Flow Nozzle

HFN Series

2 YEARS WARRANTY

HSB ISO 14001 HSB ISO 9001 ASME Kepic

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HITROL *Always The Best Solution*
HITROL CO., LTD.

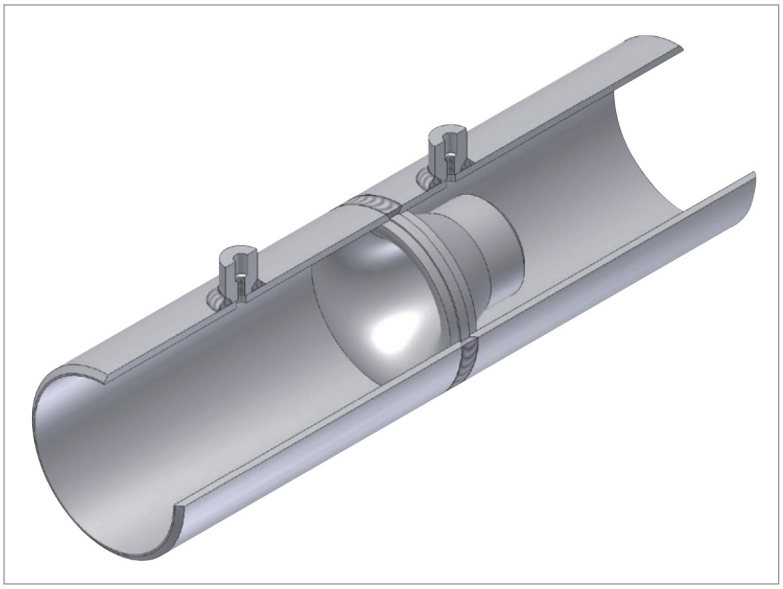
FLOW NOZZLE
Model : HFN Series

Overview

The measurement principle is based on the differential pressure that is generated between the upstream side and throat of nozzle, and the flow rate can be determined by the measured differential pressure value.

Flow Nozzle is costlier than orifice due to their construction but it is suitable to measure the flow rate of fluid flowing at high temperature and pressure. Under the same measurement condition, the flow nozzle has a higher mechanical strength, can permit the flow of more than 60 percent greater volume of a fluid, and can measure the flow rate of fluid which contains solid particles with less disturbance than an orifice which has the same bore.

Thus, it is suitable for high speed flowing fluids. HITROL can supply not only single flow nozzle but also flow nozzle having welded short pipe on both their upstream (4D) and downstream (2D) sides. Other types are available on request in full compliance with ISO-5167 (Including ISA 1932 Nozzles), Venturi-Nozzles, ASME MFC-3M, ASME PTC-6 standards.



Calibration and Discharge Coefficient Determination

All of HFN Series that is manufactured and supplied by Hitrol is calibrated with water at our liquid flow calibration system to determine the Discharge Coefficient (Cd) to verify the performance of the flow meter.

Discharge Coefficient

Long radius Nozzle manufactured in compliance with ISO-5167 and supplied with pipe wall taps have a discharge coefficient that is characterized by the equation below;

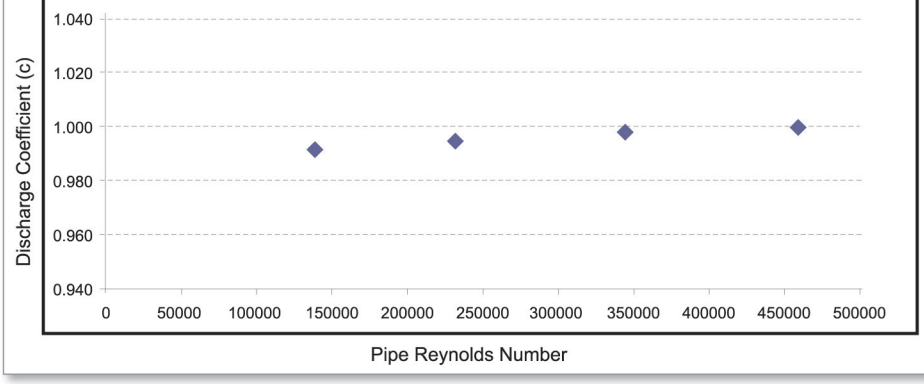
$$C = 0.9965 - 0.00653\sqrt{\frac{10^6\beta}{R_{eD}}}$$

The lap calibration report presented below is a sample of wall taps assembly.

CALIBRATION RESULTS

#62-182, Bongilcheon-Ri, Chori-Eup, Paju-City, Kyunggi-Do, Korea

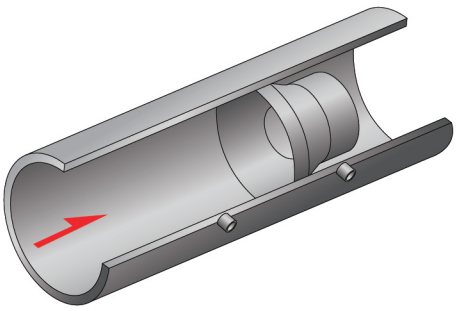
Date	2009. 01. 08		Manufacturer & Model				
Client	DOOSAN INDUSTRIES CONSTRUCTION CO., LTD.		Tag No.		12-FE1801#A		
Standard READ Flow Rate	Meter READ Delta P.	Discharge Coefficient	Reading Error	Full Scale Error	Even measurement deviation	Type A Relative St. Uncertainty	Relative Ex. Uncertainty
m^3/h	mmH_2O		%	%	%	%	%
419.432	4408.57	0.9991	-0.33	-0.33	-0.38	0.02	0.21
419.365	4401.87	0.9997	-0.39	-0.39			
419.845	4410.18	0.9999	-0.41	-0.41			
314.640	2489.08	0.9975	-0.17	-0.13	-0.19	0.02	0.20
314.658	2489.86	0.9974	-0.16	-0.12			
314.562	2484.85	0.9981	-0.23	-0.17			
211.546	1131.16	0.9948	0.10	0.05	0.14	0.02	0.20
211.386	1130.58	0.9943	0.15	0.07			
211.657	1133.94	0.9941	0.17	0.08			
126.458	406.83	0.9916	0.42	0.13	0.44	0.02	0.20
126.684	408.77	0.9910	0.48	0.14			
126.354	406.08	0.9917	0.41	0.12			

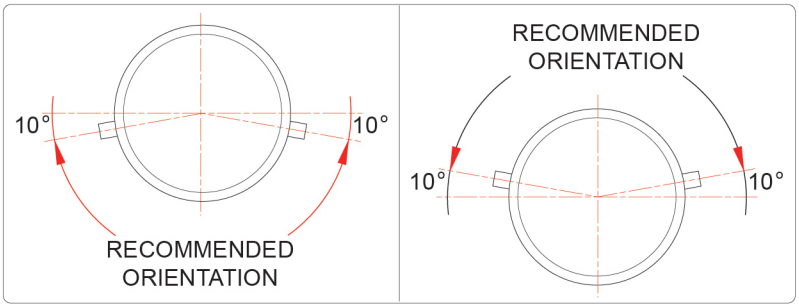


Specification

Operating Conditions	Line Fluid Capability	Clean Liquids Gas and Steam	
	Temperature Rating	Depends on material of construction	
	Pressure Rating	From full vacuum to the limits of materials.	
Line Size Capabilities **End Arrangement**	Line sizes between 2″ through 24″ Flange ends, Weld end, or other as required.		
Beta Ratio Capability	Between 0.20 through 0.80		
Material	304 or 316 stainless steel, Duplex 2205, Hastelloy C-276, 254, Carbon steels. Special materials on request.		
Beta Ratio Capability	Custom sized and designed for Beta ratio range between 0.20 through 0.75		
Pipe Reynolds Number	Must be greater than 10,000		
Permanent Pressure Loss	Varies from 40% to 95% of differential depending on application conditions and Beta Ratio.		
Accuracy	Between ±0.5% to ±1.0% of full scale.		
Pressure Taps	ASME Wall Tap Installation.	High pressure	1 Dia Upstream of Nozzle Inlet Face
		Low Pressure	0.5 Dia Downstream of Nozzle Inlet
	ASME Throat Tap Installation.	High pressure	1 Dia Upstream of Nozzle Inlet Face
		Low Pressure	Nozzle Throat-Code Specified Location

Pressure Taps Orientation

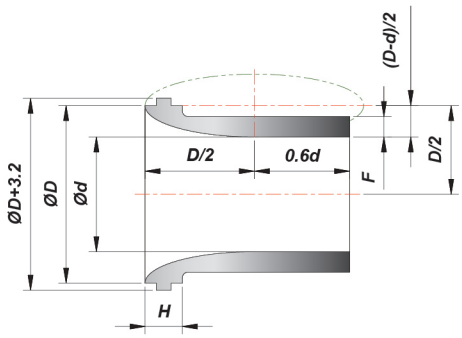




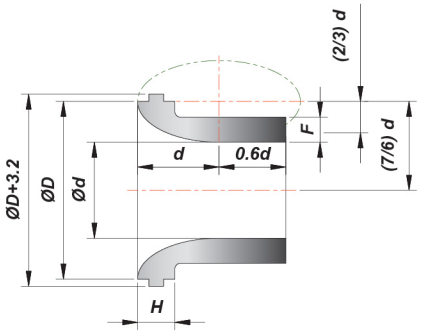
Nozzle Types

ISO 5167

HITROL manufactures and supplies all flow nozzle type as per in full compliance with ISO-5167 standard and there are two types of long radius nozzle in ISO-5167 standard, one is a High Ratio Nozzle and other is a Low Ratio Nozzle, and they can be designed with a ß-Value between 0.2 and 0.8 and it complies with ISA 1932 Nozzle and Venturi-Nozzle. Flow Nozzle is suitable to determine the flow rate of fluid at high temperature and pressure. Also it can measure the flow rate of fluid containing a little amount of solid particles.



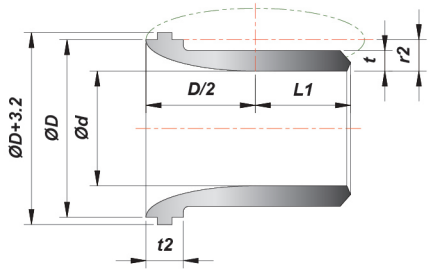
3≤H≤0.15D
3≤F
High Ratio 0.25≤β≤0.8



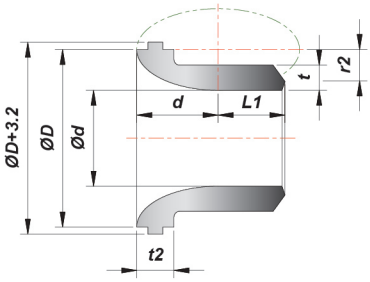
3≤H≤0.15D
3≤F
Low Ratio 0.2≤β≤0.5

ASME MFC-3M

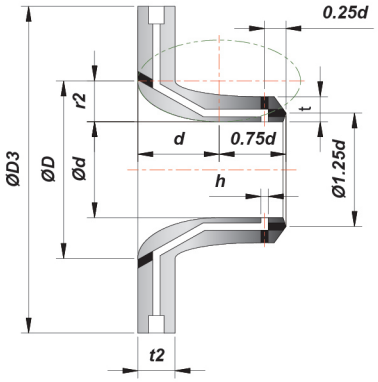
HITROL supplies flow nozzle types as per in full compliance with ASME standard, high and low ß nozzles in ASME MFC-3M and low ß nozzle with throat tap in ASME PTC 6.



0.5≤β≤0.8
L1≤0.6d or ≤ D/3
r2=(D-d)/2
2t≤D-(d+6mm)
3mm≤t2≤0.15D
High β Nozzle



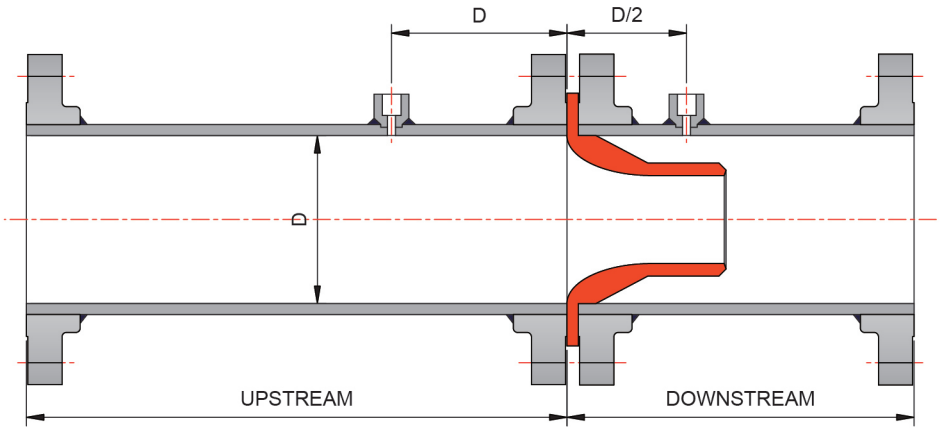
0.2≤β≤0.5
0.6d≤L1≤0.75d
0.63d≤r2≤0.67d
3mm≤t≤12mm
3mm≤t2≤0.15D
Low β Nozzle



0.25≤β<0.5
0.63d≤r2≤0.67d
t=0.25d
t2=38mm
Low β Nozzle with Throat Tap

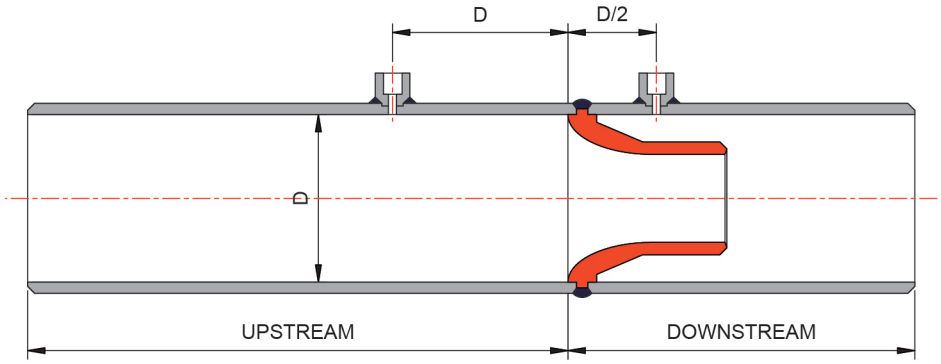
Flanged Type Flow Nozzle

Flanged Type Flow Nozzle is used for insertion between piping flanges, where frequent maintenance is required in the line, and is designed in accordance with ISO 5167 and ASME MFC-3M.



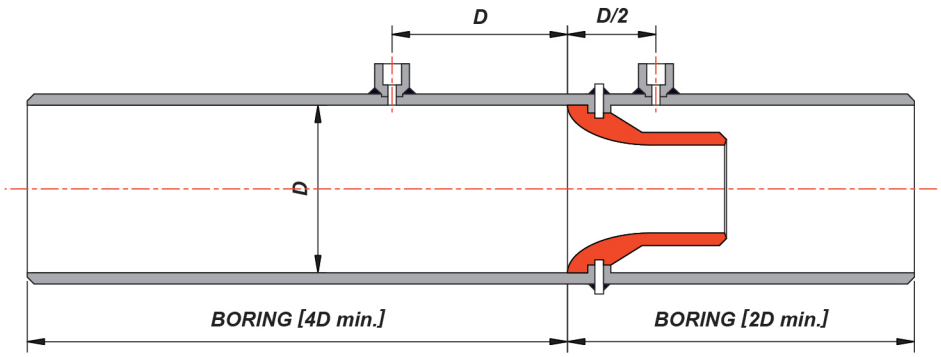
Weld-in Type Flow Nozzle

Weld-in Type Flow Nozzle is used where flanges are not applicable such as high temperature and pressure applications. Unless otherwise specified, HITROL offers this type as standard.



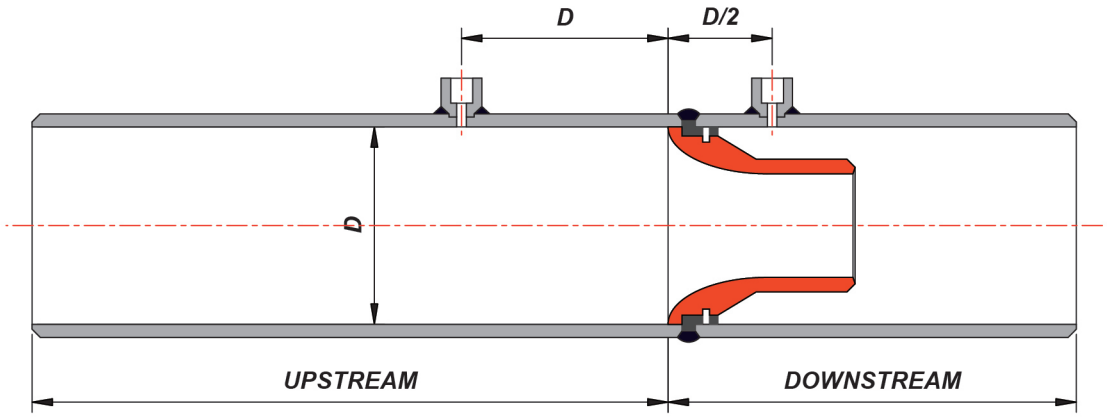
Holding Ring Type Flow Nozzle

Holding Ring Type Flow Nozzle is usually designed to be installed in pipes without flanges and it is mounted with the assistance of holding ring and pins that are made of same materials as pipe to avoid a welding of dissimilar materials.



Knock-pin Type Flow Nozzle

Knock-pin Type Flow Nozzle also eliminates welding of dissimilar materials, just like holding ring types do. The only difference is that it is usually more difficult to assemble this nozzle to piping.



Required Straight Pipe Length

Diameter ratio β[a]	Upstream (Inlet) side of the primary device																				Downstream (outlet) side of the primary device	
	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 *D* to 2*D*		Globe valve fully open		Full bore ball or gate valve fully open		Abrupt symmetrical reduction		Thermometer pocket or well[b] of diameter ⩽0.03*D*		Thermometer pocket or well[b] of diameter between 0.03*D* and 0.13*D*		Fittings (Columns 2 to 8)	
1	2		3		4		5		6		7		8		9		10		11		12	
	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]
0.20	10	6	14	7	34	17	5	e	16	8	18	9	12	6	30	15	5	3	20	10	4	2
0.25	10	6	14	7	34	17	5	e	16	8	18	9	12	6	30	15	5	3	20	10	4	2
0.30	10	6	16	8	34	17	5	e	16	8	18	9	12	6	30	15	5	3	20	10	5	2.5
0.35	12	6	16	8	36	18	5	e	16	8	18	9	12	6	30	15	5	3	20	10	5	2.5
0.40	14	7	18	9	36	18	5	e	16	8	20	10	12	6	30	15	5	3	20	10	6	3
0.45	14	7	18	9	38	19	5	e	17	9	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
0.55	16	8	22	11	44	22	8	5	20	10	24	12	14	7	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
0.65	22	11	32	16	54	27	11	6	25	13	28	14	16	8	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
0.75	36	18	42	21	70	35	22	11	38	19	36	18	24	12	30	15	5	3	20	10	8	4
0.80	46	23	50	25	80	40	30	15	54	27	44	22	30	15	30	15	5	3	20	10	8	4

NOTE 1 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 upstream face of the primary device

NOTE 2 These lengths are not based on modern data.

a For some types of primary device not all values of β are permissible.

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

c Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values.

d Column B for each fitting gives lengths corresponding to "0.5% additional uncertainty" values.

e The straight length in Column A gives zero additional uncertainty: data are not available for shorter straight lengths which could be used to give the required straight lengths for Column B.

■ Values expressed as multiples of internal diameter, D

Flow Nozzle

In order to calculate a differential pressure and design a Flow Nozzle, below information should be informed.

Flow Data \ Tag No.			
Fluid Name / Fluid State			
Max. / Nor. Flow Rate (m^3/hr)			
Max. / Nor. Temperature (℃)			
Max. / Nor. Pressure (psia)			
Pipe Inside Diameter (mm)			
Density at Base (kg/m^3)			
Density at Operating (kg/m^3)			
Operating Viscosity (cP)			