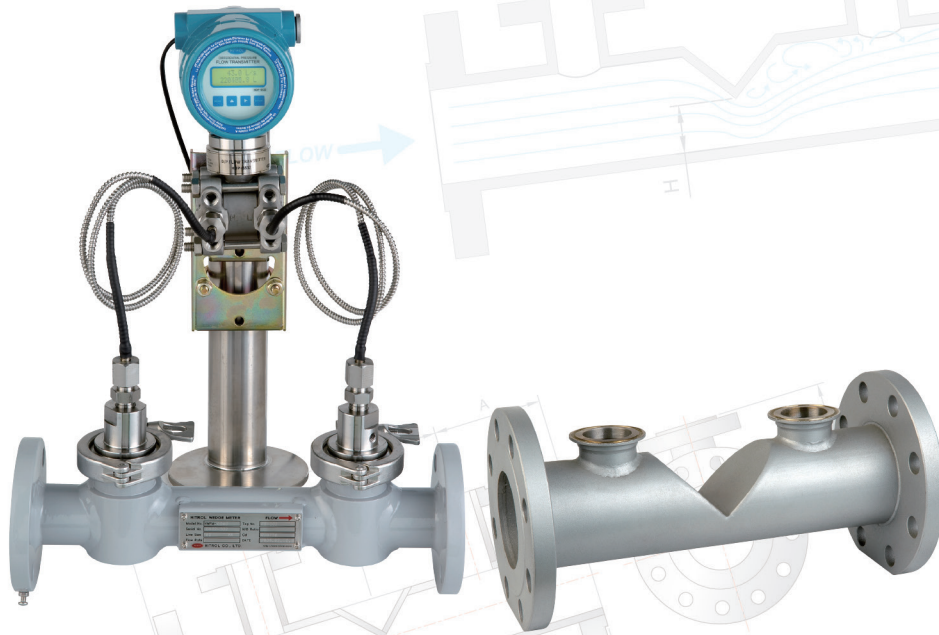


Wedge Meter

HWFM Series



2 YEARS WARRANTY



ASME



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Always The Best Solution
HITROL CO., LTD.

Wedge Meter

Model : HWFM Series

Introduction

HWFM Series provides the best solution to measure the flow rates for high viscosity fluids, slurries and fluid in which solid particle is contained. HWFM Series can be applied for the line size from 0.5" to 24" and is a representative differential pressure flow element which can be applied for fluids that are difficult to be measured, especially for liquids in that air or solid particle is contained, high viscosity fluids and slurries. It can also be applied for abrasive or fibrous slurries and the discharge coefficient (Cd) is stable even in a relatively low pipe Reynolds number. Even though the accuracy, reliability and pressure loss are worse than venturi tube but HWFM Series is a valuable product because it can be applied for liquids that are not available by other differential pressure flow element. Hitrol can provide a specialized technical assistance for calculated bore size, differential pressure and flow rate that are related to the high quality.



Design and Calibration

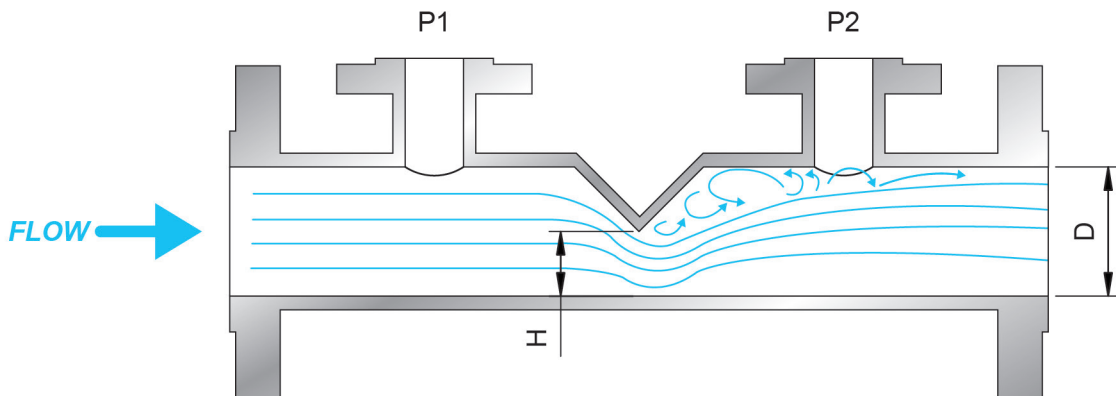
The basic system of HWFM Series consists of a cylindrical pressure vessel including of wedge which generates a differential pressure, and sensors connected to pressure taps on both sides of wedge transmit the differential pressure signal to D/P transmitter.

In order to provide an accuracy of $\pm 1\%$, all HWFM Series is actually calibrated with a liquid flow standard system.



Measurement Principle

The line fluid flows downward similar to segmental orifice plate but it is guided along a sloping wedge shape rather than a sharp edge. Pressure taps are located in upstream and downstream and they can be used after assembling of diaphragm seal type sensors. The differential pressure generated by the wedge is a function of the ratio between the wedge segment opening (H) and diameter of the body (D).



An equation of Beta Ratio is as below.

$$\beta = \frac{D}{D} = \left(\frac{1}{\pi} \left(\text{Arc cos} \left[1 - \frac{2H}{D} \right] - 2 \left[1 - \frac{2H}{D} \right] \left(\frac{H}{D} - \left[\frac{H}{D} \right]^2 \right)^{\frac{1}{2}} \right) \right)^{\frac{1}{2}}$$

And, an equation of the mass flow rate for compressible fluid flow is as below.

$$Q_M = N_{MG} \frac{Cd^2}{\sqrt{1 - (d/D)^4}} \sqrt{F_P G_F} \sqrt{H_W}$$

N_{MG} = Dimensional constant

H_W = Differential inches of water

G_F = Specific gravity

F_P = Thermal expansion factor

The calculation for compressible fluid flow is similar for incompressible fluid flow but temperature, adiabatic expansion and compressibility factor should be considered.

The operating principle of HWFM Series is similar to other differential pressure flow element such as orifice and venturi tube as fluid flows through the sloping wedge that is a narrowest cross section of the flow element.

Pressure taps are located in upstream and downstream from a wedge placed at a center of the body, wedge creates pressure drop between the pressure taps located in upstream and downstream related to the velocity of the flow in the pipe line, and it is measured as volumetric flow rate flowing through the narrowest cross section of the flow element. The design for an opening height of the wedge can be changed in accordance with the required differential pressure for the application of the changed flow rate within an allowable tolerance range for permanent pressure loss.



Calibration and Discharge Coefficient Determination

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



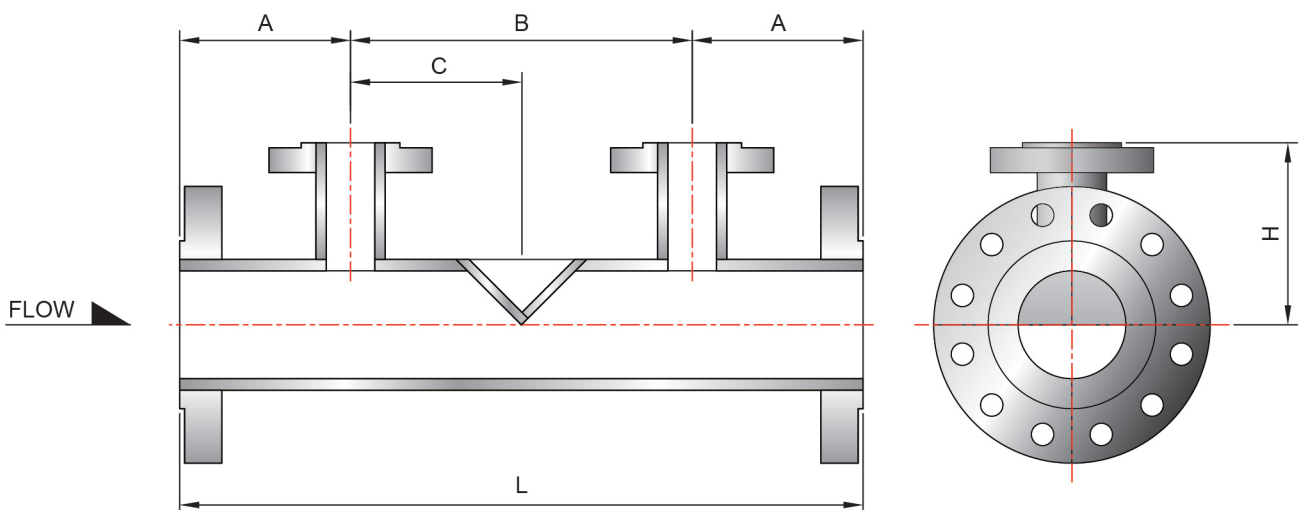
Specification

Operating Conditions	Fluid Capability	Ideal for harsh High viscosity, Liquid Slurry or gas service
	Temperature Rating	Temperature rating is dependent on wetted material and gasket material.
	Pressure Rating	Maximum working pressure is per ANSI B16.5
Line Size Capabilities / End Arrangement	Line sizes between 1/2" through 24" Flange ends, Weld end, Mechanical joint or other as required.	
H/D Ratio Capability	Between 0.20 through 0.50 H/D	
Material of Construction	304, or 316 stainless steel, Duplex 2205, Hastelloy C, Monel 400, Carbon steels. Special materials on request.	
Pipe Reynolds Number R_D	Must be greater than 500	
Accuracy	Between $\pm 0.5\%$ to $\pm 1.0\%$ of full scale.	

Dimension Table

■ Unit : inch

Standard Dimension from 2" to 24"					
Nomnal Line Size	L	A	B	C	H
2.00	28.00	9.37	9.26	4.63	7.19
3.00	34.00	9.44	15.12	7.56	7.75
4.00	36.00	10.5	15.00	7.50	8.25
6.00	40.00	11.0	18.00	9.00	9.31
8.00	42.00	10.75	20.50	10.25	10.31
10.00	45.00	10.75	23.50	11.75	11.38
12.00	47.00	10.25	26.50	13.25	12.38
14.00	49.00	10.50	28.00	14.00	13.00
16.00	49.00	9.25	30.50	15.25	14.00
18.00	52.00	9.25	33.50	16.75	15.00
20.00	56.00	9.50	37.00	18.50	16.00
24.00	62.00	10.0	42.00	21.00	18.00



Installation Method

In order to guarantee a best performance of HWFM-Series at the site, below recommendation for the installation should be observed. For the recommendation on the proper installation of the flow element, pressure taps and impulse lines can affect to the accuracy by inflow of an air so they should be installed vertically.

Direction of the installation

Horizontal installation is generally recommended. This flow element can be installed with a rotation between 45 degrees to 90 degrees according to a direction of pressure taps in order that undissolved solids can easily pass through the wedge without build-up and to minimize an entrapment of an air at pressure taps locations (Refer to installation picture 1). Vertical installation may generate a water head pressure at inlet due to the difference of heights between impulse lines but it can be corrected through the adjustment (calibration) of the transmitter. If the proper consideration of the installation for the relative heights difference of impulse lines and pressure taps, the installation in other orientation is permitted.



Required Straight Pipe Length

The performance of HWFM Series can be affected by pipes and disturbers at the site as below. Same as other flow meters, required straight pipe length at upstream and downstream should be provided at the site for the best performance and high accuracy of the flow element. Generally required straight pipe length is as below table.

Required Straight Pipe Length				
Upstream Disturber	Preferred		Minimum	
	Upstream	Downstream	Upstream	Downstream
Partially Opened Gate Valve	10 Dia.	5 Dia.	10 Dia.	3 Dia.
Concentric Increaser	10 Dia.	5 Dia.	5 Dia.	3 Dia.
Concentric Reducer	10 Dia.	5 Dia.	5 Dia.	3 Dia.
1 Elbow	10 Dia.	5 Dia.	5 Dia.	3 Dia.
2 Elbows Close Coupled in Plane	10 Dia.	5 Dia.	5 Dia.	3 Dia.
2 Elbows Close Coupled out of Plane	10 Dia.	5 Dia.	10 Dia.	3 Dia.



Wedge Meter

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

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