

Datasheet *Flow Nozzle & Venturi-Nozzle*

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- ✓ Design of the nozzle in accordance with the ISO5167, BS1042, ASME.MFC.3M or ISO TR15377 :2007 standards
- ✓ No need of calibration – standardised principle
- ✓ Accuracy, repeatability and reliability of the flow element
- ✓ Use for non viscous fluids at high velocity
- ✓ Especially suitable for high velocity measurement of vapor flow
- ✓ Very long life-time product
- ✓ Different types of flow nozzles : ISA1932, long radius, venturi-nozzle



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A flow nozzle is a curve-shaped convergent entry leading to a short cylindrical throat. Nozzles are particularly appropriated for high velocity measurement of non-viscous fluids. When such a fluid is forced through an orifice plate, erosion or cavitation could occur degrading the flow element. The nozzle doesn't rely on a sharp edge which can wear out or damage over time, therefore offering excellent long-term accuracy. Nozzles are often used for measurement of vapor flow.

Deltafluid manufactures different types of nozzles :

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

To combine the low pressure loss and the short length of the primary element for high velocity flow measurement, an axisymmetric device called « venturi – nozzle » is available. It comprises a convergent entrance section of the same profile as the ISA1932 nozzle, a cylindrical throat and a divergent outlet.

Technical specifications

Applications – standards

Standards	ISO5167, BS1042, ASME.MFC.3M, ISO TR15377 :2007
Fluid temperature	According specifications
Type of fluid	Gas, steam, liquid (single-phase fluids)
Nominal diameters	ND50 à ND1000 according ISO5167-3 (from 2 to 40 inches) Smaller diameters available according application
Max operating pressure	Limited by the flange rating

The orifice plate is dimensionally checked in compliance with the manufacturing quality controls. Manufacturing is possible according the european directive DESP97/23 CE requirements.

Features

Ratio pressure loss	14% of ΔP for $\beta=0,8$ to 81% of ΔP for $\beta=0,3$ Venturi-nozzle : 11-21% of ΔP for $\beta=0,4$ to 3-8% of ΔP for $\beta=0,75$ (depending on the outlet cone angle)
Accuracy	1 to 2,5% depending on the installation
Material	Carbon steel, Stainless steel, Monel alloy, Hastelloys, Inconels, Titanium, Tantalum, PVC, etc

Mounting

Assembly	Between flanges, inserted between carrier rings with annular slots, monoblock
Piping connection	Between straight sections (variable lengths regarding β and obstacles located up and downstream – see table hereafter)
Type of gaskets	Flat seal (spiral wound gasket, graphite, PTFE) or RTJ (mild steel, stainless steel, monel alloy...)
Centering of orifice bore relative to piping	Distance e between the centerline of the throat and the centerline of the pipe on the upstream and downstream sides : $e \leq 0,002 5D / (0,1 + 2,3 \beta^4)$

Technical description

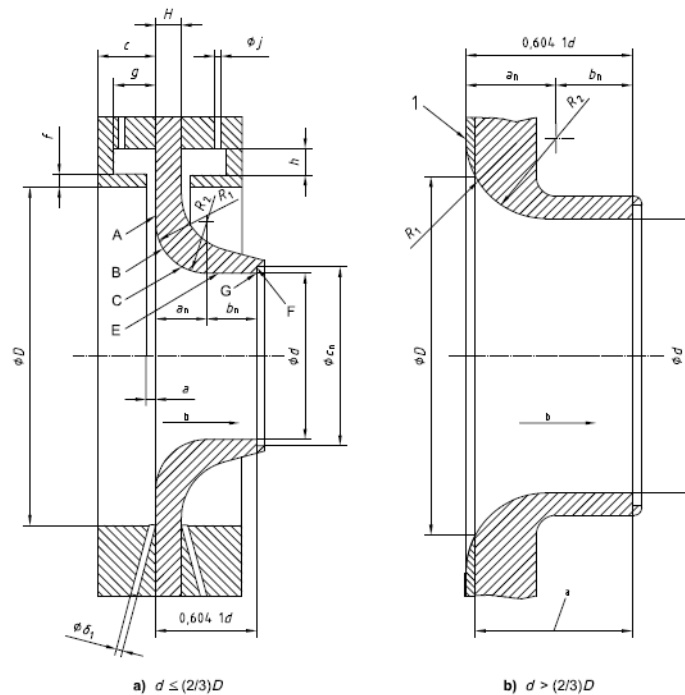
Upstream and internal surfaces	Polished : roughness criterion $Ra < 10^{-4} d$
Diameter of the convergent inlet	2 diameters in the same plane perpendicular to the axial centerline shall not differ from each other by more than 0,1%
Throat cylindricality	No diameter of any cross-section shall differ by more than 0,05% from the value of the mean diameter
Divergent section (venturi-nozzle)	Angle of the divergent section $\leq 30^\circ$

Limits of use

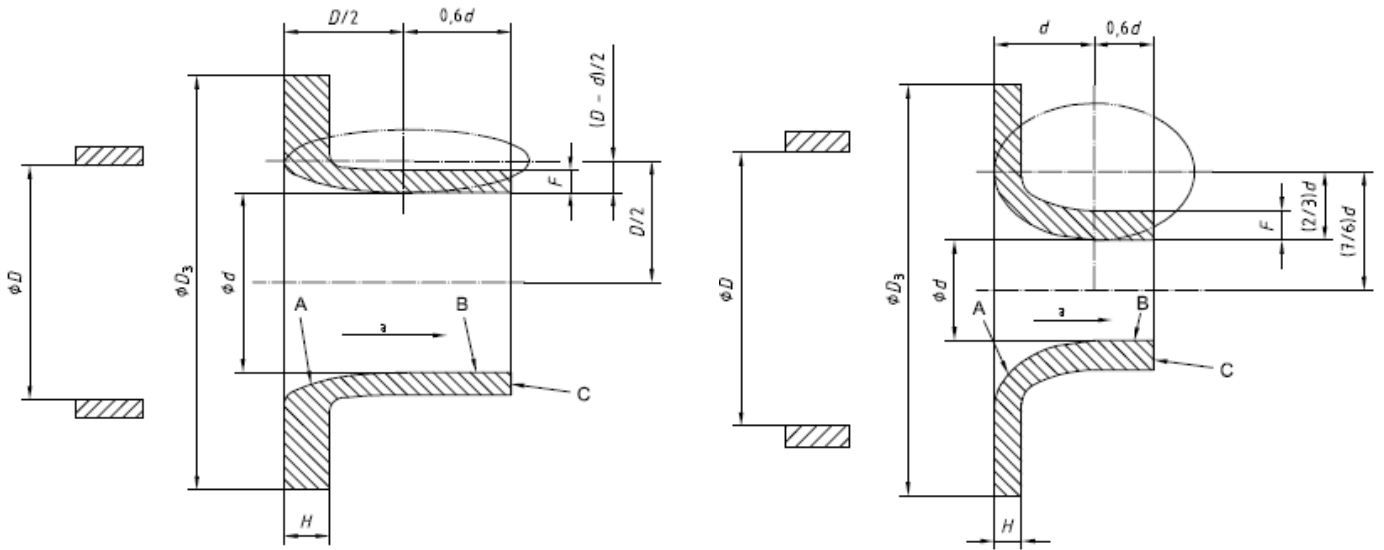
ISA1932 Corner taps	$0.30 \leq \beta \leq 0.80$ $7 \cdot 10^4 \leq Re_D \leq 10^7$ for $0.3 \leq \beta \leq 0.44$ $2 \cdot 10^4 \leq Re_D \leq 10^7$ for $0.44 \leq \beta \leq 0.80$ $50 \leq ND \leq 1000$
Long radius Radius taps	$0.20 \leq \beta \leq 0.80$ $10^4 \leq Re_D \leq 10^7$ $50 \leq ND \leq 630$
Venturi-nozzle Corner taps for upstream pressure tap + downstream tap located in the throat	$0.316 \leq \beta \leq 0.775$ $1,5 \cdot 10^5 \leq Re_D \leq 2 \cdot 10^6$ $65 \leq ND \leq 500$ $d \geq 50 \text{ mm}$

Drawings

ISA1932 nozzle



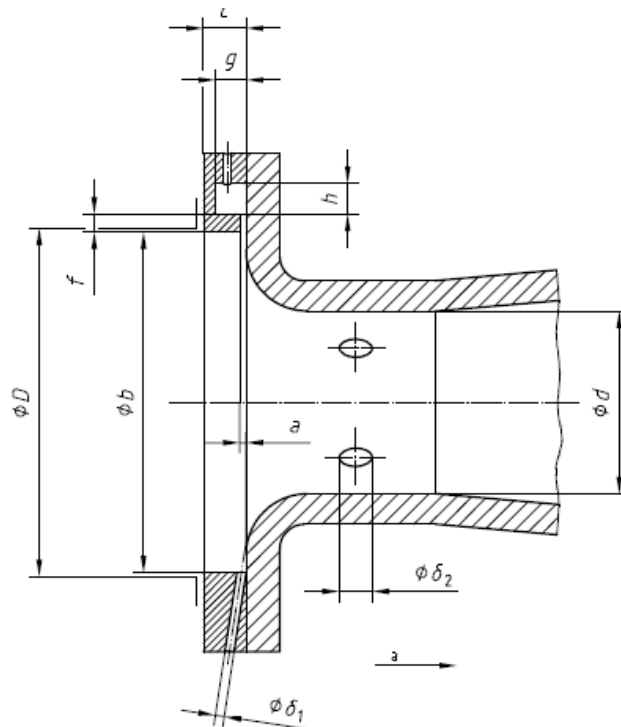
Long radius nozzle



a) High-ratio nozzle ($0,25 \leq \beta \leq 0,8$; $\beta \leq 0,8$)

b) Low-ratio nozzle ($0,20 \leq \beta \leq 0,5$)

Venturi-nozzle



Ordering information Nozzle– MAIN CODE

Delta NZ-	MAIN CODE									
Nozzle	XX	XX	XXX	XXX	XXX	X	XX	XX	XXXXX	XXX
Type of nozzle										
ISA1932 - pressure taps O/O	IS									
Long Radius - pressure taps D-D/2	LR									
for ISA1932 nozzle :										
Annular chamber		AC								
Monobloc		MB								
for Long Radius Nozzle :										
welded		WD								
with pins		PN								
Nominal diameter										
DN15 - 1/2"				1						
DN20 - 3/4"				0,75						
DN25 - 1"				1						
DN32 - 1"1/4				1,25						
DN40 - 1"1/2				1,5						
DN50 - 2"				2						
DN65 - 2"1/2				2,5						
DN80 - 3"				3						
DN100 - 4"				4						
DN125 - 5"				5						
DN150 - 6"				6						
DN200 - 8"				8						
DN250 - 10"				10						
DN300 - 12"				12						
DN350 - 14"				14						
DN400 - 16"				16						
DN450 - 18"				18						
DN500 - 20"				20						
DN600 - 24"				24						
Pipe Schedule										
5-5S				5						
10-10S				10						
20				20						
30				30						
40S-Std				STD						
40				40						
60				60						
XS-80S				XS						
80				80						
100				100						
120				120						
140				140						
160				160						
XXS				XXS						
Material										
Stainless steel 304					SS4					
Stainless steel 316					SS6					
Inconel					INC					
Monel					MON					
Hastelloy					HLY					
PTFE					PTF					
Duplex					DPX					
Superduplex					SDX					
Others - SPECIFY					O					

Delta NZ-	MAIN CODE									
Nozzle	XX	XX	XXX	XXX	XXX	X	XX	XX	XXXXX	XXX
Number of pressure tapings										
2 pressure tapings										
4 pressure tapings						2				
Others - SPECIFY						4				
						O				
Types of pressure tapings										
1/2NPTF								NP		
1/2BSP								BS		
SW								SW		
Others - SPECIFY								O		
Process connection										
Butt welding									BW	
Flanges - <i>type of flanges see options</i>									FL	
Rating	<i>for flange assembly</i>									
150#										A150
300#										A300
600#										A600
900#										A900
1500#										A1500
2500#										A2500
PN10										D10
PN16										D16
PN25										D25
PN40										D40
PN63										D63
PN100										D100
Type of face										
	<i>for flange assembly</i>									
Raising face										RF
Ring Torque Joint										RTJ

Ordering information Venturi-Nozzle– MAIN CODE

Delta VT-NZ							
Venturi Nozzle	XXX	XXX	XXX	XX	XX	XXXXX	XXX
Nominal diameter							
DN15 - 1/2"		1					
DN20 - 3/4"		0,75					
DN25 - 1"		1					
DN32 - 1"1/4		1,25					
DN40 - 1"1/2		1,5					
DN50 - 2"		2					
DN65 - 2"1/2		2,5					
DN80 - 3"		3					
DN100 - 4"		4					
DN125 - 5"		5					
DN150 - 6"		6					
DN200 - 8"		8					
DN250 - 10"		10					
DN300 - 12"		12					
DN350 - 14"		14					
DN400 - 16"		16					
DN450 - 18"		18					
DN500 - 20"		20					
DN600 - 24"		24					
Pipe Schedule							
5-5S		5					
10-10S		10					
20		20					
30		30					
40S-Std		STD					
40		40					
60		60					
XS-80S		XS					
80		80					
100		100					
120		120					
140		140					
160		160					
XXS		XXS					
Material							
Stainless steel 304				SS4			
Stainless steel 316				SS6			
Inconel				INC			
Monel				MON			
Hastelloy				HLY			
PTFE				PTF			
Duplex				DPX			
Superduplex				SDX			
Others - SPECIFY				O			
Types of pressure tapings							
1/2NPTF				NP			
1/2BSP				BS			
SW				SW			
Others - SPECIFY				O			
Process connection							
Butt welding					BW		
Flanges - type of flanges see options					FL		

Delta VT-NZ							
Venturi Nozzle	XXX	XXX	XXX	XX	XX	XXXXX	XXX
Rating	<i>for flange assembly</i>						
150#						A150	
300#						A300	
600#						A600	
900#						A900	
1500#						A1500	
2500#						A2500	
PN10						D10	
PN16						D16	
PN25						D25	
PN40						D40	
PN63						D63	
PN100						D100	
Type of face	<i>for flange assembly</i>						
Raising face							RF
Ring Torque Joint							RTJ

Ordering information both Nozzle & Venturi-Nozzle – OPTIONS

OPTIONAL CODE	XX	XXX	X	XX	XX	XX	X
Flanges*⁽¹⁾							
Welding neck	WN						
Slip on	SO						
Socket welding	SW						
Hub connector	HC						
Others	O						
Flanges material							
ASTM A105		105					
A350LF2		350					
Carbon steel* ⁽²⁾		CST					
Stainless steel 304		SS4					
Stainless steel 316		SS6					
Inconel		INC					
Monel		MON					
Hastelloy		HLY					
PTFE		PTF					
Duplex		DPX					
Superduplex		SDX					
Other		O					
Gaskets							
Flat			F				
Graphite			G				
Spiral wound			S				
PTFE			P				
Others			O				
Boltings material							
Carbon steel				CS			
Stainless steel				SS			
Others				O			
Manifold							
3-way direct mounting					3D		
3-way remote mounting					3R		
5-way direct mounting					5D		
5-way remote mounting					5R		
DP Transmitter							
Standard						SD	
Multivariable						MV	
Temperature sensor*⁽³⁾							
With temperature sensor							Y
Without temperature sensor							N

*⁽¹⁾ NZ- with RF face can be assembled with simple or double & male or female facing depending on the flange

*⁽²⁾ Type of carbon steel to be specified

*⁽³⁾ Type of temperature sensor to be specified

Straight lengths

Required straight lengths for nozzles and venturi-nozzles

Values expressed as multiple of D (D = internal diameter)

Diameter ratio d/D	UPSTREAM SIDE OF THE PRIMARY DEVICE												DOWNSTREAM OF THE PRIMARY DEVICE		
	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 $\varnothing < 0,03 D$	Thermometer pocket or well of \varnothing between 0,03 D and 0,13 D			Fittings columns 2 to 8
β	2	3	4	5	6	7	8	9	10	11					12
1															
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

Notes :

The minimum straight lengths required are the lengths between various fittings located upstream and downstream of the orifice plate and the orifice plate itself.

Straight lengths shall be measured from the upstream face of the orifice plate.

First column for each fitting gives lengths corresponding to « zero additional uncertainty » values (cf standard ISO 5167.1)

Second column for each fitting gives lengths corresponding to "0,5% additional uncertainty" values (cf standard ISO 5167.1).

S represents the distance between two accessories