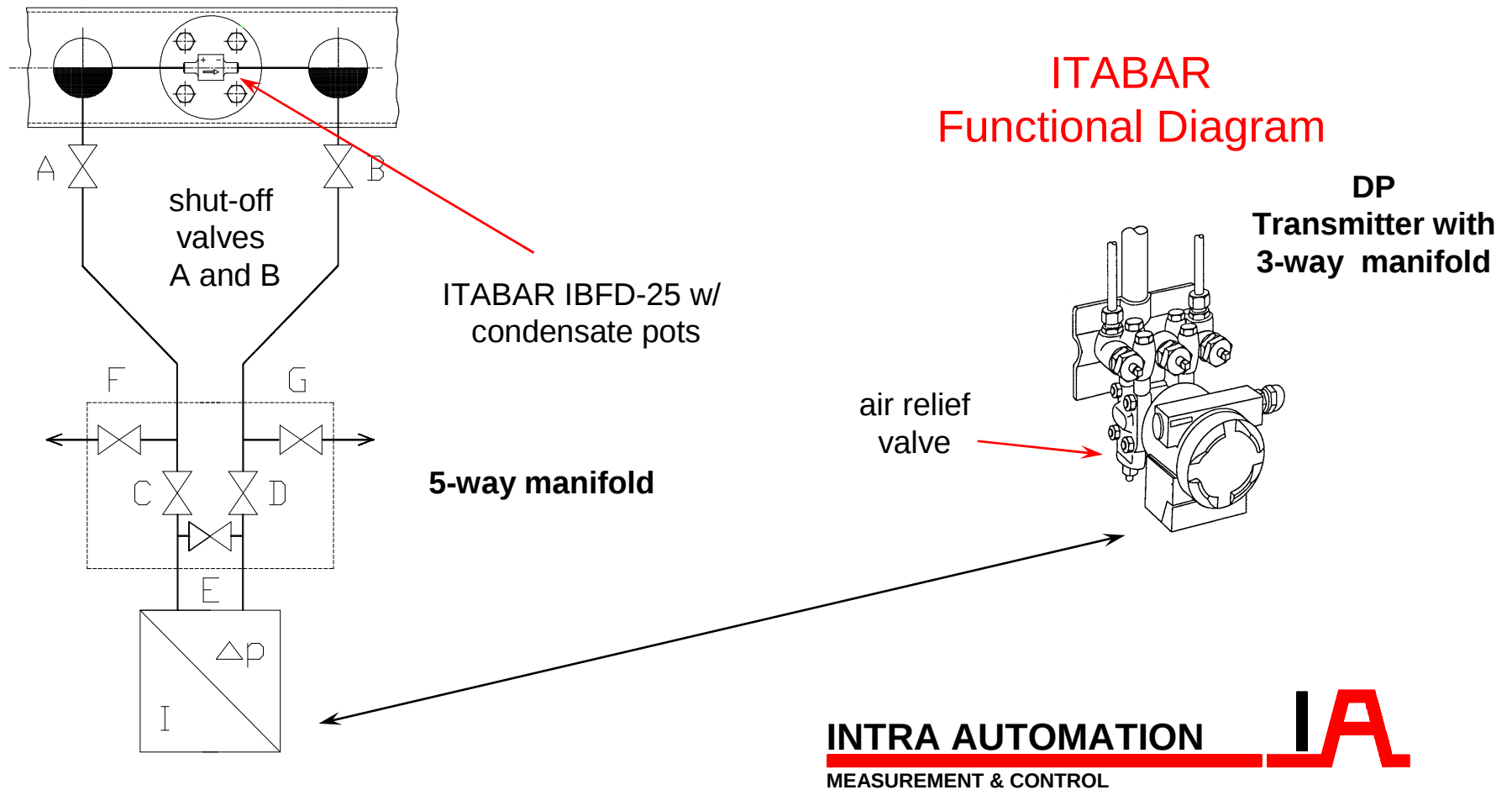
INTRA AUTOMATION

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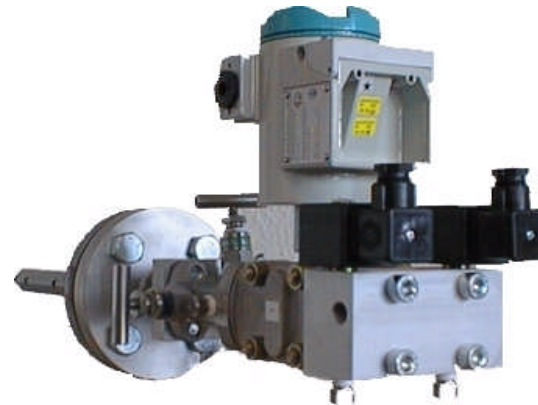
ITABAR[®]

Superheated & Saturated Steam

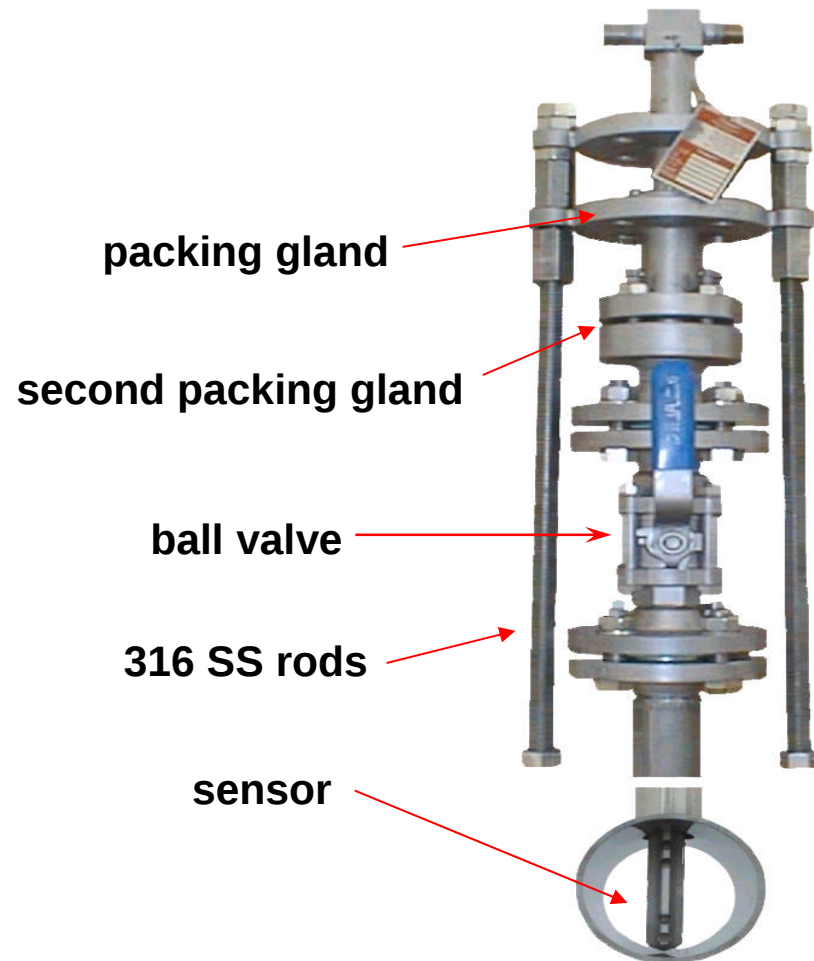




ITABAR[®] Flo Tap Models



ITABAR[®] Flo-Tap Models



Allows installation / removal
under pressure

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MEASUREMENT & CONTROL

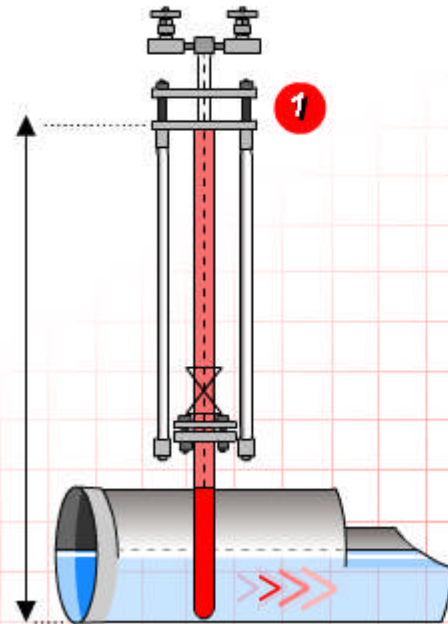


ITABAR[®] Flo-Tap Models

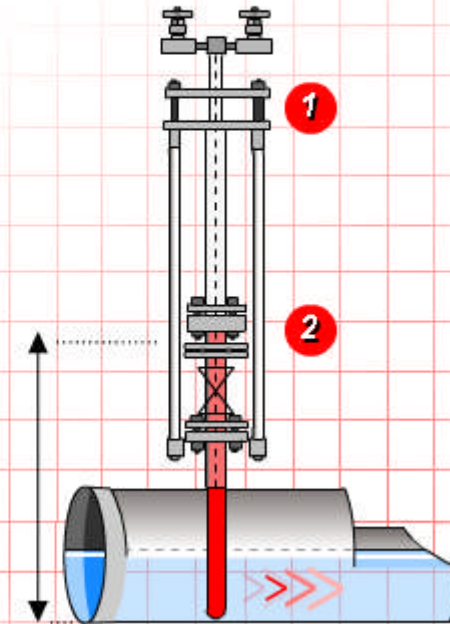
Conventional:
large lever arm =
less mechanical
stability

- 1) **Index**
One single packing gland

Conventional
Flo-Tap Styles



ITABAR
Flo-Tap Sensor

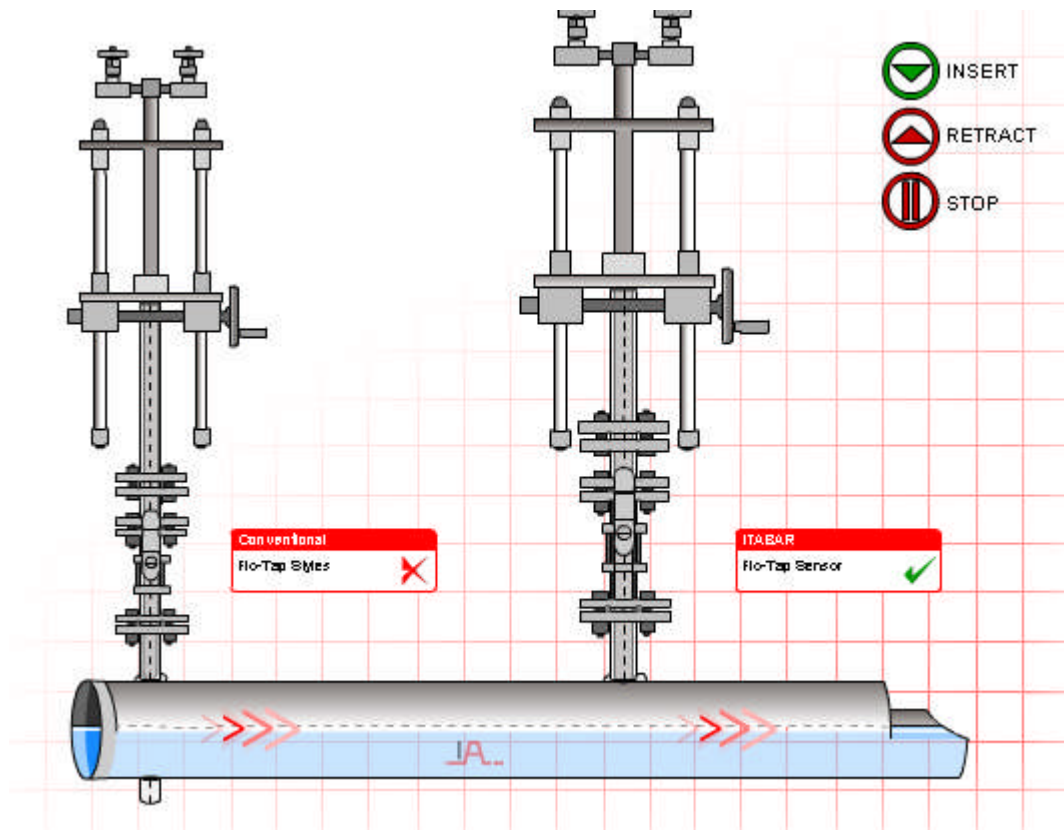


ITABAR:
shorter length of lever
arm = **better**
mechanical stability

- Index**
1) First packing gland
2) Second packing gland

ITABAR[®]

Flo-Tap Models – problem with end support



ITABAR[®]

Flo-Tap Models – problem with end support

FTH-26: max. flow rate installed >> flow rate while inserting the sensor.
A flow tap sensor with end support cannot be installed under full pressure because the the sensor would bend and does not hit the end support.

This problem can be avoided by choosing a larger sensor size.

FTH-35: max. flow rate installed = max. flow rate while inserting the sensor

The lacking of a second packing gland increases this effect as the mechanical stability is already lower on the competitors versions.

ITABAR[®] Flo-Tap Models

3 Basic Models

FTN



FTM



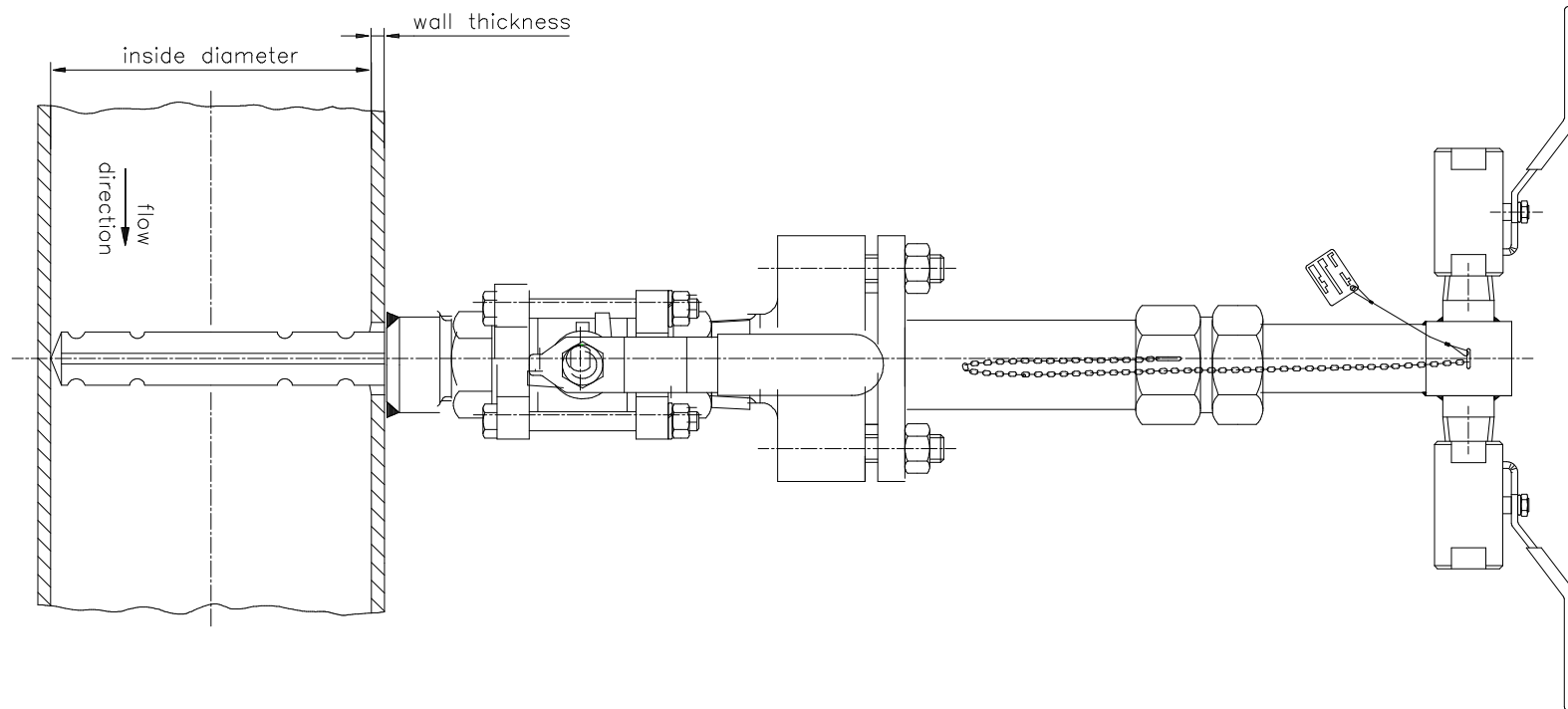
FTH



Gases, liquids, steam	X	X	X
Flue gas emissions	X	X	X
Install / Oper. pressure 6 / 16 bar g	X	X	X
Install / Oper. pressure 16 / 40 bar g		X	X
Install / Oper. pressure 16 / 63 bar g			X
300° C	X	X	X
300° C		X	X
300° C			X

ITABAR[®]

Flo-Tap Model FTN

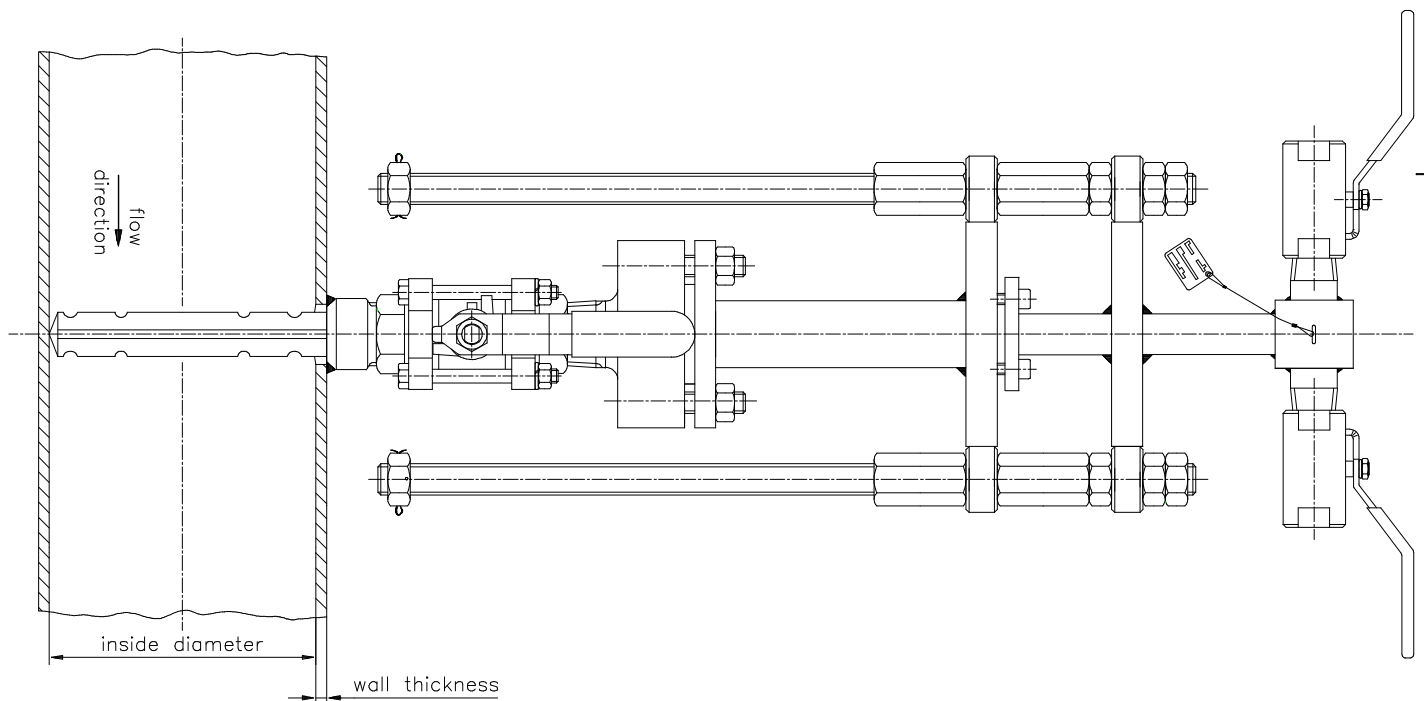


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Flo-Tap Model FTM

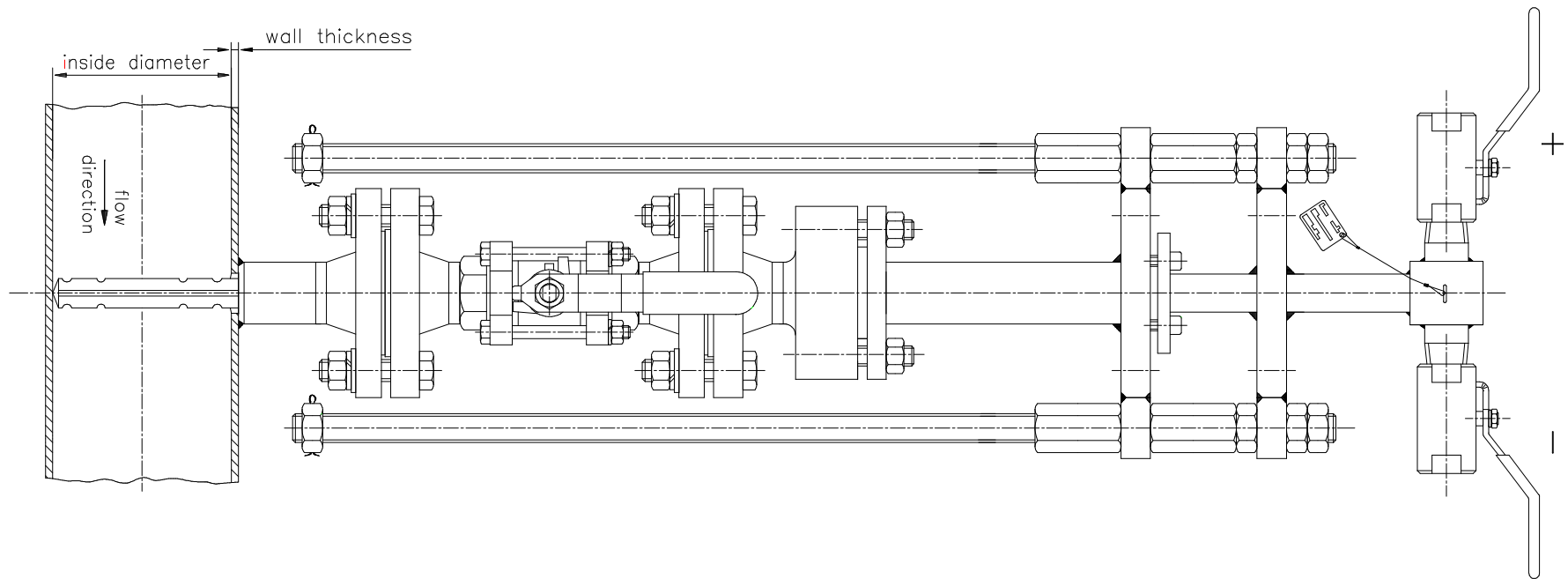


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ITABAR[®]

Flo-Tap Model FTH

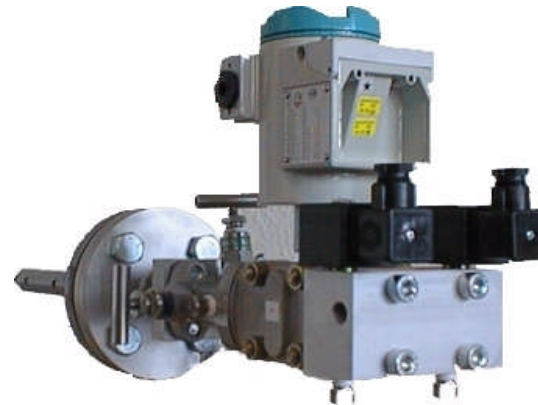


INTRA AUTOMATION
MEASUREMENT & CONTROL

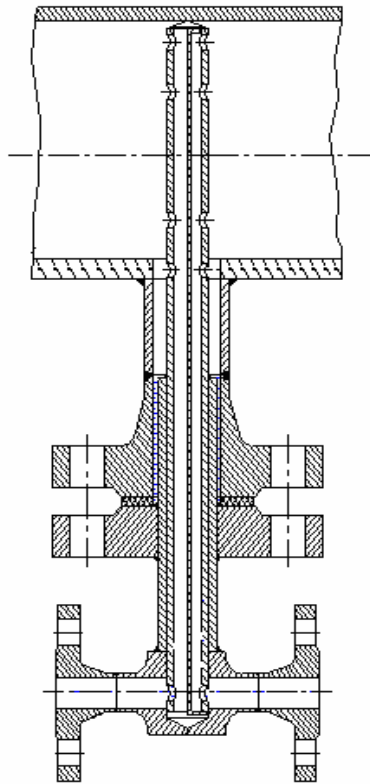




ITABAR® Installation Issues



Intallation Issues



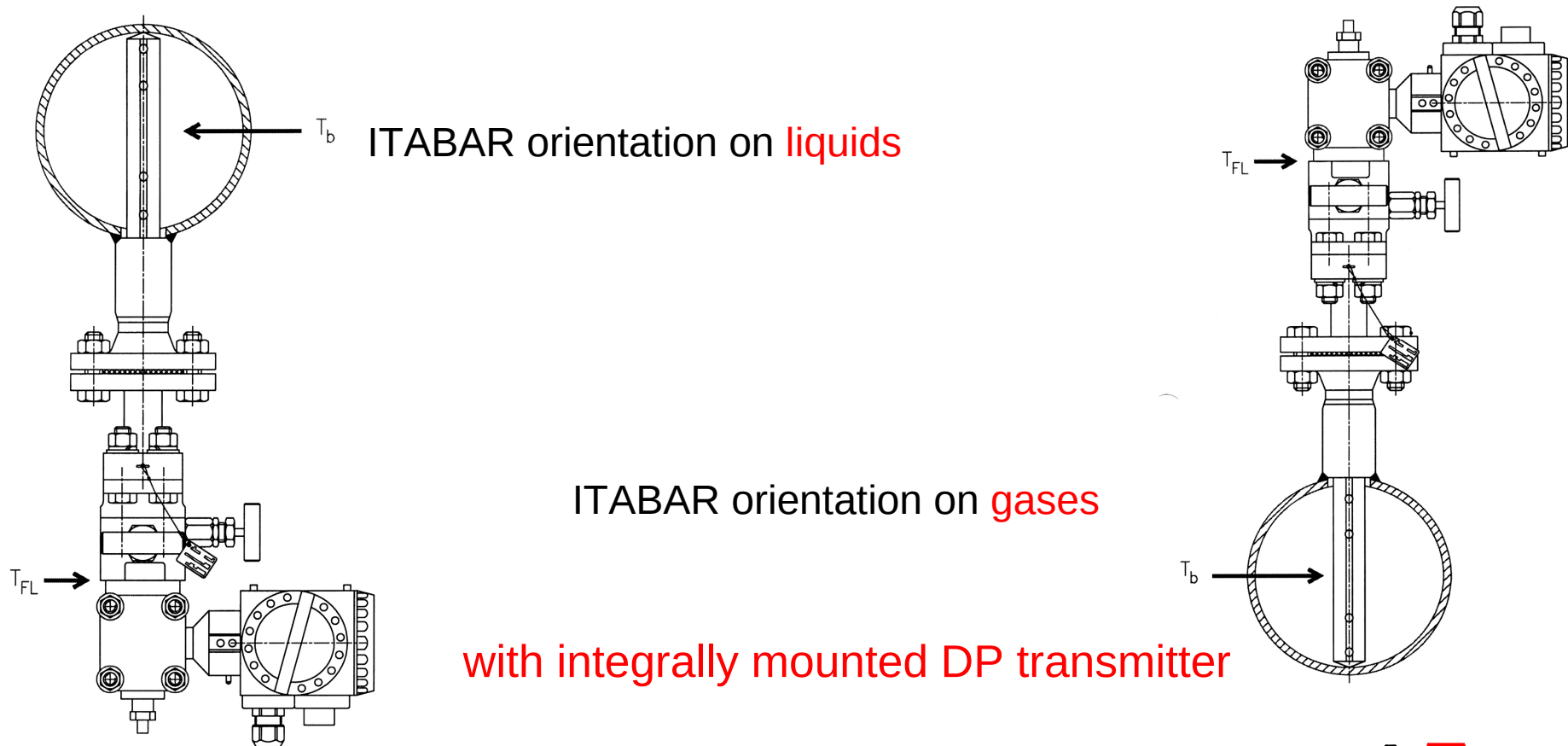
Accurate information about pipe ID and wall thickness are required to avoid shutting off measurement openings and thereby creating a measurement error

Quality comes first!
INTRA AUTOMATION
MEASUREMENT & CONTROL



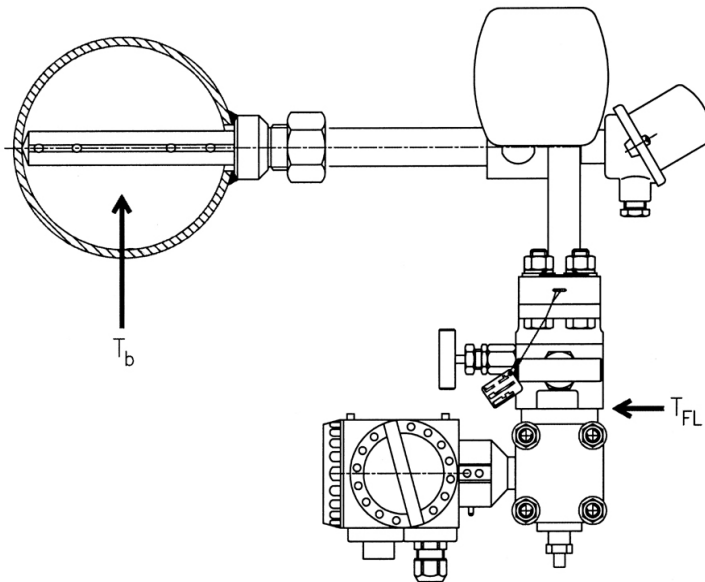
ITABAR[®]

Installation Issues



ITABAR[®]

Installation On Steam



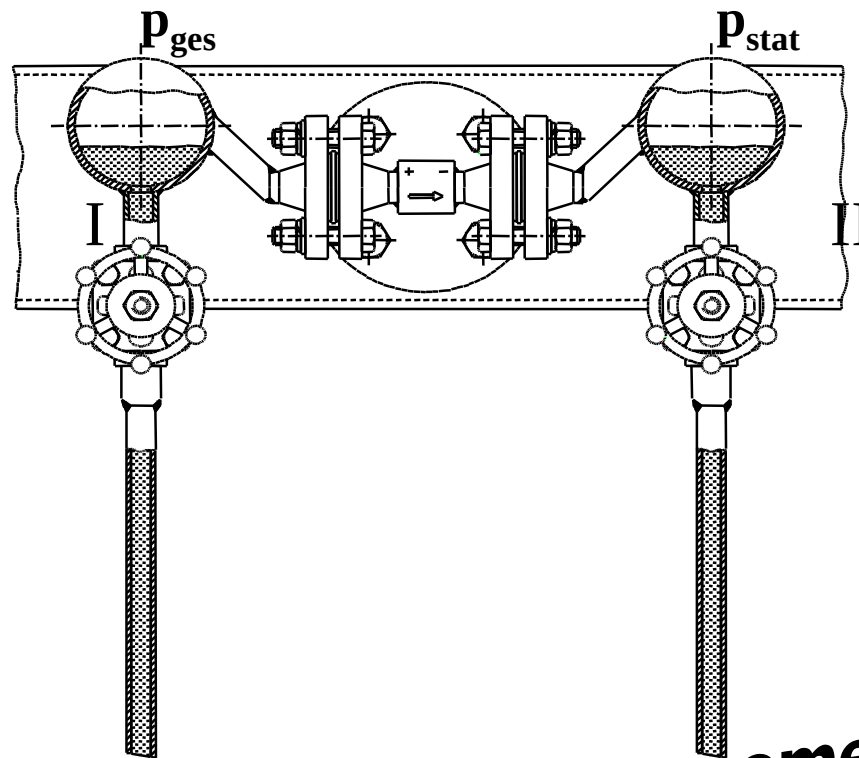
ITABAR orientation on **steam**

with integrally mounted DP transmitter

ITABAR[®]

Installation On Steam ... Continued

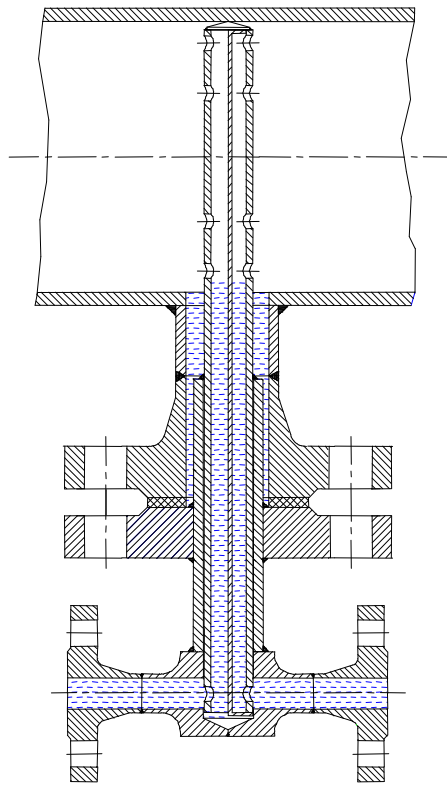
horizontal mounting (with water level)



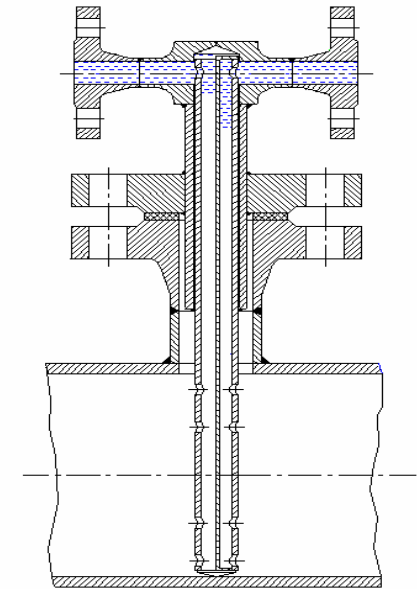
Quality comes first!
INTRA AUTOMATION
MEASUREMENT & CONTROL



Installation On Steam - vertical



- Undefined and uncontrolled condensation and vaporization
- DP caused by uneven water columns
- clogging of measurement opening possible



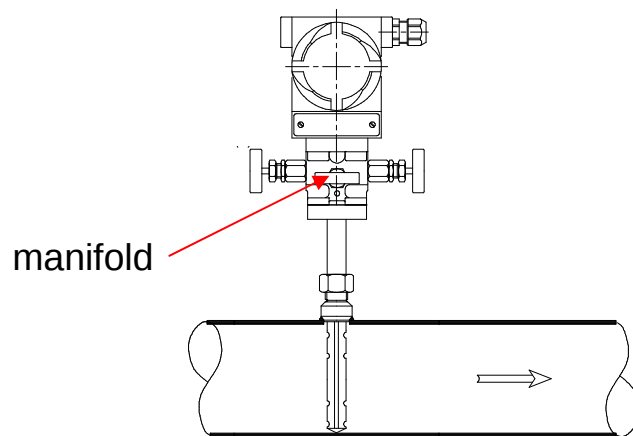
Quality comes first!
INTRA AUTOMATION
MEASUREMENT & CONTROL



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Installation Issues ... continued

Option: direct mounted DP transmitter



Option: remote mounted DP transmitter

