

FOR SPECIFYING AND PURCHASING ENGINEERS

Venturi tubes and flow nozzles

Classical Venturi tubes with machined or fabricated convergent to ISO 5167-4;
ISA 1932, long radius, throat-tapped and Venturi nozzles to ISO 5167-3 —
flanged, welded in or wafer · DN 50 – DN 1200 · ASME Class 150 – 2500

LINE SIZES	DESIGN CODES	MATERIAL CERTIFICATION
DN 50 – DN 1200	ISO 5167-3 · 5167-4 · MFC-3M	EN 10204 3.1

1. Product and variants

Venturi tubes and nozzles are differential pressure elements with a shaped inlet instead of a square edge. The throat diameter d is calculated for the duty and machined to that figure.

A correctly made element is one part of a working measurement: straight lengths, tappings and instruments count as much. Inkotek states the element geometry and its verification; the installed uncertainty belongs to the whole meter and is stated on the calculation sheet.

 Venturi Tube Flow Element MACHINED OR WELDED CONVERGENT A conical convergent into a machined throat; the divergent cone recovers most of the pressure. Flanged, butt-weld or wafer ends.	 Venturi Nozzle NOZZLE PROFILE WITH A DIVERGENT OUTLET CONE ISA 1932 inlet, tappings in the throat, then a divergent cone that gives back part of the drop.	 Flow Nozzles ISA-1932 · LONG RADIUS · THROAT TAP ISA 1932, long radius (high and low ratio) and throat-tapped nozzles; ISA 1932 and Venturi nozzle profiles also in a wafer body between the line flanges, with the tappings in the body.	 Welded Nozzle BUTT WELD ENDS · NO GASKET JOINT ISA 1932 or long radius nozzle welded between pipe sections, with tapping pipes; shut-off valves and condensate chambers can be welded on.
---	---	---	--

TYPE	ISO 5167 PART: CLAUSE	D, mm	β	REYNOLDS NUMBER	U OF C, K = 2
Classical Venturi tube, machined convergent	-4: 5.1.3, 5.5.3, 5.7.2	50 – 350	0.40 – 0.75	Re_D from 2×10^5	1 % to $Re_D 10^6$; 1.8 % above
Classical Venturi tube, fabricated (welded) convergent	-4: 5.1.4, 5.5.4, 5.7.3	200 – 1200	0.40 – 0.70	$Re_D 2 \times 10^5 – 2 \times 10^6$	1.5 %
ISA 1932 nozzle	-3: 5.1.6.1, 5.1.7.1	50 – 500	0.30 – 0.80	$Re_D 7 \times 10^4 – 10^7$ below $\beta 0.44$; $2 \times 10^4 – 10^7$ from $\beta 0.44$	0.8 % to $\beta 0.60$; ($2\beta – 0.4$) % above

TYPE	ISO 5167 PART: CLAUSE	D, mm	β	REYNOLDS NUMBER	U OF C, K = 2
Long radius nozzle, high / low ratio	-3: 5.2.1, 5.2.6.1, 5.2.7.1	50 – 630	0.25 – 0.80; low ratio 0.20 – 0.50	$Re_D 10^4 - 10^7$	2.0 %
Throat-tapped nozzle	-3: 5.3.5.1, 5.3.6.1	100 – 630	0.40 – 0.50	$Re_d 8 \times 10^5 - 2 \times 10^7$ (throat)	0.7 %
Venturi nozzle	-3: 5.4.4.1, 5.4.5.1	65 – 500; $d \geq 50$	0.316 – 0.775	$Re_D 1.5 \times 10^5 - 2 \times 10^6$	$(1.2 + 1.5\beta^4) \%$

Table 1 — Types and uncalibrated limits. ISO 5167-4:2022 covers $50 \text{ mm} \leq D \leq 1200 \text{ mm}$ and ISO 5167-3:2022 $50 \text{ mm} \leq D \leq 630 \text{ mm}$ (Clause 1). Outside the type limits above the element needs a flow calibration (ISO 5167-4, 5.5.1 and Clause 7; ISO 5167-3, Clause 7); ISO/TR 15377 does not extend them. U of C: expanded uncertainty of the discharge coefficient inside these limits, with the upstream pipe within the roughness limits of the same clauses and straight lengths at or above the zero-additional-uncertainty values of ISO 5167-4, Table 1 or ISO 5167-3, Table 3; between those and the shorter values, add 0.5 % arithmetically. DN 50 pipe in Sch 80 and heavier bores below 50 mm. For an element specified to ASME MFC-3M, the limits and C of that standard apply and are stated on the calculation sheet.

2. Technical data

2.1 Venturi tube

PROPERTY	VALUE
TYPE	Classical Venturi tube with a machined or fabricated (welded) convergent (ISO 5167-4:2022, 5.1.3, 5.1.4)
LINE SIZE	DN 50 – DN 1200 (2" – 48"); larger with flow calibration, on request. Uncalibrated limits: Table 1
PRESSURE RATING	Flanged: EN 1092-1 PN 6 – PN 400 / ASME Class 150 – 2500; other flange standards to the project. Butt-weld ends: by pressure design (Section 6)
DESIGN STANDARD	ISO 5167-4:2022 — convergent profile, throat length and divergent angle; ASME MFC-3M-2004, Part 4, where specified
PRESSURE TAPPINGS	Inlet and throat; single wall tapplings, or several per plane joined by an annular chamber, piezometer ring or triple-T (5.4.1). Hole diameter (5.4.2): for $d \geq 33.3 \text{ mm}$, 4 – 10 mm, at most 0.1D at the inlet and 0.13d in the throat; for $d < 33.3 \text{ mm}$, throat 0.1d – 0.13d, inlet 0.1d – 0.1D
THROAT TOLERANCE	d: mean of at least four diameters in the tapping plane, one near each tapping; diameters also in other planes, none along the throat more than 0.1 % from the mean (5.2.4); entrance cylinder 0.4 % (5.2.2)
SURFACE FINISH	Throat $Ra < 10^{-4}d$ (5.2.7); machined convergent as the throat; fabricated convergent about $5 \times 10^{-4}D$ (5.2.9, 5.2.10)
STRAIGHT LENGTHS	ISO 5167-4:2022, Table 1; shorter than for an orifice plate, nozzle or Venturi nozzle of the same β , but the tube's own length adds to the run (6.2.1). With single tapplings, longer upstream lengths may be needed
MEASURING UNCERTAINTY	Stated on the calculation sheet for the duty; discharge coefficient: Table 1
PERMANENT PRESSURE LOSS	5 – 20 % of the differential, for guidance (5.9.2). With a 7° divergent above $Re_D 10^6$, mostly 5 – 15 % at $\beta 0.4 - 0.75$; more with a wider divergent (Annex C)
FLOW CALIBRATION	On request, at an accredited laboratory: outside Table 1, or for a lower uncertainty of C; each tapping set calibrated separately, no extrapolation (5.5.1, Clause 7)

2.2 Nozzles — ISA 1932, long radius, throat-tapped, Venturi nozzle

PROPERTY	VALUE
PROFILES	ISA 1932, long radius (high and low ratio), throat-tapped, Venturi nozzle (ISO 5167-3:2022, 5.1 – 5.4); geometry in Table 2
LINE SIZE	ISA 1932: DN 50 – DN 500 (2" – 20"); long radius: DN 50 – DN 600 (2" – 24"); throat-tapped: DN 100 – DN 600 (4" – 24"); Venturi nozzle: DN 80 – DN 500 (3" – 20"). Uncalibrated limits: Table 1
PRESSURE CLASS	Flanged: ASME Class 150 – 2500 / EN 1092-1 PN 6 – PN 400; other flange standards to the project. Butt-weld ends: by pressure design (Section 6)
STANDARDS	ISO 5167-3:2022; ASME MFC-3M-2004, Part 3; ASME PTC 6-2004, 4-8, for the throat-tapped nozzle as a calibrated flow section
BETA RATIO	0.20 – 0.80 depending on profile; Venturi nozzle 0.316 – 0.775 (Table 1)
CONSTRUCTION	Welded into a spool, flanged, or wafer between line flanges (wafer: ISA 1932 and Venturi nozzle)
TAPPINGS	ISA 1932: corner; downstream also wall, within 0.15D ($\beta \leq 0.67$) or 0.20D of the upstream face (5.1.5). Long radius: wall, 1D upstream and 0.5D downstream of the inlet face; low ratio below β 0.3188, downstream at 1.6d (5.2.5). Throat-tapped: 1D upstream and in the throat (5.3.4). Venturi nozzle: corner upstream, at least four in the throat into a chamber or ring (5.4.3)
THROAT AND PROFILE	d: mean of at least four diameters, none more than 0.05 % off (5.1.2.5, 5.2.2.3, 5.4.1.6; also 5.3.2.4); inlet template (5.1.2.8, 5.2.2.2); $Ra \leq 10^{-4}d$ (5.1.2.9, 5.2.2.6, 5.4.1.9). Measured and recorded
INSTALLATION THICKNESS	Per design, on the drawing. Nozzle thickness H: ISA 1932 at most 0.1D (5.1.3.1); long radius 3 mm – 0.15D (5.2.2.5)
STRAIGHT LENGTHS	ISO 5167-3:2022, Table 3; throat-tapped nozzle also with a perforated-plate conditioner (6.3.2)
MEASURING UNCERTAINTY	Stated on the calculation sheet for the duty; discharge coefficient: Table 1
PERMANENT PRESSURE LOSS	Without a divergent cone (5.1.8, 5.2.8, 5.3.8): about 84 % of the differential at β 0.30, 61 % at 0.50, 25 % at 0.80 (ISA 1932, Re_D 10 ⁶); long radius about 92 % at β 0.20, 22 % at 0.80. Venturi nozzle, divergent 15° or less: 5 – 20 %, for guidance (5.4.6)
FLOW CALIBRATION	On request, at an accredited laboratory: outside Table 1 or for a lower uncertainty of C (Clause 7). Throat-tapped nozzle: at six or more Reynolds numbers, then extrapolated (5.3.7); as an ASME PTC 6 flow section, always calibrated (4-8.4)

2.3 Welded nozzle (special design)

PROPERTY	VALUE
CONSTRUCTION	ISA 1932 or long radius nozzle welded between inlet and outlet pipe sections; ASME B16.25 butt-weld ends; flanged spool on request
LINE SIZE	NPS 2" – 24" (DN 50 – DN 600); uncalibrated limits: ISA 1932 $D \leq 500$ mm, long radius $D \leq 630$ mm (Table 1)
PRESSURE RATING	Butt-weld ends: by pressure design of the pipe sections to ASME B31.1, B31.3 or EN 13480-3, as specified. Flanged spool: ASME Class 150 – 2500 / EN 1092-1 PN 6 – PN 400
WELD PREPARATION	Cut to the actual pipe wall, not the nominal
PIPE SECTIONS	Upstream and downstream lengths to ISO 5167-3:2022, Table 3, as the project needs; overall length on the installation drawing
INSTALLATION	On steam lines, welded in after chemical cleaning and steam blow-out; a straight pipe takes its place until then
UNCERTAINTY, PRESSURE LOSS	As 2.2 for the profile

3. Materials

PART	MATERIAL	NOTE
NOZZLE & THROAT	316 / 316L, 304 / 304L stainless steel	Default for water, steam and clean gas; where the throat has to expand with the pipe, an alloy matched to the line, e.g. A182 F11
VENTURI TUBE THROAT & LINER	316 / 316L, 304 / 304L stainless steel	Hardfacing or a ceramic liner for solids-bearing media
BODY, CONES & PIPE SECTIONS	A106 Gr B carbon, A335 P11 / P22 alloy, A312 TP316L stainless; 16Mo3; P235GH for pipe sections and fabricated Venturi bodies only	Matched to the piping class; a fabricated Venturi tube may combine a carbon steel body with a stainless throat insert
HIGH TEMPERATURE SERVICE	A182 F11 / A335 P11; A182 F22, F91 / F92, 347H	Creep resistant grades for main steam and reheat lines
CORROSION RESISTANT UPGRADE	Duplex (UNS S31803 / S32205), super duplex (UNS S32750), Alloy C-276 (UNS N10276), Alloy 625 (UNS N06625), Alloy 400 (UNS N04400)	Nozzle or throat only, or the whole body, where chloride or acidic service governs
NON-METALLIC, WAFER TYPE	PTFE, PEEK	Clamped between the line flanges, so the polymer carries no pipe load
TAPPINGS & ACCESSORIES	To the pipe grade, or 316L	Tapping pipes, shut-off valves, two-port condensate chambers

4. Dimensions

There is no catalogue dimension table: d comes from the calculation, the installed length from the line and the tapping arrangement. The installation drawing is issued with the project for approval. Symbols: D inlet internal diameter; d throat diameter, $\beta = d/D$; L overall face to face length; H nozzle thickness; α_1 and α_2 convergent and divergent angles.

ELEMENT	INLET	THROAT	OUTLET
Classical Venturi tube	Entrance cylinder at least D long; $\alpha_1 = 21^\circ \pm 1^\circ$, convergent about $2.7(D - d)$ long	Cylindrical, length $d \pm 0.03d$	$\alpha_2 = 7^\circ - 15^\circ$, $7^\circ - 8^\circ$ for low loss; may be truncated by about 35 % of its length
ISA 1932 nozzle	Flat inlet (none above $\beta 0.667$) and two arcs, $R1 = 0.2d$, $R2 = d/3$	$0.3d$ long	Thickness $H \leq 0.1D$
Long radius nozzle	Quarter ellipse, semi-axes $D/2$ and $(D - d)/2$ (high ratio) or d and $2d/3$ (low ratio)	$0.6d$ long	$3 \text{ mm} \leq H \leq 0.15D$
Throat-tapped nozzle	Ellipse, $r1 = d$, $0.625d < r2 < 0.67d$	Tapping plane $0.5d$ into the throat, then $0.25d - 0.3d$	—
Venturi nozzle	As ISA 1932	$0.3d$, then $0.4d - 0.45d$	Divergent 30° or less; may be truncated by about 35 %

Table 2 — Geometry fixed by the standards. ISO 5167-4:2022, 5.2.2 – 5.2.10; ISO 5167-3:2022, 5.1.2 – 5.1.3, 5.2.2 – 5.2.3, 5.3.2, 5.4.1. Dimensions are for the listed configurations; the approved project drawing governs.

5. Options and configuration

OPTION	CHOICES
END CONNECTIONS	Flanged, facing to the flange standard specified (RF, FF, RTJ and others); ASME B16.25 butt-weld ends; wafer between the line flanges
TAPPING INTERFACE	Plain, butt weld, threaded, flanged, compact per IEC 61518, or compression fitting

OPTION	CHOICES
TAPPING ARRANGEMENT	Single tappings, or an annular chamber or piezometer ring where the type allows; drain connections (not on long radius nozzles)
WELDED ACCESSORIES	Shut-off valves, two-port condensate chambers, or both
SUPPLY	Element alone, in a spool with straight lengths, or in a meter run built to the project

6. Quality control and documentation

ITEM	SCOPE
QUALITY SYSTEM	ISO 9001:2015; PED where it applies
PRESSURE DESIGN	ASME B31.1, B31.3 or EN 13480-3, as specified
WELDING	Procedures qualified to EN ISO 15614-1 or ASME Section IX, including stainless nozzle to alloy steel pipe; preheat, PWHT and hardness checks where the grade requires them
NDE	To the project specification and the design code: visual, penetrant or magnetic particle, and radiographic or ultrasonic examination, extent as specified
PRESSURE TEST	Hydrostatic, or pneumatic where the project specifies, on welded builds
DIMENSIONAL REPORT	Throat d and D (Venturi tube: entrance cylinder; nozzle: pipe, where İnkotek supplies it) from the number of diameters ISO 5167-3 / -4 requires, used in the calculation; roughness, tapping holes, inlet profile by template. Calibrated internal micrometers up to 1000 mm, above that calibrated micrometers of the required range, reading to 0.005 mm where the instrument allows; CMM on request
MARKING	Marking method to the project. Tag and serial number, size, rating — or design pressure and temperature for weld ends — throat diameter, β , materials and flow direction
CERTIFICATES	EN 10204 3.1, heat numbers traceable to the marking; 3.2 on request
DOCUMENTATION	Sizing calculation, material certificates, dimensional (profile inspection) report and installation drawing; on welded builds, WPS and PQR, NDE and pressure test records where the scope of supply calls for them, and PWHT records where PWHT is performed; declaration of conformity to ISO 5167-3 / -4:2022 on request

7. What to send with an enquiry

1. Element and profile: ISA 1932, long radius, throat-tapped nozzle, Venturi nozzle, Venturi tube; wafer construction
2. Line size and schedule — sets the body and the throat diameter d
3. Flange standard, rating and facing, or butt-weld ends
4. Medium, phase and density
5. Minimum, normal and maximum flow — sets β and the differential
6. Operating and design pressure and temperature
7. Tapping interface: plain, butt weld, threaded, flanged, compact per IEC 61518 or compression fitting
8. Face-to-face length available (Venturi nozzle: room for the divergent cone)

For a **welded nozzle**, also: pipe material, actual wall thickness, welding procedure and NDT scope.

Send the enquiry to info@inkotekenerji.com or through the enquiry form at inkotekenerji.com/en/contact/.

DOCUMENT CONTROL

Ranges are manufacturing capability and are not an offer. Final geometry, materials and documentation are governed by the approved project drawing and the contract.

© 2026 İnkotek Enerji Sanayi ve Ticaret Ltd. Şti. · INK-DS-04 Rev 00 · 4 October 2026