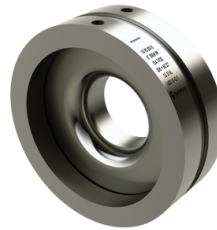


KEY FEATURES

- Nozzle design according to ISO5167-1 & ISO5167-3 or ASME.MFC.3M standards
- Recommended for clean fluids and steam -
Optimal solution for measuring large flow rates (high ReD) for non-viscous fluids
- Internal pipe diameter : from 50 mm to 630 mm
- Reynolds number : from 10^4
- Accuracy: from 0,8% to 2% of the max flowrate without calibration - see paragraphs 5.1.7 et 5.2.7 of the ISO 5167-3 standard
- Repeatability of measurement : 0,1%



ISA1932 nozzle



Long Radius nozzle

BENEFITS

- ▶ Very long life-time product, no drift over time
- ▶ Standardized principle : reliability and accuracy of measurement
 - ▶ No need of calibration
- ▶ Suitable for measuring steam flowrates at high speed
- ▶ Different types of nozzles: ISA 1932, long radius, venturi-nozzle



A nozzle consists of a converging inlet section with a radiated or elliptical profile (depending on the model) leading to a cylindrical throat.

The nozzles are suitable for measuring the flowrates of non-viscous fluids circulating at high speed: when such fluids pass through an orifice plate, there is a risk of erosion or cavitation whereas the nozzle does not have any sharp edges likely to be damaged. Under these conditions, the nozzle is the primary element which offers a longer lifetime and therefore a better measurement accuracy over time.

Nozzles are often used for steam flow measurement.

Deltafluid offers several types of nozzles:

- ISA1932
- Long radius (high-ratio or low-ratio)

To reduce the pressure loss and maintain a short primary element accepting high speed flowrates, the solution called "venturi-nozzle" can be proposed. It combines an inlet with the radiated profile of a nozzle and an outlet with a measuring throat and a divergent equivalent to a venturi outlet.

STANDARDS & DIRECTIVE

- ISO 5167-1 & ISO 5167-3
- ASME MFC-3M
- Pressure equipment directive PED 2014/68/UE

TECHNICAL CHARACTERISTICS - GENERAL INFO

- Fluid temperature ⁽¹⁾ : cryogenic to +800°C
- Type of fluid: gas, steam, single-phase liquid
- Primary element materials ⁽²⁾ : carbon steel, stainless steel, monel, hastelloy, inconel, duplex, super duplex, titanium, tantalum, PVC, PTFE...
- Maximum operating pressure : limited by the flange rating

(1) No temperature restriction with remote-mounted transmitter, otherwise +125°C max


(2) For an aggressive fluid, applying a specific coating on the part in contact with the fluid can increase the product lifetime

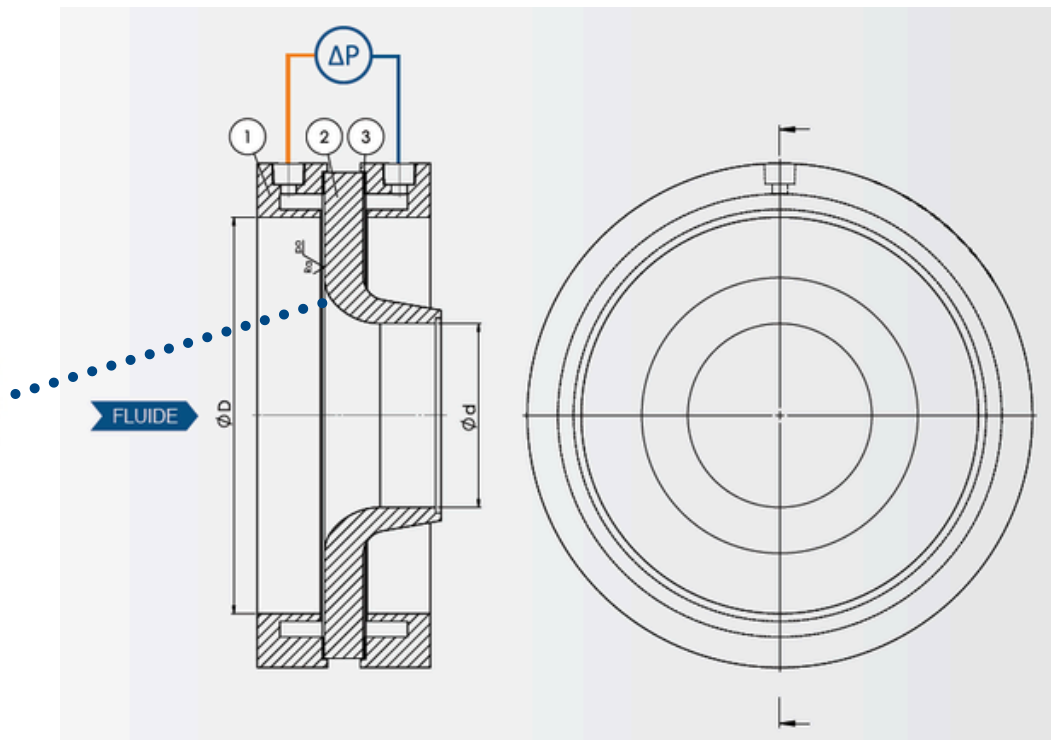
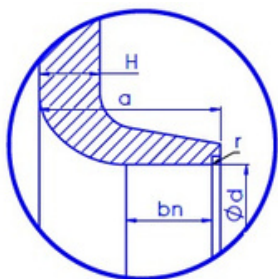
TECHNICAL CHARACTERISTICS - ISA 1932 NOZZLE

- Accuracy: 0,8% of the max flowrate without calibration - see paragraph 5.1.7 of the ISO 5167-3 standard
- Pressure taps: corner taps 0/0 (monoblock or carrier rings)
- Characteristics and dimensions according to the standard in force:

ISO 5167-1&3 & ASME MFC-3M

ReD	Reynolds number in the pipe	$2 \cdot 10^4 \leq \text{ReD} \leq 10^7$
D	Inside pipe diameter	$50 \text{ mm} \leq D \leq 500 \text{ mm}$
β	d/D	$0,3 \leq \beta \leq 0,8$
Ra	Upstream face and throat roughness	$Ra \leq 10^{-4} \cdot d$
bn	Length of the cylindrical throat	$bn = 0,3 \cdot d$
a	Total length of the nozzle	consult us
r	Downstream sharp edge radius	$r < 0,0004 \cdot d$
H	Thickness	$H \leq 0,1 \cdot D$


differential pressure
transmitter connection



① annular slots

② nozzle

③ downstream gasket (also present on the upstream side of the nozzle)

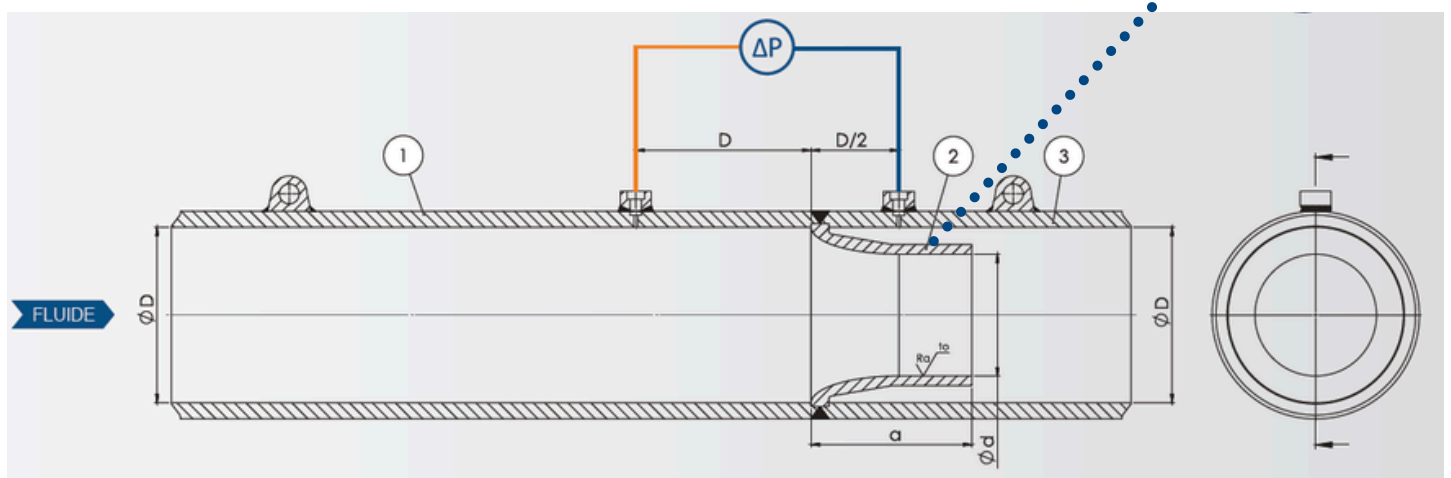
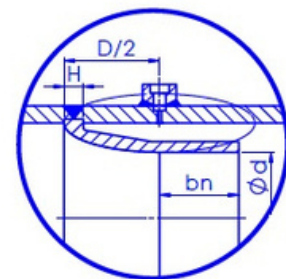
TECHNICAL CHARACTERISTICS - LONG RADIUS NOZZLE

- Accuracy: 2% of the max flowrate without calibration - see paragraph 5.2.7 of the ISO 5167-3 standard (consider calibration for higher accuracy)
- Pressure taps : D - D/2 (see diagram below)
- Characteristics and dimensions according to the standard in force:

		ISO 5167-1&3 & ASME MFC-3M	
		High ratio	Low ratio
ReD	Reynolds number in the pipe	$10^4 \leq \text{ReD} \leq 10^7$	
D	Inside pipe diameter	$50 \text{ mm} \leq D \leq 630 \text{ mm}$	
β	d/D	$0,25 \leq \beta \leq 0,8$	$0,2 \leq \beta \leq 0,5$
Ra	Upstream face and throat roughness	$Ra \leq 10^{-4} \cdot d$	
bn	Length of the cylindrical throat	$bn = 0,6 \cdot d$	
a'	Total length of the nozzle	$a = D/2 + 0,6 \cdot d$	$a = d + 0,6 \cdot d$
H	Thickness	$3 \text{ mm} \leq H \leq 0,15 \cdot D$	



differential pressure
transmitter connection



① upstream nozzle

② long radius nozzle

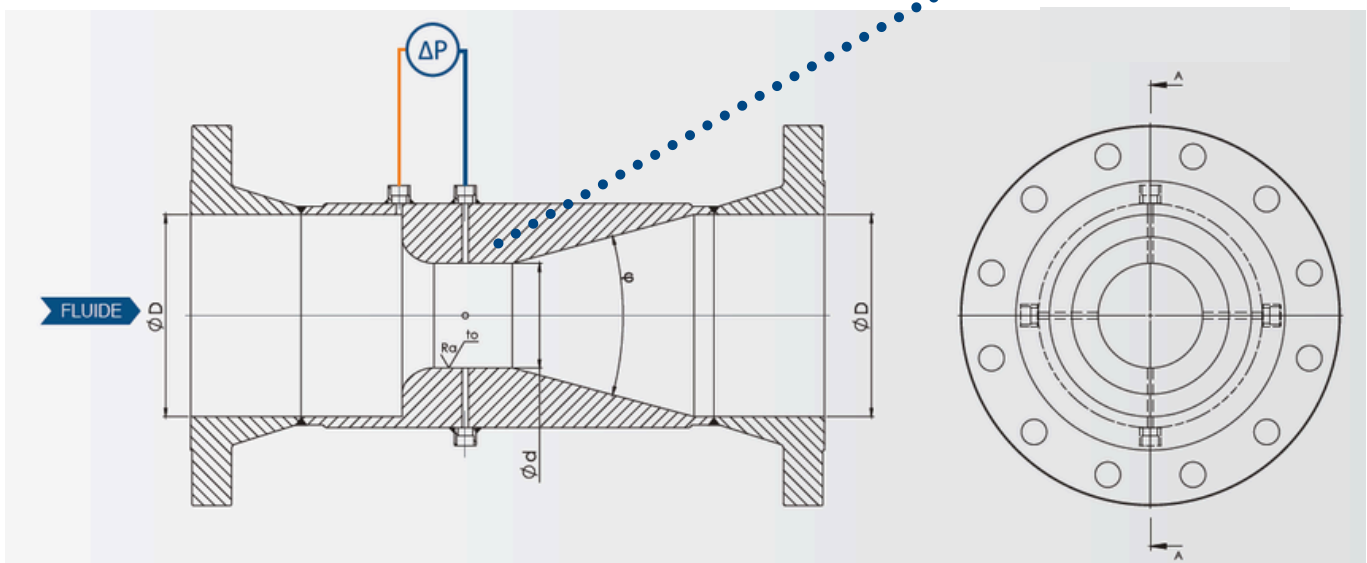
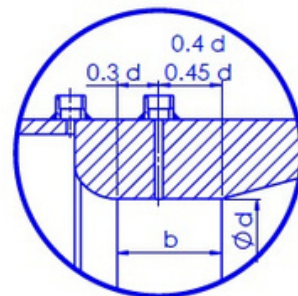
③ downstream nozzle

TECHNICAL CHARACTERISTICS - VENTURI-NOZZLE

- Accuracy > 1.2% of the max flowrate without calibration - see paragraph 5.4.5 of the ISO 5167-3 standard (consider calibration for higher accuracy)
- Pressure taps: upstream, corner tapplings - at the throat, single pressure tapplings leading into an annular chamber (see diagram below) or a "triple-T" arrangement.
- Characteristics and dimensions according to the standard in force:

		ISO 5167-1&3 & ASME MFC-3M
ReD	Nb de Reynolds dans canalisation	$1.5 \cdot 10^5 \leq ReD \leq 2.10^6$
D	Diamètre intérieur tuyauterie	$65 \text{ mm} \leq D \leq 500 \text{ mm}$
β	d/D	$0.316 \leq \beta \leq 0.775$
d	Diamètre orifice	$d \geq 50 \text{ mm}$
Ra	Rugosité face amont et surfaces internes	$Ra \leq 10^{-4} \cdot d$
b	Longueur du col cylindre	$b = 0.7 \cdot d \text{ à } 0.75 \cdot d$
ϕ	Angle du divergent de sortie	$\phi \leq 30^\circ$


differential pressure
transmitter connection



MOUNTING ON PIPE

- Mounting between flanges or to be welded (BW)
- Flange types : ISO PN 2,5 to PN 420, ASME 150# to 2500#, API flanges
- Gasket types : flat gasket (spiral wound, graphite, PTFE) or RTJ (soft iron, inox, monel...)
- Piping connection between straight sections according to the standard (variable upstream and downstream straight lengths according to β ($\beta=d/D$) and according to the upstream fittings) - see upstream straight lengths table on page 7

STRAIGHT LENGTHS

- Straight lengths required between a nozzle or a venturi-nozzle and fittings
- Values expressed as multiples of D (D = pipe internal diameter)

d/D	UPSTREAM SIDE OF PRIMARY ELEMENT											Downstream side of primary element										
	Single 90° bend or tee	Two or more 90° bends in the same plane	Two or more 90° bends in different planes	Reducer 2D to D over a length of 1,5D to 3D	Expander 0,5D to D over a length of D to 2D	Globe valve fully open	Full bore ball or gate valve fully open	Abrupt symmetrical reduction	Thermometer pocket or well of diameter ≤ 0,03D	Thermometer pocket of diameter between 0,03D and 0,13D	Fittings (Columns 2 to 8)											
	1	2	3	4	5	6	7	8	9	10	11	12										
0,20	10	6	14	7	34	17	5	16	8	18	9	12	6	30	15	5	3	20	10	4	2	
0,40	14	7	18	9	36	18	5	16	8	20	10	12	6	30	15	5	3	20	10	6	3	
0,50	14	7	20	10	40	20	6	5	18	9	22	11	12	6	30	15	5	3	20	10	6	3
0,60	18	9	26	13	48	24	9	5	22	11	26	13	14	7	30	15	5	3	20	10	7	3,5
0,70	28	14	36	18	62	31	14	7	30	15	32	16	20	10	30	15	5	3	20	10	7	3,5
0,80	46	23	50	25	80	40	30	15	54	27	44	22	30	15	30	15	5	3	20	10	8	4

Nota :

The minimum straight lengths required are the lengths between various fittings located upstream or downstream of the primary device and the primary device itself.

All straight lengths shall be measured from the downstream end of the bend or the closest reducer/expander to the upstream face of the primary device.

The installation of thermometer pockets or wells will not alter the required minimum upstream straight lengths for the other fittings.

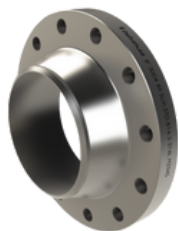
In the columns, left values give lengths corresponding to zero additional uncertainty (see ISO 5167-1 standard).

Right values give lengths corresponding to 0,5% additional uncertainty (see ISO 5167-1 standard). Empty cells when no available data.

ACCESSORIES

For flow measurement, we offer a full range of accessories for assembly with venturi tubes.

■ Flanges



Flanges with flat gasket face, raised face, large male/female face, tongue/groove face, RTJ-F face

■ Transmitter



Differential pressure transmitter, multivariable transmitter

■ Manifold



2-way / 3-way / 5-way manifold with or without direct mounting

■ Condensation pot



■ Valve



■ Flow straightener or conditioner



■ Fittings



FURTHER INFORMATION

All the information on the mounting of nozzles (and their accessories) such as :

- pressure taps orientation
- mounting of the differential pressure transmitter
- flange tightening

can be found on the IOM notice "User guide - installation, operation and maintenance manual" ref DTF-DTF-SMQ-P3-IOM-011 ou DTF-SMQ-P3-IOM-012 provided on request upon delivery of components.

ITEM CODES

- Long Radius nozzle (to be welded) : DTUY-LR-DN-BW-SCH-Material
Long Radius nozzle (with flanges) : DTUY-LR-DN-PN-SCH-Material

DTUY-LR	ND	NP	Schedule	Material
Nominal diameter - ASME	2" to 24"	150# to 2500#	STD	304L 316L Others
OR			40	
			XS	
			80	
			120	
Nominal diameter - ISO	DN50 to 630	PN2,5 to 400	160	

- ISA 1932 nozzle (to be welded) : DTUY-ISA-DN-BW-SCH-Material
ISA 1932 nozzle (with flanges) : DTUY-ISA-DN-PN-SCH-Material

DTUY-ISA	ND	NP	Schedule	Matière
Nominal diameter - ASME	2" to 20"	150# to 2500#	STD	Carbon steel 304L 316L Others
OR			40	
			XS	
			80	
			120	
Nominal diameter - ISO	DN50 to 500	PN2,5 to 400	160	

- Examples nozzle codes:
 - DTUY-LR-8-150-SCH120-316
 - DTUY-ISA-4-900-SCH80-AC
 - For codes for venturi nozzles (DVT) and sonic nozzles (DTS), contact us



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