+ NUFLO Cone DP Flowmeter

Accurate, cost-effective solutions for challenging flow measurement applications

APPLICATIONS

+ Wet and dry gas
+ Water and low-viscosity liquids
+ Steam

BENEFITS

+ Field-proven technology
+ Ruggedness and erosion resistance
+ Size range from ½ in to 48 in
+ High static line pressures
+ Wide range of exotic materials available
+ Long, cost-effective service life with no moving parts and minimal maintenance

The NUFLO* measurement technology portfolio includes a differential pressure (DP) cone meter that provides accurate, repeatable, and cost-optimized flow measurement solutions. Designed to work in unprocessed and processed fluids, the DP cone meter is ideal for upstream, midstream, and downstream applications that present a wide range of measurement challenges.

NUFLO DP cone meter technology

NUFLO DP cone meter technology with Scanner* flow computer, which computes volume, mass, and energy amounts for many types of fluid flow

NUFLO DP Cone Meter Measurement Technology

The NUFLO DP cone meter technology provides a unique solution outside the scope of traditional technologies due to the hydrodynamic shape of the cone. The design of the meter positions a low permanent pressure-loss restriction in the center of the flow stream, which enables solids or liquids to pass by unimpeded with a negligible effect on the intended measurement. Cone measurement technology is well suited to any gas or low-viscosity liquid with or without contaminants.

The downstream differential pressure is sensed from the center of the flowline downstream of the cone, where turbulence is least and the signal is most stable. This position enables the meaningful measurement of less that 1 in of water column and therefore large flow rangeability or turndown.

Supported by decades of experience and a broad and complementary base of instrumentation capabilities, the NUFLO DP cone meter technology strengthens the capability of Sensia to provide the best solution for virtually any measurement application.

Wide-ranging applications

+ Oil and gas: upstream and midstream
  - Natural gas custody transfer measurement (CTM)
  - Wellhead and separator measurement (both produced water and gas)
  - Compressor control and fuel gas
  - Wet gas and steam†
  - Natural gas allocation metering‡
  - White oil blending
  - Seawater pump control, crude oil pump control allocation, and injection metering (all forms)
  - Enhanced oil and gas recovery ($C0_2$ and steam)§
  - Coalbed methane (CBM) for low-pressure systems (5- to 20-psi gauge pressure)
  - Produced water and water injection and disposal
+ Oil and gas: downstream
  - Gas processing
  - Butane
  - O_2
  - CO_2
  - Liquid natural gas (LNG)
+ Wastewater
  - Treated water
  - Blower air flow
+ Municipal water
+ Utilities
  - Wet or dry steam
  - Condensate return
  - Feedwater

HIGH-PERFORMANCE CHARACTERISTICS

The NUFLO DP cone meter technology achieves accuracies of up to ±0.5% of reading (Reynolds number and fluid dependent) with a nominal repeatability of 0.1% under many conditions and modes of operation. The meter can operate with flow turndowns up to 10 to 1.

TECHNICAL FLEXIBILITY

The NUFLO DP cone meter technology can be manufactured in diameters from ½ in to 48 in with flanges ranging from Class 150 to 2500 in accordance with ASME B31.3. This sizing flexibility, plus the availability of special materials (duplex stainless steel and Hastelloy®), offers a new solution for specialty fluid metering requirements. Custom designs for higher pressure ratings are available upon request. Threaded NPT or butt weld connections are also available.

SPACE SAVINGS AND WEIGHT REDUCTION

To condition the flow profile, differential pressure measurement systems typically require long upstream and downstream piping sections. This can add significant cost to most metering installations.The NUFLO DP cone meter technology has the ability to redistribute and change the velocity profile upstream of its cone. This flow conditioning enables using a shorter meter run, which reduces installation and setup costs. This is especially significant in the offshore environment, where space and weight reductions are paramount and where real estate is at a premium.

LOW COST OF OWNERSHIP

The NUFLO DP cone meter technology has no moving parts and does not require the replacement of primary spare parts for the operational life of the unit. The meter is constructed from high-grade traceable materials, and high-quality welding and nondestructive testing (NDT) techniques are strictly applied throughout the manufacturing process.

Wear is minimized at the beta edge of the cone because this edge is downstream of the flow, which helps to maintain a constant stable geometry through the meter's operating life.

SIZING

Sensia sizing software is available for download from the Sensia measurement website. After entering the fluid details and intended flow, pressure, and temperature conditions, the user can consider the influence of different rates of flow, minimum and maximum pressure, and temperature together with beta ratio. Through this process, the optimal sizing selection can be made.

The beta ratio changes the amount of unrestricted flow area to the blocked area. This selection changes the amount of differential pressure generated for a given flow rate and pipe size.

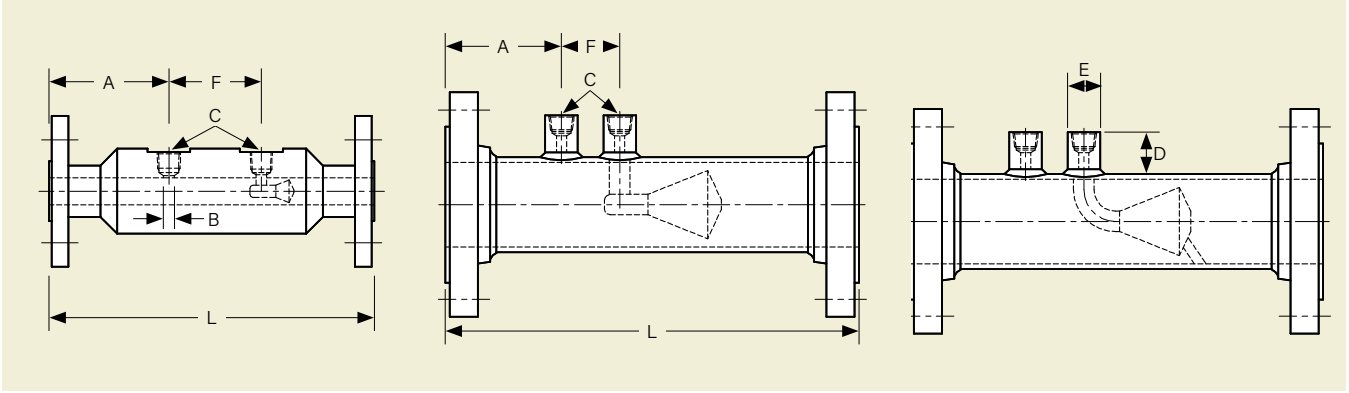
The sizing software produces a comprehensive sizing report that is reviewed by Sensia engineers prior to meter fabrication.

† By using the Stevens wet gas correlation (Published: NSFMW 2004 and Flomeco 2005 with beta at 0.75 only). ‡ To ISO 5167 Part 5 standard.
§ SAGD processes

Class ANSI B16.5 Raised-Face Slip-On Flange; B31.1 & B31.3 Body

Size, JIS [ANSI]	150		300		600		900		1500		2500		B, in	C, NPT	D, in [mm]	E, in [mm]		F, in [mm]	
	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]				3000	6000	3000	6000
15A [½ in]	8.27 [210]	3.15 [80]	8.27 [210]	3.15 [80]	9.06 [230]	3.54 [90]	9.45 [240]	3.74 [95]	9.45 [240]	3.74 [95]	–	–	⅛	¼	–	–	–	–	2.13 [54]
20A [¾ in]	8.66 [220]	3.35 [85]	8.66 [220]	3.35 [85]	9.45 [240]	3.74 [95]	9.84 [250]	3.94 [100]	9.84 [250]	3.94 [100]	–	–	⅛	¼	–	–	–	–	2.13 [54]
25A [1 in]	7.87 [200]	2.56 [65]	8.07 [205]	2.76 [70]	11.81 [300]	4.72 [120]	12.60 [320]	5.12 [130]	12.60 [320]	5.12 [130]	–	–	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
40A [1 ½ in]	10.24 [260]	2.95 [75]	10.43 [265]	3.15 [80]	12.60 [320]	5.12 [130]	13.39 [340]	5.51 [140]	13.39 [340]	5.51 [140]	–	–	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
50A [2 in]	11.81 [300]	3.54 [90]	11.81 [300]	3.54 [90]	13.39 [340]	5.12 [130]	15.75 [400]	6.30 [160]	15.75 [400]	6.30 [160]	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
65A [2 ½ in]	11.81 [300]	3.54 [90]	11.81 [300]	3.54 [90]	14.17 [360]	5.51 [140]	15.75 [400]	6.30 [160]	15.75 [400]	6.30 [160]	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
80A [3 in]	14.17 [360]	3.54 [90]	14.57 [370]	3.94 [100]	16.14 [410]	5.51 [140]	16.93 [430]	6.30 [160]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
100A [4 in]	15.75 [400]	3.94 [100]	16.14 [410]	4.33 [110]	18.11 [460]	6.30 [160]	18.50 [470]	6.69 [170]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
125A [5 in]	22.05 [560]	4.33 [110]	22.44 [570]	4.72 [120]	24.41 [620]	6.69 [170]	24.80 [630]	7.09 [180]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
150A [6 in]	22.05 [560]	4.33 [110]	22.44 [570]	4.72 [120]	24.41 [620]	6.69 [170]	25.59 [650]	7.87 [200]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
200A [8 in]	25.98 [660]	5.12 [130]	26.38 [670]	5.51 [140]	28.35 [720]	7.48 [190]	29.53 [750]	8.66 [220]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
250A [10 in]	27.95 [710]	5.12 [130]	28.74 [730]	5.91 [150]	31.10 [790]	8.27 [210]	32.28 [820]	9.45 [240]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
300A [12 in]	29.92 [760]	5.12 [130]	30.71 [780]	5.91 [150]	33.07 [840]	8.27 [210]	35.04 [890]	10.24 [260]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
350A [14 in]	31.50 [800]	6.30 [160]	32.28 [820]	7.09 [180]	39.37 [1,000]	9.84 [250]	42.52 [1,080]	11.81 [300]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
400A [16 in]	35.43 [900]	7.09 [180]	36.22 [920]	7.87 [200]	42.91 [1,090]	10.63 [270]	45.28 [1,150]	12.20 [310]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
450A [18 in]	39.37 [1,000]	7.87 [200]	40.16 [1,020]	8.66 [220]	46.06 [1,170]	10.63 [270]	49.21 [1,250]	12.60 [320]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
500A [20 in]	43.31 [1,100]	7.87 [200]	44.09 [1,120]	8.66 [220]	50.39 [1,280]	11.02 [280]	52.76 [1,340]	13.39 [340]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
600A [24 in]	53.15 [1,350]	7.87 [200]	53.94 [1,370]	8.66 [220]	57.87 [1,470]	11.42 [290]	61.81 [1,570]	15.35 [390]	–	–	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]

Note: 3000 and 6000 denote class in psi of threaded pressure taps.

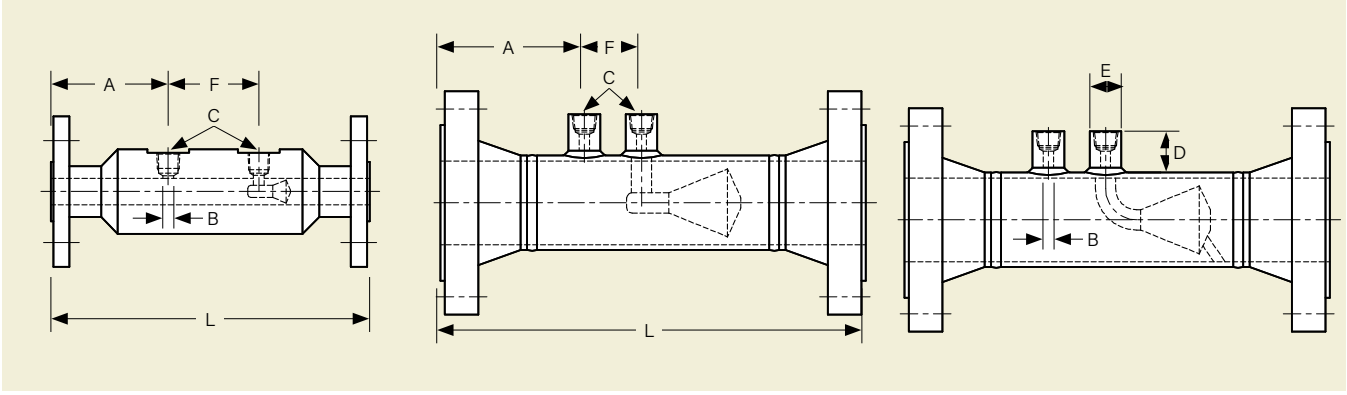


Size ½ in and ¾ in (machined body) **Size 1–6 in** **Size 8–24 in**

Class ANSI B16.5 Raised-Face Weld Neck and Ringjoint Weld Neck Flange, B31.1 & B31.3 Body

Size, JIS [ANSI]	150		300		600		900		1500		2500		B, in	C, NPT	D, in [mm]	E, in [mm]		F, in [mm]	
	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]	L, in [mm]	A, in [mm]				3000	6000	3000	6000
15A [½ in]	8.27 [210]	3.15 [80]	8.27 [210]	3.15 [80]	9.06 [230]	3.54 [90]	9.45 [240]	3.74 [95]	9.45 [240]	3.74 [95]	9.84 [250]	3.94 [100]	⅛	¼	–	–	–	–	2.13 [54]
20A [¾ in]	8.66 [220]	3.35 [85]	8.66 [220]	3.35 [85]	9.45 [240]	3.74 [95]	9.84 [250]	3.94 [100]	9.84 [250]	3.94 [100]	10.24 [260]	4.13 [105]	⅛	¼	–	–	–	–	2.13 [54]
25A [1 in]	11.02 [280]	4.33 [110]	11,42 [290]	4.72 [120]	11.81 [300]	4.72 [120]	12.60 [320]	5.12 [130]	12.60 [320]	5.12 [130]	14.17 [360]	5.91 [150]	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
40A [½ in]	11,42 [290]	4.72 [120]	12.20 [310]	5.12 [130]	12.60 [320]	5.12 [130]	13.39 [340]	5.51 [140]	13.39 [340]	5.51 [140]	15.75 [400]	6.69 [170]	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
50A [2 in]	12.99 [330]	4.72 [120]	13.39 [340]	5.12 [130]	13.39 [340]	5.12 [130]	15.75 [400]	6.30 [160]	15.75 [400]	6.30 [160]	17.32 [440]	7.48 [190]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
65A [½ in]	13.39 [340]	5.12 [130]	13.39 [340]	5.12 [130]	14.17 [360]	5.51 [140]	15.75 [400]	6.30 [160]	15.75 [400]	6.30 [160]	18.90 [480]	7.87 [200]	⅜	½	1,54 [39]	1.18 [30]	1,50 [38]	2.13 [54]	2.76 [70]
80A [3 in]	15.75 [400]	5.12 [130]	16.14 [410]	5.51 [140]	16.14 [410]	5.51 [140]	16.93 [430]	6.30 [160]	17.72 [450]	7.09 [180]	21,26 [540]	9.06 [230]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
100A [4 in]	16.93 [430]	5.12 [130]	17.32 [440]	5.51 [140]	18.11 [460]	6.30 [160]	18.50 [470]	6.69 [170]	18.90 [480]	7.09 [180]	23.62 [600]	9.84 [250]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
125A [5 in]	23.62 [600]	5.91 [150]	24.02 [610]	6.30 [160]	24.41 [620]	6.69 [170]	25.20 [640]	7.48 [190]	25.98 [660]	8.66 [220]	29.53 [750]	11.81 [300]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
150A [6 in]	23.62 [600]	5.91 [150]	24.02 [610]	6.30 [160]	24.80 [630]	7.09 [180]	25.59 [650]	7.87 [200]	26.77 [680]	9.45 [240]	32.28 [820]	13.78 [350]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
200A [8 in]	27.17 [690]	6.30 [160]	27.56 [700]	6.69 [170]	28.35 [720]	7.48 [190]	29.53 [750]	8.66 [220]	31.50 [800]	11,02 [280]	37.40 [950]	15.75 [400]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
250A [10 in]	29.13 [740]	6.30 [160]	29.92 [760]	7.09 [180]	31.10 [790]	8.27 [210]	32.28 [820]	9.45 [240]	35.43 [900]	12.60 [320]	51.18 [1,300]	21.65 [550]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
300A [12 in]	31.50 [800]	6.69 [170]	32.28 [820]	7.48 [190]	33.07 [840]	8.27 [210]	35.04 [890]	10.24 [260]	38.58 [980]	13.78 [350]	55.12 [1,400]	22.44 [570]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
350A [14 in]	37.40 [950]	8.27 [210]	38.19 [970]	9.06 [230]	39.37 [1,000]	9.84 [250]	42.52 [1,080]	11.81 [300]	49.21 [1,250]	15.35 [390]	–	–	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
400A [16 in]	40.55 [1,030]	8.27 [210]	41.34 [1,050]	9.06 [230]	42.91 [1,090]	10.63 [270]	45.28 [1,150]	12.20 [310]	53.15 [1,350]	16.14 [410]	–	–	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
450A [18 in]	44.49 [1,130]	9.06 [230]	45.28 [1,150]	9.84 [250]	46.06 [1,170]	10.63 [270]	49.21 [1,250]	12.60 [320]	57.09 [1,450]	16.93 [430]	–	–	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
500A [20 in]	48.43 [1,230]	9.06 [230]	49.21 [1,250]	9.84 [250]	50.39 [1,280]	11,02 [280]	52.76 [1,340]	13.39 [340]	61.02 [1,550]	17.72 [450]	–	–	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
600A [24 in]	55.91 [1,420]	9.45 [240]	56.69 [1,440]	10.24 [260]	57.87 [1,470]	11,42 [290]	61.81 [1,570]	15.35 [390]	70.87 [1,800]	20.08 [510]	–	–	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]

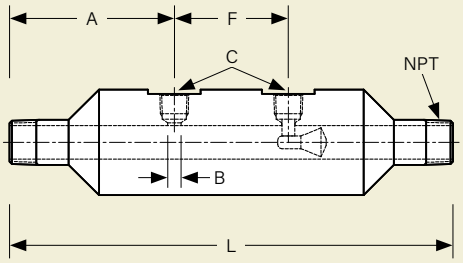
Note: 3000 and 6000 denote class in psi of threaded pressure taps.



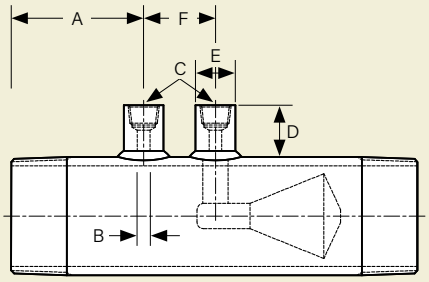
Size ½ in and ¾ in (machined body) **Size 1–6 in** **Size 8–24 in**

Threaded NPT Connection, B31.1 and B31.3 Body									
Size, JIS [ANSI]	L, in [mm]	A, in [mm]	B, in	C, NPT	D, in [mm]	E, in [mm]		F, in [mm]	
						3000	6000	3000	6000
15A [½ in]	7.87 [200]	2.56 [65]	⅛	¼	–	–	–	–	2.13 [54]
20A [¾ in]	7.87 [200]	2.56 [65]	⅛	¼	–	–	–	–	2.13 [54]
25A [1 in]	7.87 [200]	2.56 [65]	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
40A [1 ½ in]	10.24 [260]	2.95 [75]	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
50A [2 in]	11.81 [300]	3.54 [90]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
65A [2 ½ in]	11.81 [300]	3.54 [90]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
80A [3 in]	14.17 [360]	3.54 [90]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
100A [4 in]	15.75 [400]	3.94 [100]	⅜	½	1,54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]

Note: 3000 and 6000 denote class in psi of threaded pressure taps



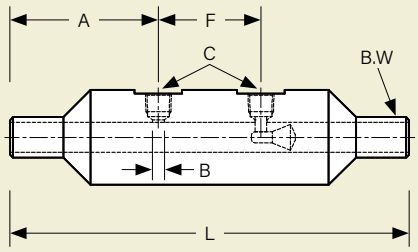
Size ½ in and ¾ in (machined body).



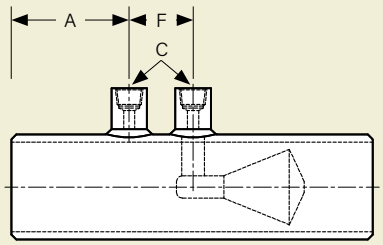
Size 8–24 in.

Class ANSI B16.25 Butt-Welded Body									
Size, JIS [ANSI]	L, in [mm]	A, in [mm]	B, in	C, NPT	D, in [mm]	E, in [mm]		F, in [mm]	
						3000	6000	3000	6000
15A [½ in]	7.87 [200]	2.56 [65]	⅛	¼	–	–	–	–	2.13 [54]
20A [¾ in]	7.87 [200]	2.56 [65]	⅛	¼	–	–	–	–	2.13 [54]
25A [1 in]	7.87 [200]	2.56 [65]	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
40A [1 ½ in]	10.24 [260]	2.95 [75]	¼	¼	0.98 [25]	0.87 [22]	1.18 [30]	2.13 [54]	2.13 [54]
50A [2 in]	11.81 [300]	3.54 [90]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
65A [2 ½ in]	11.81 [300]	3.54 [90]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
80A [3 in]	14.17 [360]	3.54 [90]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
100A [4 in]	17.72 [450]	3.94 [100]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
125A [5 in]	20.47 [520]	4.33 [110]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
150A [6 in]	23.62 [600]	4.33 [110]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
200A [8 in]	25.98 [660]	5.12 [130]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
250A [10 in]	27.95 [710]	5.12 [130]	⅜	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
300A [12 in]	29.92 [760]	5.12 [130]	½	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
350A [14 in]	31.50 [800]	6.30 [160]	½	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
400A [16 in]	35.43 [900]	7.09 [180]	½	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
450A [18 in]	39.37 [1,000]	7.87 [200]	½	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
500A [20 in]	43.31 [1,100]	7.87 [200]	½	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [54]	2.76 [70]
600A [24 in]	53.15 [1,350]	7.87 [200]	½	½	1.54 [39]	1.18 [30]	1.50 [38]	2.13 [541	2.76 [70]

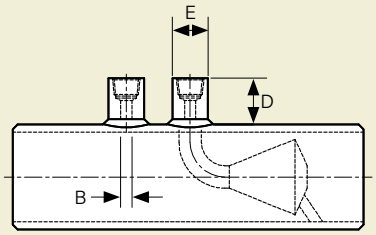
Note: 3000 and 6000 denote class in psi of threaded pressure taps



Size ½ in and ¾ in (machined body)



Size 1–6 in



Size 8–24 in

NUFLO DP Cone Meter Measurement Technology

DIFFERENTIAL PRESSURE MEASUREMENT PRINCIPLES

When a cross-sectional area of a closed conduit (or pipe) is reduced by a diametric change or by the use of a differential producer element, the velocity of fluids passing through the conduit is increased across the boundary change area (per the continuity equation). Pressure decreases (per the Bernoulli equation), and a differential pressure is generated across the reduction or producer (A1 and A2 in Figure 1).

The differential pressure (DP) and flow rate (Qv) have a proportional relationship such that $Q^v \propto K \cdot \sqrt{P/\rho}$, and it is by this universal relationship that flow rate can be determined.

While this principle is used by other differential pressure flow meters, the NUFLO DP cone meter technology generates a differential pressure by creating an area of reduction using a cone-shaped flow element located on the center line of a pipe section as opposed to a reduced diameter pipe wall or orifice.

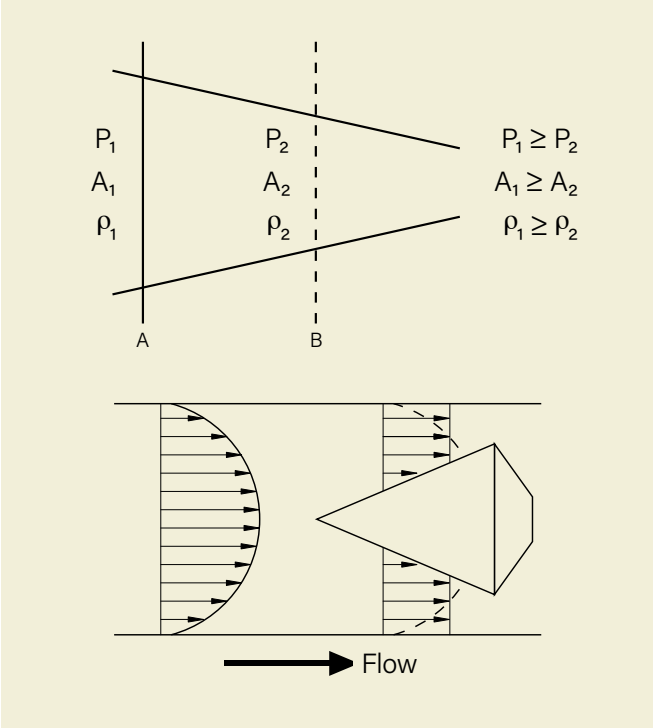


Figure 1.

CALIBRATION AND COEFFICIENT OF DISCHARGE DETERMINATION

Every NUFLO DP cone meter technology is calibrated with water at four flow rates at the factory to determine its coefficient of discharge (C_d), which enables enhanced performance. Further enhanced C_d determination is available at various approved laboratories in the US and Europe. This enables higher Reynolds numbers to be determined (larger meter sizes may be limited by test laboratory flow rates and uncertainties).

FLOW MEASUREMENT SYSTEM COMMISSIONING

The calibrated C_d value is entered into the original sizing to determine the scaling of a differential pressure transmitter. If a Sensia Scanner flow computer is used, all C_d values and fluid properties information are directly entered into the flow computer, which automatically performs an exact and dynamic flow calculation.

1. Effective area ratio (A_t), velocity of approach (E), and beta ratio (β) defined as

$$A_t = \frac{\pi}{4}(D^2 - d^2)$$

$$E = \frac{1}{\sqrt{1-\beta^4}}$$

$$\beta = \frac{\sqrt{D^2 - d^2}}{D}$$

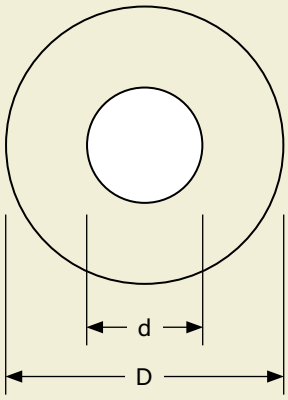


Figure 2.

2. Volumetric flow defined as

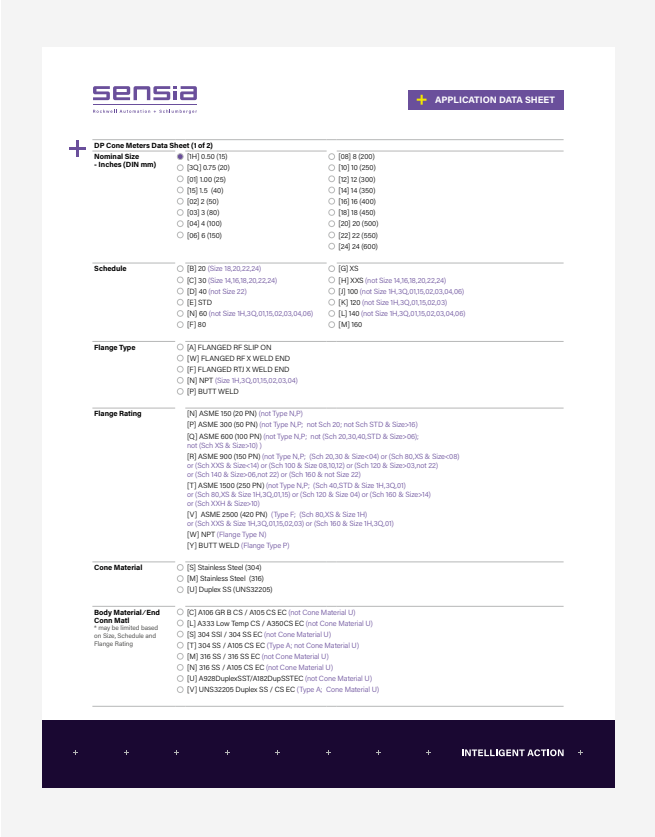
$$Q_v = C_d\, A_t\, E\, \varepsilon \sqrt{\frac{2\,\Delta P}{\rho}}$$

3. Mass flow defined as

$$Q_m = C_d\, A_t\, E\, \varepsilon \sqrt{2\rho \cdot \Delta P}$$

where

Q_v = Volumetric flow
Q_m = Mass flow
C_d = Coefficient of discharge
E = Velocity of approach
A_t = Meter throat (minimum cross section area A)
ε = (Y-factor) expansibility coefficient (gaseous fluids only)
ρ = Fluid density
ΔP = Differential pressure ($P_1 - P_2$)



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APPLICATION DATA SHEET

DP Cone Meters Data Sheet (1 of 2)

Nominal Size - Inches (DIN mm)
- ○ [H] 0.50 (15)
- ○ [3Q] 0.75 (20)
- ○ [01] 1.00 (25)
- ○ [15] 1.5 (40)
- ○ [02] 2 (50)
- ○ [03] 3 (80)
- ○ [04] 4 (100)
- ○ [06] 6 (150)
- ○ [08] 8 (200)
- ○ [10] 10 (250)
- ○ [12] 12 (300)
- ○ [14] 14 (350)
- ○ [16] 16 (400)
- ○ [18] 18 (450)
- ○ [20] 20 (500)
- ○ [22] 22 (550)
- ○ [24] 24 (600)

Schedule
- ○ [B] 20 (Size 18,20,22,24)
- ○ [C] 30 (Size 14,16,18,20,22,24)
- ○ [D] 40 (not Size 22)
- ○ [E] STD
- ○ [N] 60 (not Size 1H,3Q,01,15,02,03,04,06)
- ○ [F] 80
- ○ [G] XS
- ○ [H] XXS (not Size 14,16,18,20,22,24)
- ○ [I] 100 (not Size 1H,3Q,01,15,02,03,04,06)
- ○ [K] 120 (not Size 1H,3Q,01,15,02,03)
- ○ [L] 140 (not Size 1H,3Q,01,15,02,03,04,06)
- ○ [M] 160

Flange Type
- ○ [A] FLANGED RF SLIP ON
- ○ [W] FLANGED RF X WELD END
- ○ [F] FLANGED RTJ X WELD END
- ○ [N] NPT (Size 1H,3Q,01,15,02,03,04)
- ○ [P] BUTT WELD

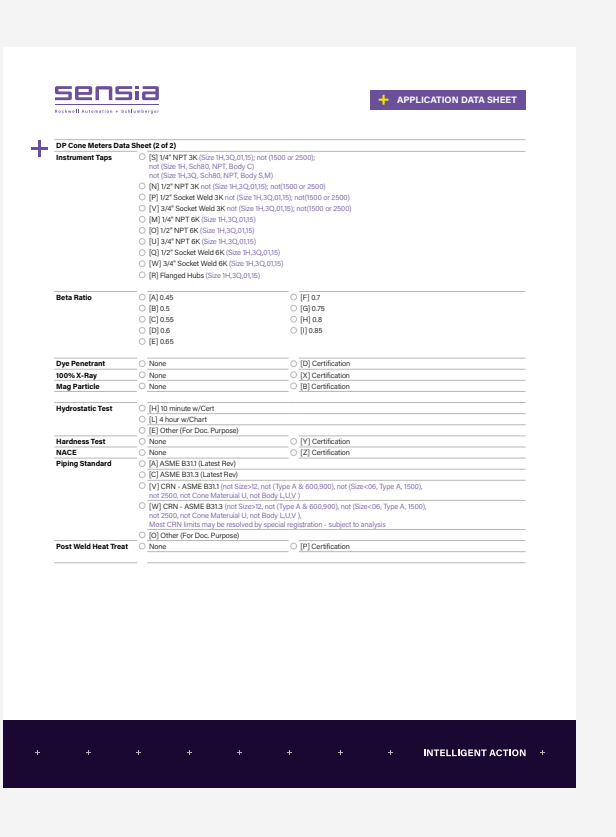
Flange Rating
- [N] ASME 150 (20 PN) (not Type N,P)
- [P] ASME 300 (50 PN) (not Type N,P; not Sch 20; not Sch STD & Size>16)
- [Q] ASME 600 (100 PN) (not Type N,P; not (Sch 20,30,40,STD & Size>06); not (Sch XS & Size>10))
- [R] ASME 900 (150 PN) (not Type N,P; (Sch 20,30 & Size<04) or (Sch 80,XS & Size<08) or (Sch XXS & Size<14) or (Sch 100 & Size 08,10,12) or (Sch 120 & Size>03,not 22) or (Sch 140 & Size>06,not 22) or (Sch 160 & not Size 22))
- [T] ASME 1500 (250 PN) (not Type N,P; (Sch 40,STD & Size 1H,3Q,01) or (Sch 80,XS & Size 1H,3Q,01,15) or (Sch 120 & Size 04) or (Sch 160 & Size>14) or (Sch XXH & Size>10)
- [V] ASME 2500 (420 PN) (Type F; (Sch 80,XS & Size 1H) or (Sch XXS & Size 1H,3Q,01,15,02,03) or (Sch 160 & Size 1H,3Q,01)
- [W] NPT (Flange Type N)
- [Y] BUTT WELD (Flange Type P)

Cone Material
- ○ [S] Stainless Steel (304)
- ○ [M] Stainless Steel (316)
- ○ [U] Duplex SS (UNS32205)

Body Material / End Conn Matl
* may be limited based on Size, Schedule and Flange Rating
- ○ [C] A106 GR B CS / A105 CS EC (not Cone Material U)
- ○ [L] A333 Low Temp CS / A350CS EC (not Cone Material U)
- ○ [S] 304 SSI / 304 SS EC (not Cone Material U)
- ○ [T] 304 SS / A105 CS EC (Type A; not Cone Material U)
- ○ [M] 316 SS / 316 SS EC (not Cone Material U)
- ○ [N] 316 SS / A105 CS EC (not Cone Material U)
- ○ [U] A928DuplexSST/A182DupSSTEC (not Cone Material U)
- ○ [V] UNS32205 Duplex SS / CS EC (Type A; Cone Material U)

INTELLIGENT ACTION

Ordering guide form



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APPLICATION DATA SHEET

DP Cone Meters Data Sheet (2 of 2)

Instrument Taps
- ○ [S] 1/4" NPT 3K (Size 1H,3Q,01,15); not (1500 or 2500); not (Size 1H, Sch80, NPT, Body C) not (Size 1H,3Q, Sch80, NPT, Body S,M)
- ○ [N] 1/2" NPT 3K not (Size 1H,3Q,01,15); not(1500 or 2500)
- ○ [P] 1/2" Socket Weld 3K not (Size 1H,3Q,01,15); not(1500 or 2500)
- ○ [V] 3/4" Socket Weld 3K not (Size 1H,3Q,01,15); not(1500 or 2500)
- ○ [M] 1/4" NPT 6K (Size 1H,3Q,01,15)
- ○ [O] 1/2" NPT 6K (Size 1H,3Q,01,15)
- ○ [U] 3/4" NPT 6K (Size 1H,3Q,01,15)
- ○ [Q] 1/2" Socket Weld 6K (Size 1H,3Q,01,15)
- ○ [W] 3/4" Socket Weld 6K (Size 1H,3Q,01,15)
- ○ [R] Flanged Hubs (Size 1H,3Q,01,15)

Beta Ratio
- ○ [A] 0.45
- ○ [B] 0.5
- ○ [C] 0.55
- ○ [D] 0.6
- ○ [E] 0.65
- ○ [F] 0.7
- ○ [G] 0.75
- ○ [H] 0.8
- ○ [I] 0.85

Dye Penetrant
- ○ None
- ○ [D] Certification

100% X-Ray
- ○ None
- ○ [X] Certification

Mag Particle
- ○ None
- ○ [B] Certification

Hydrostatic Test
- ○ [H] 10 minute w/Cert
- ○ [L] 4 hour w/Chart
- ○ [E] Other (For Doc. Purpose)

Hardness Test
- ○ None
- ○ [Y] Certification

NACE
- ○ None
- ○ [Z] Certification

Piping Standard
- ○ [A] ASME B31.1 (Latest Rev)
- ○ [C] ASME B31.3 (Latest Rev)
- ○ [V] CRN - ASME B31.1 (not Size>12, not (Type A & 600,900), not (Size<06, Type A, 1500), not 2500, not Cone Material U, not Body L,U,V)
- ○ [W] CRN - ASME B31.3 (not Size>12, not (Type A & 600,900), not (Size<06, Type A, 1500), not 2500, not Cone Material U, not Body L,U,V). Most CRN limits may be resolved by special registration - subject to analysis
- ○ [O] Other (For Doc. Purpose)

Post Weld Heat Treat
- ○ None
- ○ [P] Certification

INTELLIGENT ACTION

Contact your local representative for assistance completing the form or for a quotation once completed

THE SENSIA APPROACH TO MEASUREMENT

The NUFLO DP cone meter technology offers a diverse capability to Sensia measurement solutions. An in-depth understanding of measurement and knowledge of customers' requirements differentiates Sensia from its competitors.

From simple sensors to complex automation and custody transfer projects, Sensia has been measuring and controlling the flow and level of oil and gas, and collecting, transmitting, analyzing, and reporting data since the early 1950s. The NUFLO DP cone meter technology represents the on-going refinement of these core capabilities.

SENSIA AND QUALITY

The NUFLO DP cone meter technology is manufactured in a facility registered to ISO 9001. All equipment is subject to rigorous quality assurance plans, and all subcontractors and suppliers are quality audited to ensure that Sensia continues to meet or exceed product standards. This philosophy is applied to all facets of the supply chain, including but not limited to material selection and traceability, welding, and NDT inspections.

ORDERING INFORMATION

Sensia DP cone meters are often built to order, which gives customers the opportunity to have the meter customized for a specific application's unique flowing conditions.

The above is a guide for configuring a meter for quotation. To use it, select one choice from each group. The red font describes limits or invalid combinations. The list is not all inclusive of Sensia's capabilities but represents the most popular selections. Communicate other requirements or preferences by written corrospondence.

- Items in bold font are recommended selections.
- Prior to order, Sensia will assign a compact part number to the agreed-to configuration.
- CRN refers to Canadian Registration Number 0F08547.2.

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