Averaging Pitot Tube

HAPT Series

2 YEARS WARRANTY

HSB ISO 14001 HSB ISO 9001 ASME Kepic

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HITROL CO., LTD.

Averaging Pitot Tube
Model : HAPT Series

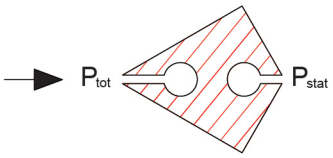
Measurement Principle

When HAPT Series is installed in a pipeline, it is called as stagnation pressure once the flow velocity in front of the HAPT Series becomes zero and the pressure difference between stagnation pressure and static pressure in the pipe is called as dynamic pressure. Dynamic pressure is related to the velocity of the fluid in the pipeline so the dynamic pressure can be calculated if the stagnation pressure and static pressure are measured.

$$P_{tot} = P_{stat} + P_{dyn}$$

$$\Delta P = P_{tot} - P_{stat}$$

$$V = \sqrt{\frac{2\Delta P}{\rho}}$$



$\Delta P =$ Differential Pressure

$P_{tot} =$ Total Pressure

$P_{stat} =$ Static Pressure

$V =$ Velocity of Fluid

$P_{dyn} =$ Dynamic Pressure

$\rho =$ Density

Design of Element

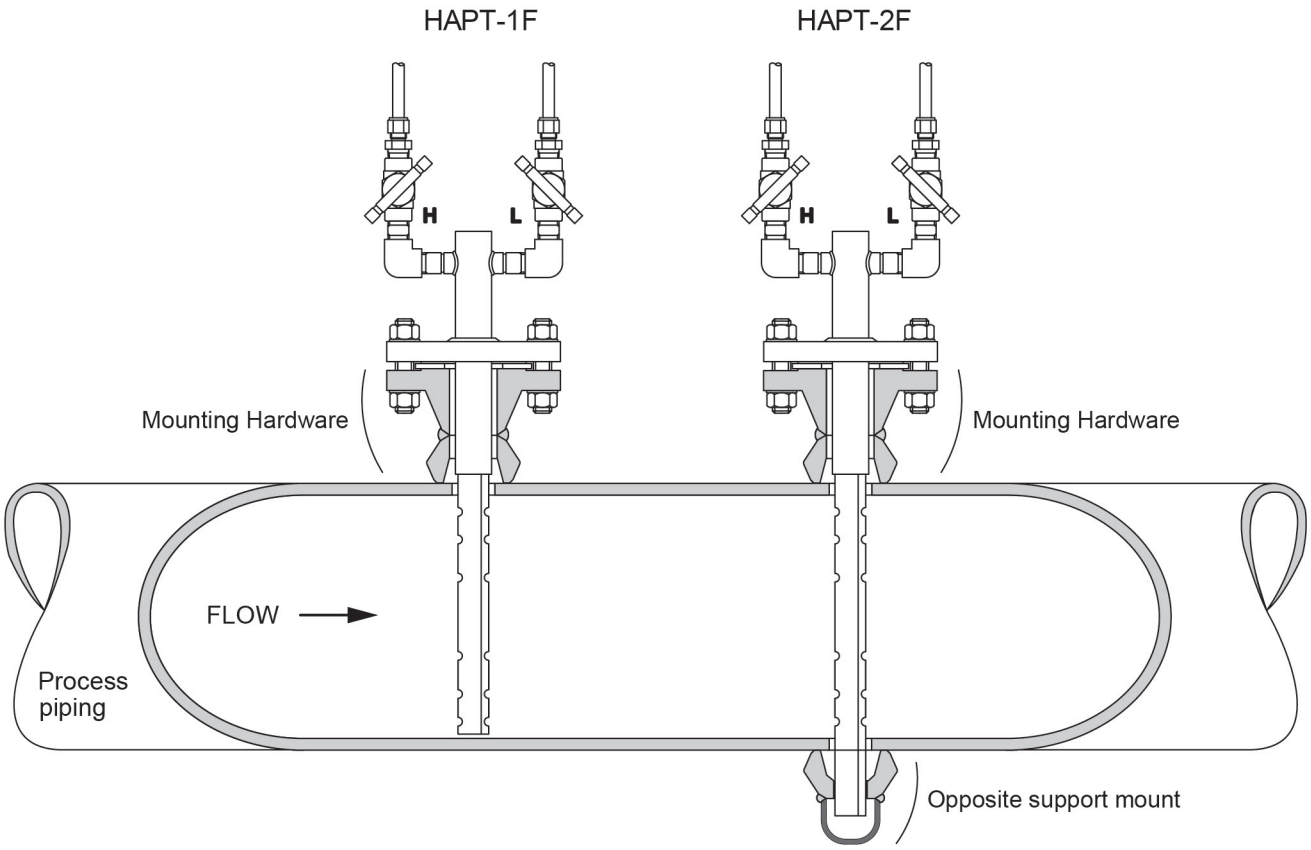
HAPT Series is hydrodynamically designed with almost vibrationless shape to generate a constant pressure and to minimize a pull force of fluid. HAPT Series consists of one body and average dynamic pressure in the pipeline is transmitted through a tube and ports for pressure measurement. The pressure difference between stagnation pressure and static pressure is called as dynamic pressure and it is proportional to a square of flow rate according to the Bernoulli equation.

Advantages

- It is easy to install by insertion to the pipeline.
- Welding area for mounting hardware is small.
- Energy cost for the operating can be reduced due to low pressure loss.
- High accuracy can be verified by confirmation of Discharge Coefficient through the calibration at our national flow calibration system.

Specification

Operating conditions	Line fluid capability	Liquids, Air, Gas and Steam
	Temperature Rating	Depends on material of construction
	Pressure Rating	Maximum working pressure is per ANSI B16.5
Element Type	HAPT-1F and HAPT-2F (As shown in below)	
Line Size Capabilities / End Arrangement	Line sizes between 2" through 72" Flange ends, Screw or other as required.	
Material	304, or 316 stainless steel, Duplex 2205, Hastelloy C-276, Monel Special materials on request.	
Permanent Pressure Loss	Varies from 0.2% to 20% of differential depending on application conditions, beta ratio.	
Pressure Taps	PT 1/2"(M), NPT 1/2"(M) or other as required.	
Turndown Ratio	10:1(extensible according to request)	
Accuracy	±1.0% of full scale.	

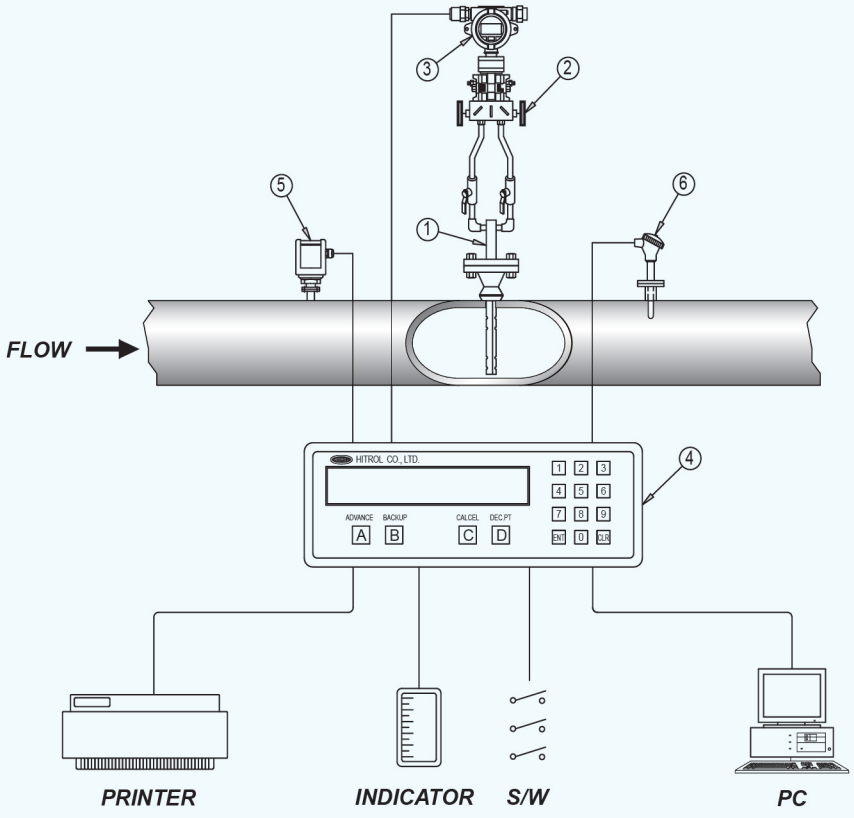


Calibration and Discharge Coefficient Determination

All of HAPT 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.

Components of Flow Measurement System

Measurement of incompressible fluids	Measurement of compressible fluids
① HAPT-1(2) Flow Element ② 3-way or 5-way manifold valve ③ Differential pressure transmitter ④ Flow computer or flow indicator	① HAPT-1(2) Flow Element ② 3-way or 5-way manifold valve ③ Differential pressure transmitter ④ Flow computer or flow indicator ⑤ Pressure transmitter ⑥ Temperature sensor (Pt 100Ω) or transmitter



Maximum Differential Pressure and Flow Range (HAPT-1F)

Pipe Size	Sensor Size : 1"		
	△P	GPM	SCFM
2"	185	230	880
3"	105	390	1500
4"	70	560	2100
6"	40	970	3700

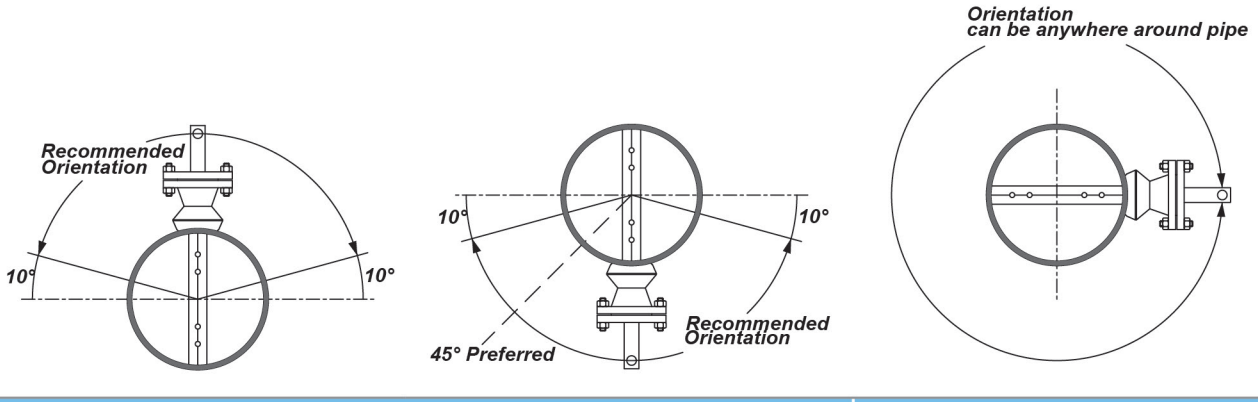
SCFM : Air @ 14.73 Psia, 60°F
GPM : Water @ 60°F, SG=1.0
△P : Inch of water column

Maximum Differential Pressure and Flow Range (HAPT-2F)

Pipe Size	Sensor Size								
	1"			1 1/2"			2"		
	△P	GPM	SCFM	△P	GPM	SCFM	△P	GPM	SCFM
2"	1200	590	2200						
3"	590	940	3500						
4"	370	1200	4900						
6"	1800	2000	8000	600	3700	14000			
8"				370	5100	19000			
10"				250	6600	25000			
12"				180	8000	31000	30	12000	47000
14"				150	9000	34500	360	13500	53000
16"				115	10500	40000	280	16000	62000
18"				95	12000	46500	220	18000	71000
20"				75	13500	53000	180	21000	81000
24"				55	15000	65000	130	26000	100000
30"				35	22000	84000	85	34000	130000
36"				25	27000	10000	60	42000	160000
42"				20	32000	120000	45	50000	190000
48"							35	59000	255000
60"							25	725000	285000
72"							15	91000	345000

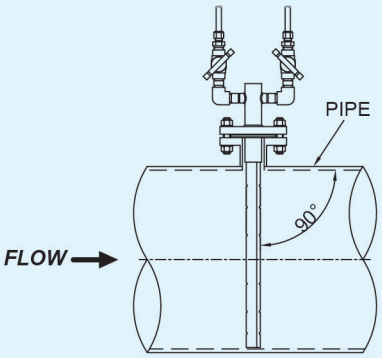
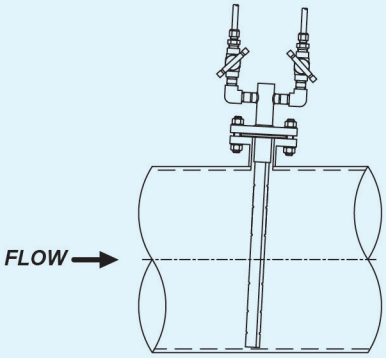
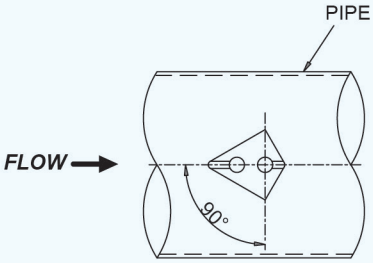
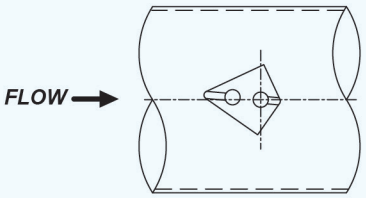
SCFM : Air @ 14.73 Psia, and 60°F GPM : Water @ 60°F,SG=1.0 △P : Inch of water column

Pressure Taps Orientation



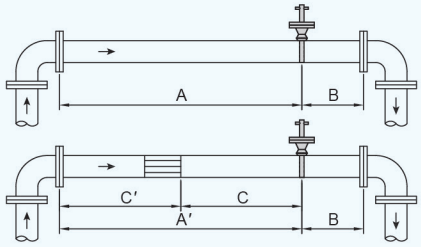
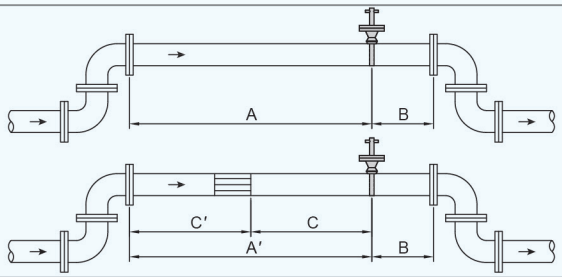
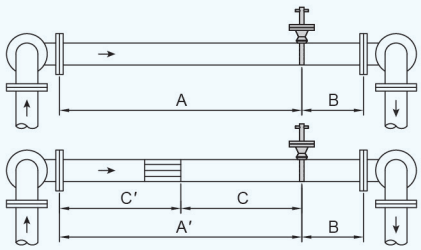
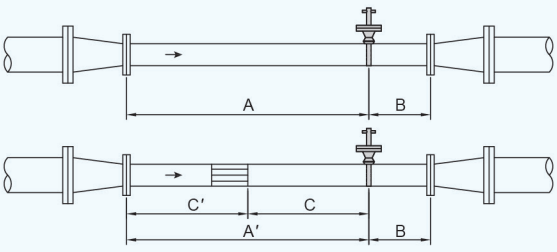
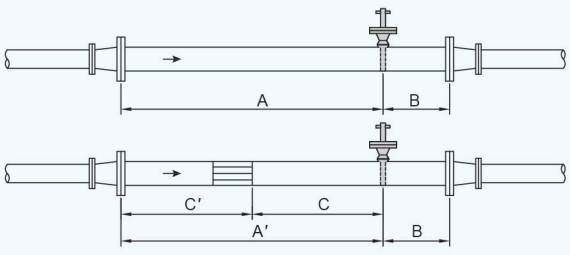
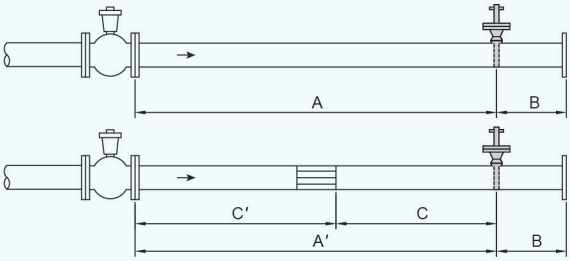
Horizontal Pipingw		Vertical Piping
Gases & Steam (with Seal Port)	Liquid & Steam (Without Seal Port)	Liquid & Gas & Steam

Installation Requirement

	Correct	Incorrect
A		
B		

The angle of installation shall be maintain the 90 degree between the averaging pitot tube and pipe as shown on Fig. A & B

Required Straight Pipe Length

Minimum Diameters of Straight Pipe	Upstream					Downstream
	Without Vanes		With Vanes			
	In plane	Out of plane	A′	C	C′	B
	A	A				
	7	9				3
			6	3	3	
	9	14				3
			8	4	4	
	19	24				4
			9	4	5	
	8	8				3
			8	4	4	
	8	8				3
			8	4	4	
	24	24				4
			9	4	5	

Averaging Pitot Tube

In order to calculate a differential pressure and design an Averaging Pitot Tube, 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)			