

**INSTRUCTION**

**for**

**EMCO ISA 1932 Nozzle**

**type DES**

**Liquid, gas, and steam**

### **Application**

EMCO ISA 1932 nozzle with single pressure tappings is the primary element in liquid, gas or steam flow measurement according to the differential pressure principle.

The fluid must be in one phase and the pipe shall run full in the measuring section. Changes of flow shall be slowly i.e. without pulsations.

### **Storage**

Before installation the primary element must be kept clean and protected against corrosion and physical damage.

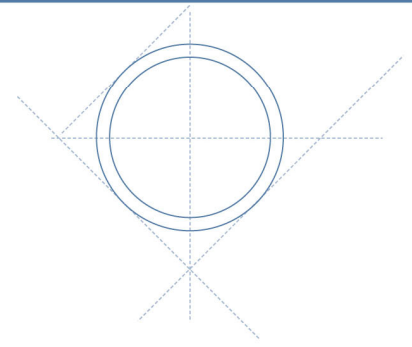
### **Pipe Run**

The EMCO ISA 1932 nozzle type DES shall be fitted between 2 sections of straight cylindrical pipe of constant cross sectional area without any obstructions.

The inner pipe diameter  $D$  must not vary more than 0,3% of  $D$  used in the bore calculation.

The required minimum straight lengths of pipe vary according to beta and the nature of obstruction - bends, reducers etc.

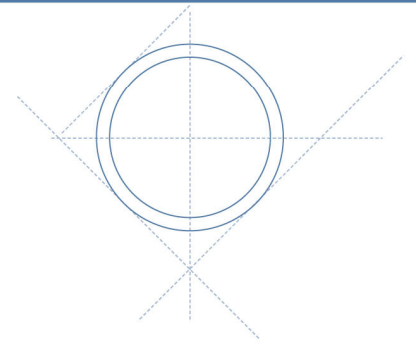
From the table below it can be seen how many times the inner pipe diameter  $D$  is required for "zero additional uncertainty". The values in the brackets give "+/-0,5% additional uncertainty". These are applicable when the length of the straight pipe run is between the unbracket and the bracket values. If the straight lengths are shorter than the bracketed values no information is available of the value of any further uncertainty.



$\beta$	On upstream (inlet) side of the primary device							On downstream (outlet) side
	Single 90° bend or tee (flow from one branch only)	Two or more 90° bends in the same plane	Two or more 90° bends in different planes	Reducer (2 D to D over a length of 1,5 D to 3 D)	Expander (0,5 D to D over a length of 1 D to 2 D)	Globe valve fully open	Gate valve fully open	All fittings included in this table
≤ 0,20	10 (6)	14 (7)	34 (17)	5	16 (8)	18 (9)	12 (6)	4 (2)
0,25	10 (6)	14 (7)	34 (17)	5	16 (8)	18 (9)	12 (6)	4 (2)
0,30	10 (6)	16 (8)	34 (17)	5	16 (8)	18 (9)	12 (6)	5 (2,5)
0,35	12 (6)	16 (8)	36 (18)	5	16 (8)	18 (9)	12 (6)	5 (2,5)
0,40	14 (7)	18 (9)	36 (18)	5	16 (8)	20 (10)	12 (6)	6 (3)
0,45	14 (7)	18 (9)	38 (19)	5	17 (9)	20 (10)	12 (6)	6 (3)
0,50	14 (7)	20 (10)	40 (20)	6 (5)	18 (9)	22 (11)	12 (6)	6 (3)
0,55	16 (8)	22 (11)	44 (22)	8 (5)	20 (10)	24 (12)	14 (7)	6 (3)
0,60	18 (9)	26 (13)	48 (24)	9 (5)	22 (11)	26 (13)	14 (7)	7 (3,5)
0,65	22 (11)	32 (16)	54 (27)	11 (6)	25 (13)	28 (14)	16 (8)	7 (3,5)
0,70	28 (14)	36 (18)	62 (31)	14 (7)	30 (15)	32 (16)	20 (10)	7 (3,5)
0,75	36 (18)	42 (21)	70 (35)	22 (11)	38 (19)	36 (18)	24 (12)	8 (4)
0,80	46 (23)	50 (25)	80 (40)	30 (15)	54 (27)	44 (22)	30 (15)	8 (4)

For all $\beta$ values	Fittings	Minimum upstream (inlet) straight length required
	Abrupt symmetrical reduction having a diameter ratio $\geq 0,5$	30 (15)
	Thermometer pocket or well of diameter $\leq 0,03 D$ Thermometer pocket or well of diameter between 0,03 D and 0,13 D	5 (3) 20 (10)

It is recommended to use full bore valves upstream the primary element. The valves shall be fully open.



The inside surface of the measuring pipe shall be clean, free from pitting and deposit for at least a length of 10 times D upstream and 4 times D downstream of the venturi nozzle.

The inner roughness shall be below the limits given in the table below.

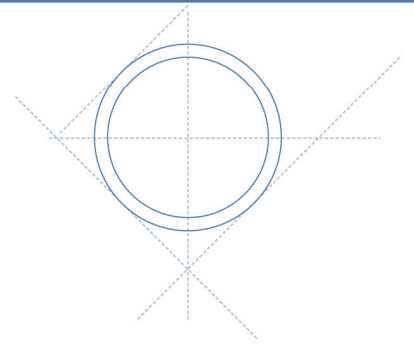
Upper limits of relative roughness for ISA 1932 nozzles

$\beta$	$\leq 0,35$	0,36	0,38	0,40	0,42	0,44	0,46	0,48	0,50	0,60	0,70	0,775
$10 \frac{k}{D}$	25	18,6	13,5	10,6	8,7	7,5	6,7	6,1	5,6	4,5	4,0	3,9

Typical inner pipe wall roughness is stated below.

Examples of values of the pipe wall roughness  $k$

Material	Condition	$k$ , mm
brass, copper, aluminium, plastics, glass	smooth, without sediments	< 0,03
steel	new, seamless cold drawn	< 0,03
	new, seamless hot drawn	0,05 to 0,10
	new, seamless rolled	0,10
	new, welded longitudinally	0,10 to 0,20
	new, welded spirally	0,20 to 0,30
	slightly rusted	0,50 to 2
	rusty	> 2
	encrusted	0,03 to 0,05
	with heavy incrustations	0,10 to 0,20
cast iron	bituminized, new	0,13
	bituminized, normal	0,25
	galvanized	1,0 to 1,5
	new	> 1,5
asbestos cement	encrusted	0,03 to 0,05
	bituminized, new	< 0,03
not insulated, normal	insulated and not insulated, new	0,05
	not insulated, normal	

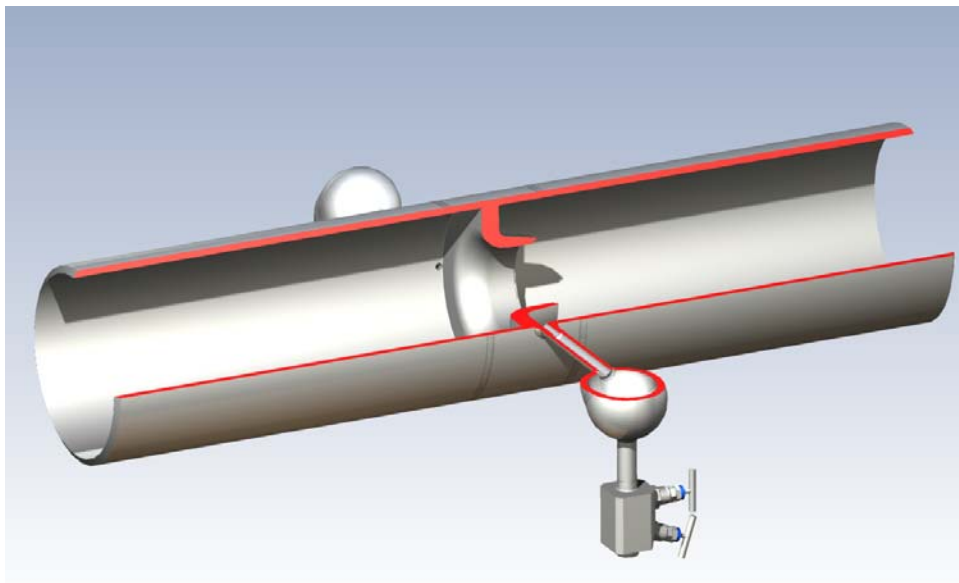


## Installation

The EMCO ISA 1932 nozzle type DES must be centred carefully in the pipe line.

When the primary element is welded into the pipe line an approved method of welding, and if necessary a preheat and a post weld heat treatment must be used.

It is important to ensure that the welding grooves of the ISA 1932 nozzle and the mating pipe are the same and that the two inner pipe diameters are equal.



## Tap location

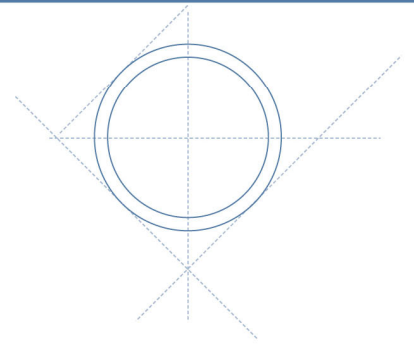
2 pressure tappings provide the pressure upstream and the pressure downstream. The upstream pressure tapping is marked "+" and the downstream pressure is marked "-".

## Liquid

In a horizontal pipe the pressure taps shall be in the horizontal pipe axis or better below.

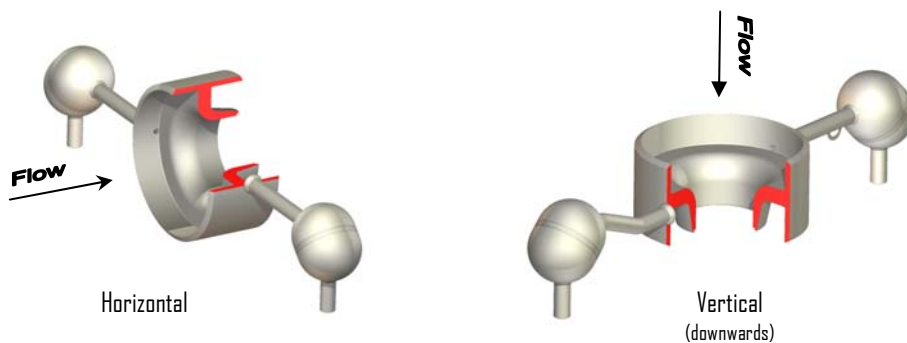
## Gas

In a horizontal pipe the pressure taps shall be in the horizontal pipe axis or better above.



## Steam

The orientation of the pressure taps is matched to either a vertical or horizontal pipe run. It is important that the 2 condensing chambers are at the same level to ensure equal water column above the differential pressure transmitter.



## Instrument Connection

It is recommended to install the differential pressure transmitter below the ISA 1932 nozzle, a part from gas flow measurement.

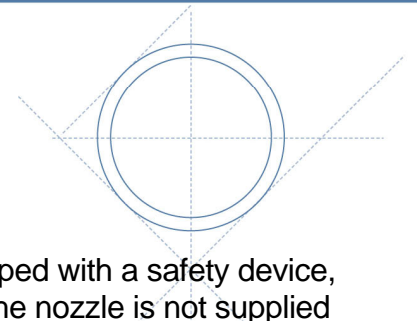
The "+" side of the ISA 1932 nozzle is connected to the "+" side of the differential pressure transmitter and the two "-" sides are connected.

The impulse lines must be installed with a slope to let captured air escape.

The impulse lines should not be less 12 x 1 mm in a material suitable to the service condition.

The ISA 1932 nozzle is normally supplied with the primary isolating valves.

It is recommended to use a 5-way manifold valve in connection with the differential pressure transmitter in order to isolate, equalize and blow-down or depressurize the transmitter.



## **Safety**

The pipe system, in which the nozzle will be part of, must be equipped with a safety device, ensuring that the maximum allowable pressure is not exceeded. The nozzle is not supplied with any safety devices and must not be used for higher pressure, than stated on the name plate.

During operation the outer surface of the tube will reach nearly the same temperature as the operating fluid. Hence it is recommended, at elevated temperatures, to insulate the tube or ensure that the tube is inaccessible during operation.

Exposing the nozzle to elevated temperatures may weaken the material. Therefore the nozzle must not be exposed to higher temperatures, than stated on the name plate.

## **Maintenance**

The EMCO ISA 1932 nozzle requires no special maintenance. It is however important that the inside of the venturi and the mating pipe are free from deposits.

## **References**

ISO 5167, DIN 1952, DIN 19205 part 1, DIN 19207, DIN 19208, DIN 19209, DIN 19210, DIN 19211, DIN 19216, Shell Flow Meter Engineering Handbook, Flow Measurement Engineering Handbook.