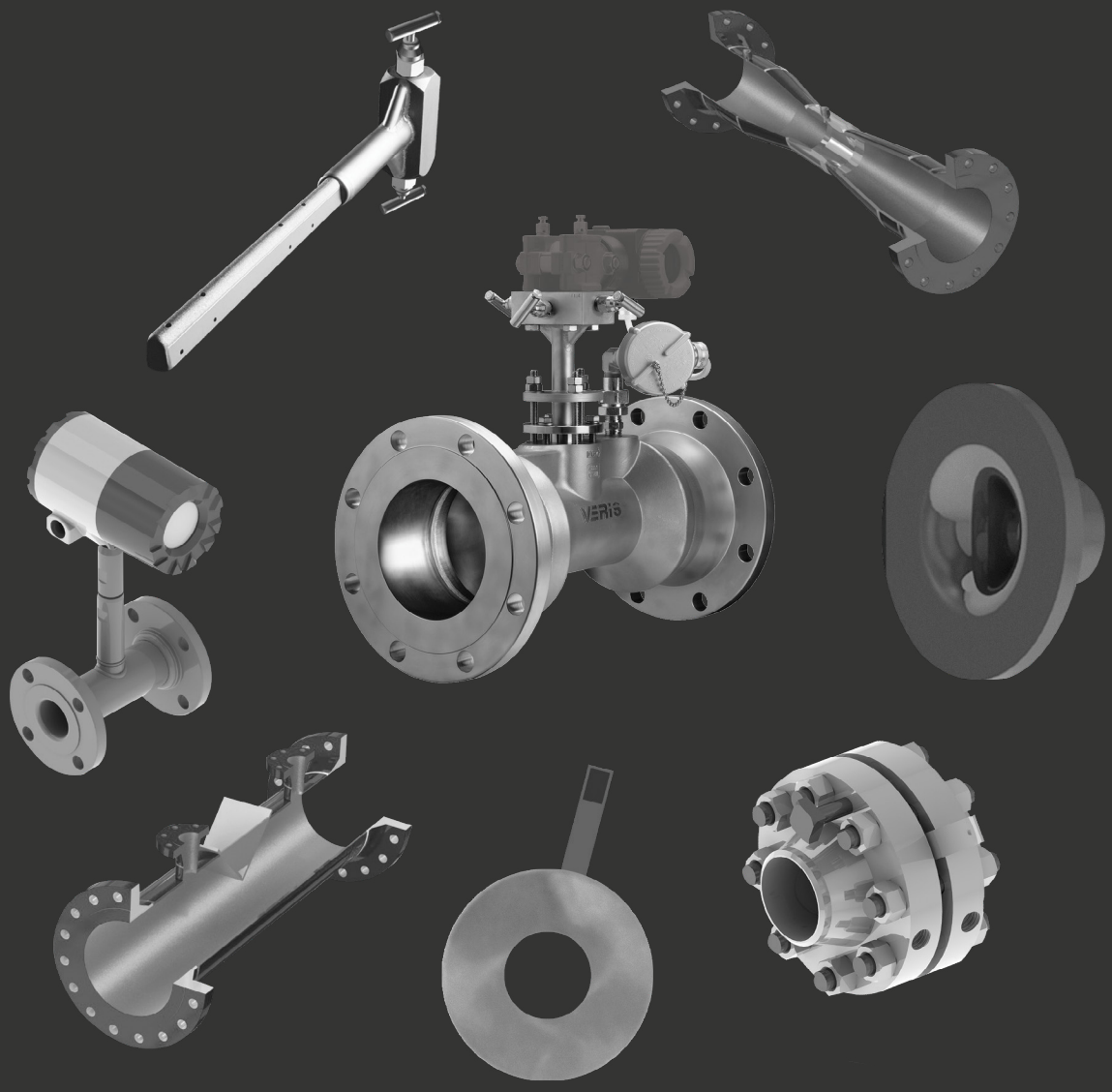
VERIS FLOW MEASUREMENT GROUP

TRUE PERFORMANCE IN FLOW MEASUREMENT



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For the best flow measurement solution in any application, turn to Armstrong.

Our state-of-the-art flow measurement technology includes a full line of differential pressure flow elements and vortex meters, as well as VERIS Accelabar®—our proprietary meter that does not require any straight pipe lengths for installation.

Armstrong's flow meters are designed to provide accuracy in measurement, even with the most challenging gases and liquids, to meet the demands of virtually any application in any industry.

With more than a century of in-depth, steam system expertise, Armstrong also provides the most advanced steam flow measurement technology available today.

The Unique VERIS Accelabar® Flow Meter

The VERIS Accelabar® is a unique flow meter that produces performance never before attainable in a single flow meter.

The Accelabar® is capable of measuring gases, liquids, or steam at previously unattainable flow rate turndowns—**with no straight run requirements**.

How the Accelabar® Works

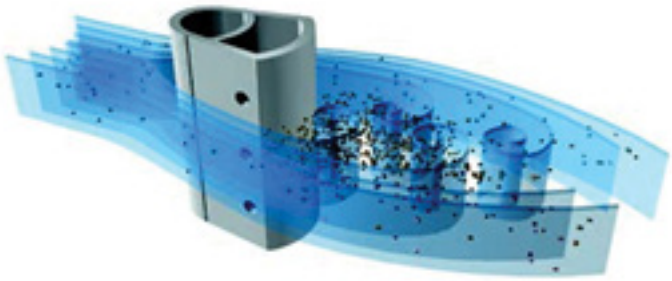
The Accelabar® combines a unique toroidal nozzle design with the VERIS Verabar® averaging Pitot tube.

The nozzle's patented "settling distance" design accelerates, linearizes, and stabilizes the fluid's velocity profile. The Verabar® located within the nozzle then accurately measures that velocity profile.

The nozzle also significantly increases the differential pressure output, thus increasing the operating range (turndown) of the Accelabar.

The Accelabar has a linear flow coefficient with an accuracy of up to ±0.50%.

VERIS Verabar® Provides the Accuracy



The proven technology of the Verabar® delivers the accurate measurement within the Accelabar®. The Verabar®'s unique bullet shape, linear flow coefficient, solid one-piece construction, non-clog design, and signal stability make it the only design capable of producing superior performance.

Absolutely No Straight Run Required

The Accelabar® can be used in extremely limited straight run piping configurations. All necessary straight run is integral to the meter. The stabilization and linearization of the velocity profile within the throat of the nozzle eliminates the need for any upstream or downstream pipe runs.

VERIS Accelabar®

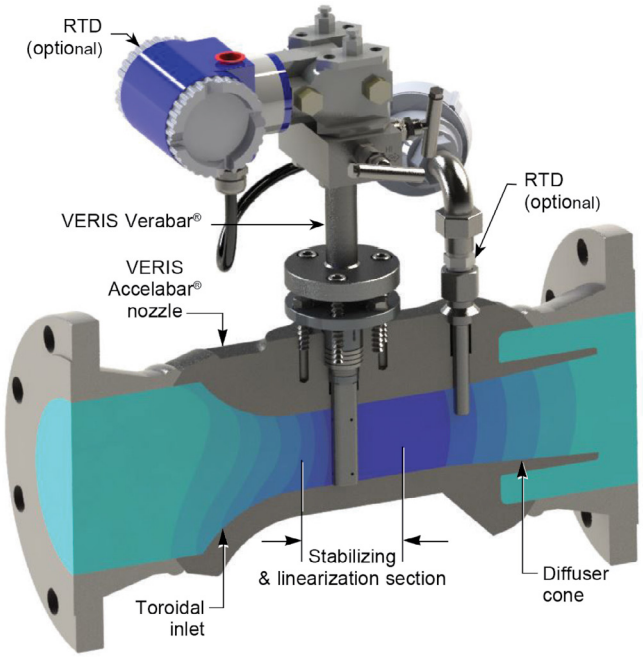
Engineering Specifications

- Liquids, gases, and steam service
- Accuracy up to ± 0.50% of rate over entire flow range
- Repeatability: ±0.050% over entire flow range
- Verified flow coefficients
- Capable of extended turndowns in flowrate
- No straight piping run requirements
- Mass or volumetric flow
- 316SS meter body and sensing element
- 1” – 12” (25.4mm – 304.8mm) in-line body sizes
- Up to ANSI600 standard & ANSI2500 upon request

Ready to Install

The Accelabar® can be furnished as a ready to install flow meter system complete with the primary element, configured transmitter, RTD, and other secondary equipment such as a flow computer or data logger.

An optional RTD can be supplied in a thermowell for density compensation of mass flow rates.



The Accelabar® Advantage vs. Other Flow Meters

The Accelabar® is able to overcome the limitations of other flow meters in applications that:

- Do not have sufficient fluid velocity to produce a readable signal or generate adequate turndown
- Require ±0.5% accuracy over a large range of flow rates
- Have limited or no straight piping runs before the meter’s installation point

Typical performance characteristics of the Accelabar® exceed those of traditional differential pressure, vortex, and other flow meter technologies.

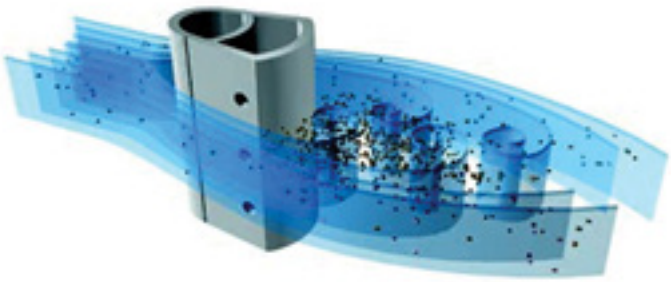
Accelabar® Face to Face Dimensions

Meter Size	Face to Face Dimension							
	Class 150#	Class 300#	Class 600#	PN10	PN16	PN40	PN63	PN100
1” (DN25)	7.50” (190.5mm)	8.25” (209.6mm)	8.75” (222.3mm)	N/A	N/A	10.15” (257.8mm)	N/A	11.57” (293.9mm)
2” (DN50)	8.75” (222.3mm)	9.38” (238.2mm)	10.13” (257.1mm)	11.54” (293.2mm)	11.54” (293.2mm)	11.78” (299.2mm)	12.88” (327.2mm)	13.35” (339.2mm)
3” (DN80)	13.78” (350.0mm)	14.53” (369.0mm)	15.28” (388.1mm)	12.31” (312.8mm)	12.31” (312.8mm)	12.94” (328.8mm)	14.04” (356.8mm)	14.52” (368.8mm)
4” (DN100)	15.15” (384.8mm)	15.90” (403.9mm)	17.65” (448.3mm)	13.34” (338.9mm)	13.34” (338.9mm)	14.36” (364.9mm)	15.39” (390.9mm)	16.34” (414.9mm)
6” (DN150)	19.15” (486.4mm)	19.90” (505.5mm)	21.90” (556.3mm)	16.58” (421.1mm)	16.58” (421.1mm)	18.15” (461.1mm)	19.73” (501.1mm)	21.30” (541.1mm)
8” (DN200)	21.40” (543.6mm)	22.15” (562.6mm)	24.40” (619.7mm)	18.38” (466.9mm)	18.38” (466.9mm)	20.42” (518.9mm)	22.16” (562.9mm)	23.74” (602.9mm)
10” (DN250)	23.15” (588.0mm)	24.40” (619.8mm)	27.65” (702.3mm)	20.76” (527.3mm)	20.76” (527.3mm)	23.51” (597.3mm)	25.09” (637.3mm)	27.61” (701.3mm)
12” (DN300)	26.22” (665.9mm)	27.47” (697.7mm)	29.97” (761.2mm)	23.41” (594.6mm)	23.41” (594.6mm)	26.32” (668.6mm)	28.29” (718.6mm)	30.65” (778.6mm)

Accurate and Reliable Technology for Measuring Gas, Liquid, and Steam

Developed from aerospace technology, the VERIS Verabar® averaging pitot flow sensor provides unsurpassed accuracy and reliability. With its solid one-piece construction and bullet shape, the clog-resistant Verabar® makes flow measurement reliable and precise.

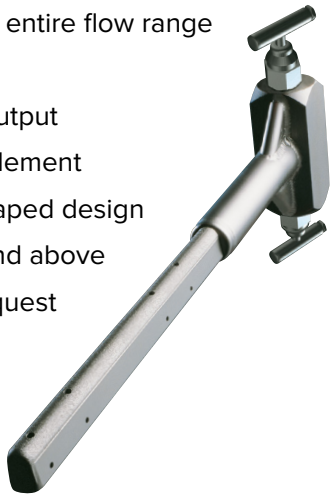
Superior Signal Stability and Greater Resistance to Clogging

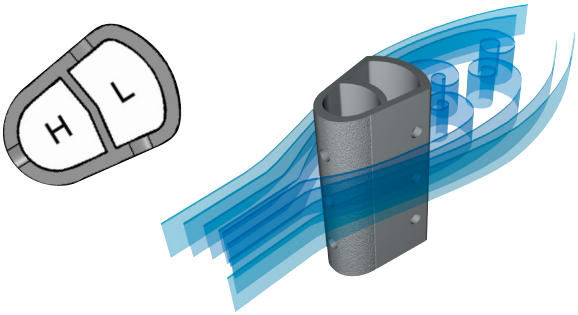


Clogging can occur in low pressure ports located in or near the partial vacuum at the rear of the sensor. The Verabar® design locates the low pressure ports on the sides of the sensor, forward of the fluid separation point and turbulent wake area. This virtually eliminates clogging and produces an extremely stable signal.

Engineering Specifications

- Liquids, gases, and steam service
- Accuracy up to ± 1.0% of rate over entire flow range (±0.75% if pipe ID is measured)
- Repeatability: ±0.10% over entire flow range
- Verified flow coefficients
- Mass or volumetric flow output
- 316SS standard sensing element
- Solid one-piece, bullet shaped design
- Pipe sizes 1.5” (38.1mm) and above
- Up to ANSI2500 upon request
- 5 year performance warranty from date of shipment





Lower Drag and Extended Turndown

The unique sensor shape reduces drag and flow induced vibration while the roughness of the Verabar®’s front surface extends its accuracy and rangeability to lower velocities.

Quality Assurance

Armstrong manufactures its own leak-proof, solid one-piece sensor. The primary goal is to provide the highest quality and most accurate sensor in the industry.

VERIS Verabar® is designed to meet or exceed applicable ANSI and ASME codes. The Verabar is available to meet B31.1, B31.3, B31.8, NACE MR-01-75, etc.

Additional QA capabilities include code welding, hydrostatic and other non-destructive testing.

The Proof of Verabar® Accuracy

Accurate Flow Coefficients

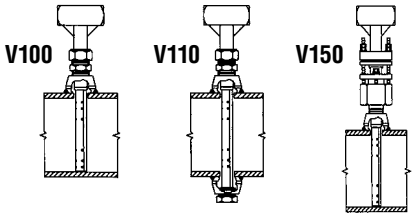
The true test of a flow measurement device is its ability to repeat its published flow coefficient within its accuracy band. Verabar® has been thoroughly tested at independent flow laboratories using multiple sensor sizes and multiple pipe sizes in both gas and liquid service.

No Calibration Necessary

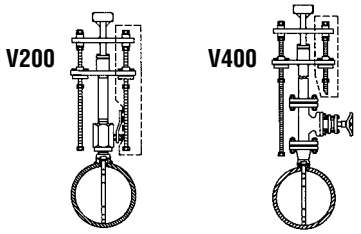
The development of a verified theoretical model allows the prediction of the Verabar®'s flow coefficients. **This eliminates the need for calibration tests to characterize the flow coefficients.** The derivation of the theoretical model and test data is published in the Verabar® Flow Test Report.

Verabar® Model Selector

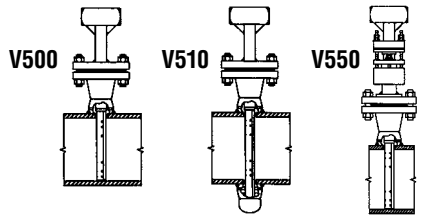
Regular Models — (Threaded Components)

Model Number	Type of Mounting
	**Tube Fitting** **V100** (Single Support) **V110** (Double Support)
	Spring-Lock **V150** (No opposite support required)

Hot Tap Models — (Threaded or Flanged Components)

Model Number	Type of Mounting
	**Threaded Screw Drive** **V200**
	Flanged Screw Drive **V400**

Flanged Models — (Flanged Components)

Model Number	Type of Mounting
	**Flanged** **V500** (Single Support) **V510** (Double Support)
	Flanged Spring-Lock **V550** (No opposite support required)

Verabar® Applications

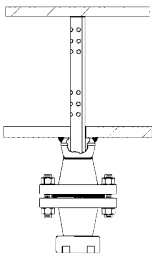
The Verabar® offers the widest application range of any flow sensor. It accurately measures gas, liquid and steam.

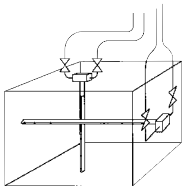
Gas	Liquid	Steam
Natural Gas	Cooling/Chilled water	Saturated
Compressed Air	Boiler Feed Water	Superheated
Combustion Air	De-Mineralized Water	Main Header
Hydrocarbon Gas	Hydrocarbon Liquids	Custody Transfer
Hot Air	Cryogenic	Distribution
Blast Furnace Gas	Thermal Transfer Fluids	Energy Studies

Extended Range Applications

The Verabar's versatile design lends itself to a wide range of applications. Contact VERIS application engineering for your special requirements.

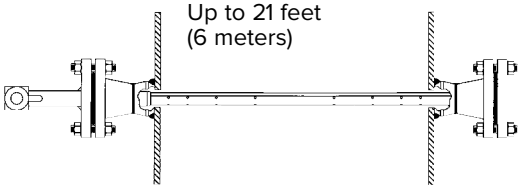
High Pressure Design
2500# ANSI Class
6000PSI and 1000°F



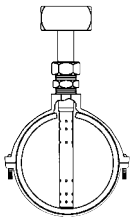


Square and Rectangular Ducts

Large Stacks and Ducts
Up to 21 feet
(6 meters)



Specialized Mounting
- PVC
- Concrete
- FRP
- Cast Iron Pipe



In-Line Vortex Flow Meter

Armstrong International is pleased to offer vortex technology for measurement of steam, liquid, and gas flows. All AVF in-line models provide multivariable measurement and mass flow output for applications in industrial and institutional environments.

The flow meter is available from ½" (15 mm) (DN 15) to 12" (300 mm) (DN 300) meter sizes handling process temps from -330°F (-200°C) to 750°F (400°C) and process connections up to ANSI Class 600 (PN 64).

Multivariable options include temperature, pressure, and velocity measurements for a fully compensated mass flow rate. Output communication is available via analog 4-20ma, HART™ protocol, Modbus, and BACnet™.

Flanged Connection

Wafer Connection

Features

- Volumetric or mass flow
- Velocity, temperature, pressure measurements integral to meter body
- Energy calculation and output available
- 1.5% of rate accuracy or better
- Turndown up to 100:1
- Push button digital display
- Remote electronics available
- FM, FMC, ATEX, IECEx - Approvals Pending
- Analog, HART™ , Modbus, BACnet™ communication

Performance Specifications

Accuracy		
Variable	**Liquids**	**Gas & Steam**
Volumetric Flow Rate	±0.7% of rate	±1.0% of rate
Mass Flow Rate	±1.0 % of rate	±1.5% of rate
Temperature	±2.0°F (±1°C)	±2.0°F (±1°C)
Pressure	±0.3% of full scale	±0.3% of full scale
Density	±0.3% of reading	±0.5% of reading
***Mass flow rate accuracy of gas and steam is based on 50-100% of pressure range**		

Repeatability	
Mass Flow Rate	±0.2% of rate
Volumetric Flow Rate	±0.1% of rate
Temperature	±0.2°F (±0.1°C)
Pressure	±0.05% of full scale
Density	±0.1% of reading
Stability Over 12 Months	
Mass Flow Rate	±0.2% of rate
Volumetric Flow Rate	Negligible
Temperature	±0.9°F (±0.5°C)
Pressure	±0.1% of full scale
Density	±0.1% of reading
Response Time	
Adjustable from 1 to 100 seconds	

Physical Specifications

Wetted Materials	
Standard	316L Stainless Steel
Optional	Carbon Steel or Hastelloy C
Approvals (Pending)	
FM, FMC	CLASS I, DIV. 1, GROUPS B, C, D CLASS II/III, DIV. 1, GROUPS E, F, G Type 4X and IP66, T6, Ta = -40°C to 60°C
ATEX	II 2 G Ex d IIB + H2 T6 II 2 D EX tD A21 IP66 T85°C, Ta = -40°C to 60°C
IECEx	Ex d IIB + H2 T6 Ex tD A21 IP66 T85°C, Ta = -40°C to 60°C

Power Requirements	
LP Option	12-36 VDC, 25mA, 1W max
DC Option	12-36 VDC, 300mA, 9W max
AC Option	100-240 VAC, 50/60Hz line power, 5W
Output Signals	
Analog	4-20 mA
Alarm	Solid state relay, 40 VDC
Totalizer Pulse	50 millisecond pulse, 40 VDC
Volumetric or LP Mass	One analog, one totalizer pulse, HART™
Multivariable	Up to three analog signals, three alarms, one totalizer pulse, HART™
Multivariable	Modbus or BACnet™ process monitoring
Display	
Alphanumeric 2 line x 16 character LCD digital display	
Six pushbuttons for full field configuration	
Pushbuttons can be operated with magnetic wand without removal of enclosure covers	
Display can be mounted in 90° intervals for better viewing	

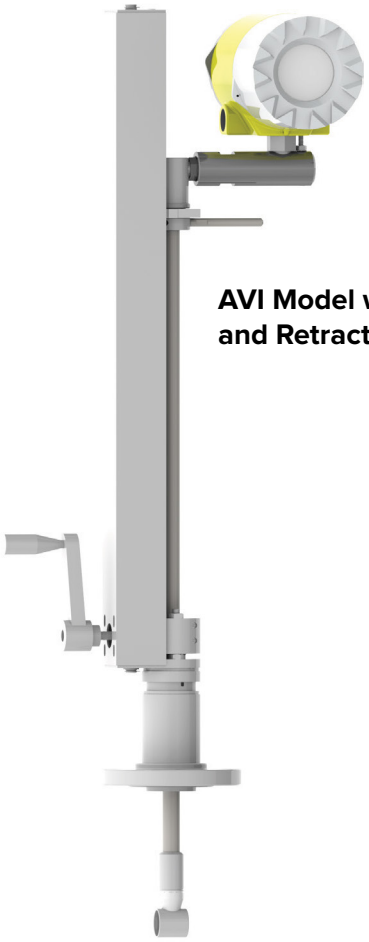
Insertion Vortex Flow Meter

Introducing the Insertion Vortex Flow Meter

The AVI insertion models provide all the same multivariable measurement and mass flow output features as the AVF in-line model in a robust, welded design.

The AVI is available for pipe sizes 2” (50 mm) (DN 50) and above with either flanged or NPT process connections up to ANSI Class 600 (PN64). Optional retractor tool provides easy hot-tap installation and removal.

AVI Model Insertion Vortex Meter



AVI Model with Packing Gland and Retractor Options

Features

- Compensated mass flow and energy calculations for gases, liquids, and steam
- Hop tap installation does not require shut down or process interruption
- Up to ±1.5% accuracy over a wide turndown in flow rates
- Reliable construction – no moving parts
- Analog, HART™, Modbus, and BACnet™ communication
- FM, FMC, ATEX, IECEx Approvals Pending

Performance Specifications

Accuracy		
Variable	**Liquids**	**Gas & Steam**
Volumetric Flow Rate	±1.2% of rate	±1.5% of rate
Mass Flow Rate	±1.5 % of rate	±2.0% of rate
Temperature	±2.0°F (±1°C)	±2.0°F (±1°C)
Pressure	±0.3% of full scale	±0.3% of full scale
Density	±0.3% of reading	±0.5% of reading
***Mass flow rate accuracy of gas and steam is based on 50-100% of pressure range**		

Repeatability	
Mass Flow Rate	±0.2% of rate
Volumetric Flow Rate	±0.1% of rate
Temperature	±0.2°F (±0.1°C)
Pressure	±0.05% of full scale
Density	±0.1% of reading
Stability Over 12 Months	
Mass Flow Rate	±0.2% of rate
Volumetric Flow Rate	Negligible
Temperature	±0.9°F (±0.5°C)
Pressure	±0.1% of full scale
Density	±0.1% of reading
Response Time	
Adjustable from 1 to 100 seconds	

Operating Specifications

Pressure Ratings			
Style Connection	**Process**	**Rating Code**	**Ordering**
Compression Fitting	2” (50 mm) MNPT	ANSI 600#	CT8
	2” (50 mm) 150# flange	ANSI 150#	CF8150
	2” (50 mm) 300# flange	ANSI 300#	CF8300
	2” (50 mm) 600# flange	ANSI 600#	CF8600
Packing Gland	2”(50 mm) MNPT	50 psig (3.5 barg)	PT8
	2” (50 mm) 150# flange	50 psig (3.5 barg)	PF8150
	2” (50 mm) 300# flange	50 psig (3.5 barg)	PF8300
Packing Gland & Removable Retractor	2” (50 mm) MNPT	ANSI 300#	PT8RR
	2” (50 mm) 150# flange	ANSI 150#	PF8150RR
	2” (50 mm) 300# flange	ANSI 300#	PF8300RR
Packing Gland & Permanent Retractor	2” (50 mm) MNPT	ANSI 600#	PT8R
	2” (50 mm) 150# flange	ANSI 150#	PF8150R
	2” (50 mm) 300# flange	ANSI 300#	PF8300R
	2” (50 mm) 600# flange	ANSI 600#	PF8600R

Orifice Plates & Flanges

Orifice Plate for Flow Measurement

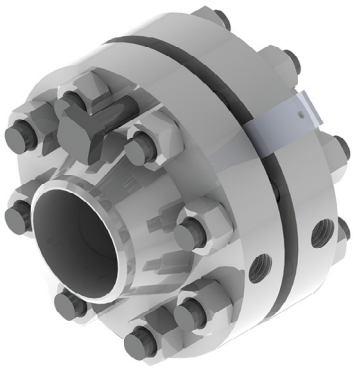
Orifice Plates are the most commonly used differential pressure measurement device and are applicable for measurements in gases, clean liquids, and low velocity steam. Orifice plates allow for relatively easy installation and replacement if necessitated by changes in process parameters or life cycle deterioration.

Armstrong supplies components for a typical orifice meter installation including flange unions, gaskets, orifice plate, and appropriate pressure tap sets.

Design and Manufacturing Standards

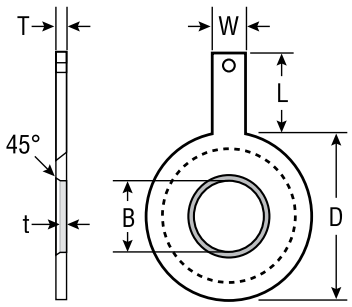
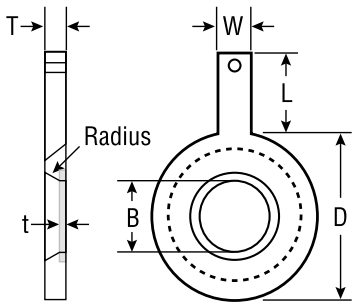
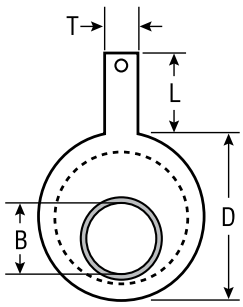
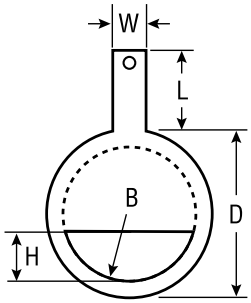
- Manufactured under strict control with high quality in observation with ASME and ISO 9001 certification standards
- AGA, ISA, ANSI, and API applicable codes
- Nondestructive testing and special service options available

Product Specifications	
Accuracy	±1.0% to ±5.0%
Turndown	Up to 10:1 turndown in flow
Operating Temperature	-400°F to 1250°F (-240°C to 677°C)
Operating Pressure	Dependent on material of construction
Line Size	½” and above (12.7mm and above)
Beta Ratio	0.30 to 0.75



Orifice Plates & Flanges

Dashed Line Represents The Pipe I.D.

Square Edge Concentric	Quadrant Edged	Eccentric Bore	Segmental Bore
			
Clean liquid, gas, vapor line fluids. Suitable for standard service requirements and with special material selection for harsh service.	For high viscosity, low Reynolds number applications. Plate thickness and rounded edge contribute to greater durability and useful plate life.	When bore is tangent to 98% of top line I.D. then entrained gases will pass the orifice. When at bottom, entrained solids will pass.	For fluids containing heavy sediments, B is 98% of line I.D. and H is height of circular segment.

Nominal Pipe Size (Inches)	ANSI 125# 150# D	ANSI 250# 300# D	ANSI 400# D	ANSI 600# D	ANSI 900# D	ANSI 1500# D	ANSI 2500# D	FOR ALL PRESSURE RATINGS					
								L	W	(AGA) T	t	Blank Weight (lbs)	(ISA) T
½”	1.875	2.125	2.125	2.125	2.500	2.500	2.750	4	1	.125	.015	1	.125
¾”	2.250	2.625	2.625	2.625	2.750	2.750	3.000	4	1	.125	.015	1	.125
1”	2.625	2.875	2.875	2.875	3.125	3.125	3.375	4	1	.125	.020	1	.125
1-1/4”	3.000	3.250	3.250	3.250	3.500	3.500	4.125	4	1	.125	.020	1	.125
1-1/2”	3.375	3.750	3.750	3.750	3.875	3.875	4.625	4	1	.125	.030	1	.125
2”	4.125	4.375	4.375	4.375	5.625	5.625	5.750	4	1	.125	.030	1	.125
2-1/2”	4.875	5.125	5.125	5.125	6.500	6.500	6.625	4	1	.125	.030	1	.125
3”	5.375	5.875	5.875	5.875	6.625	6.875	7.750	4	1	.125	.030	1	.125
4”	6.875	7.125	7.000	7.625	8.125	8.250	9.250	4	1	.125	.060	2	.125
5”	7.750	8.500	8.375	9.500	9.750	10.000	11.000	4	1	.125	.060	2	.125
6”	8.750	9.875	9.750	10.500	11.375	11.125	12.125	6	1-1/2	.125	.060	3	.125
8”	11.000	12.125	12.000	12.625	14.125	13.875	15.250	6	1-1/2	.125	.125	5	.125
10”	13.375	14.250	14.125	15.750	17.125	17.125	18.750	6	1-1/2	.125	.125	7	.125
12”	16.125	16.625	16.500	18.000	19.625	20.500	21.625	6	1-1/2	.250	.250	18	.125
14”	17.750	19.125	19.000	19.375	20.500	22.750		6	1-1/2	.250	.250	24	.125
16”	20.250	21.250	21.125	22.250	22.625	25.250		6	1-1/2	.375	.375	40	.250
18”	21.500	23.375	23.250	24.000	25.000	27.625		6	1-1/2	.375	.375	50	.250
20”	23.750	25.625	25.375	26.750	27.375	29.625		6	1-1/2	.375	.375	65	.250
22”	26.000	27.750	27.500	28.875				6	1-1/2	.375	.375	72	.250
24”	28.125	30.375	30.125	31.000	32.875	35.500		6	1-1/2	.375	.375	90	.250
30”	34.625	37.375	37.250	38.125				6	1-1/2	.500	.500	160	.250
36”	41.125	43.875	43.875	44.375				6	1-1/2	.500	.500	220	.375

Orifice Meter Runs

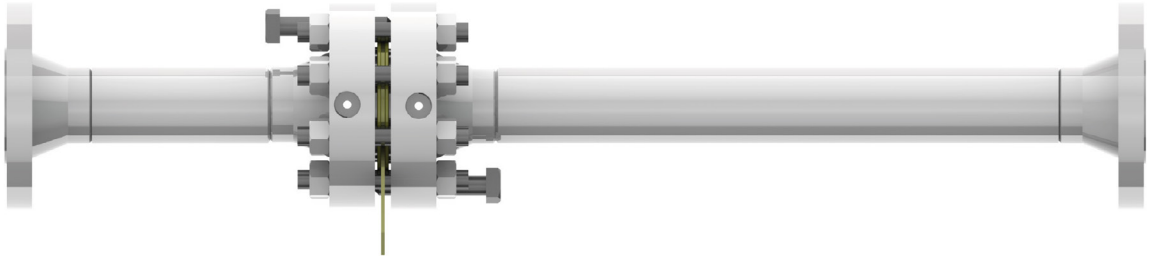
Orifice meter runs are available in accordance with AGA 3 code or any other desired specification for material, size, and capacity. General configuration of orifice meter runs includes:

Instrument Connection – ½" (12.7mm) pipe coupling and plug are supplied on downstream tube. Additional couplings are available upon request.

End Connection – Ends are supplied beveled for field welding. Threaded, flanged, and mechanical connections are available upon request.

Alignment – Meter runs are provided with alignment holes and studs.

Packing/Crating – Meter runs are crated and shipped fully assembled, ready for installation.



Orifice Plate and Meter Offerings - Model Numbers	
AOP	Universal Orifice Plate
AOU	Orifice Flange Union, Hardware Optional, Gaskets, No Plate
AOUP	Orifice Flange Union, Hardware Optional, Gaskets, Plate
AOUPFR	Orifice Meter Run, Plate, Flanged In-Line, Union
AOUPWR	Orifice Meter Run, Plate, Welded In-Line, Union
AOPTR	Orifice Meter Run, Plate, Threaded, Welded In-Line, No Flange Union
AOPWR	Orifice Meter Run, Plate, Welded, Welded In-Line, No Flange Union

Armstrong Venturi Tube Flow Meter

Venturi Tube Flow Meter

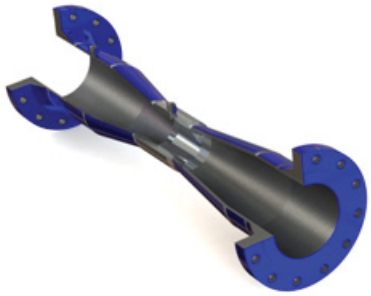
Venturi tubes have long been specified and used in a multitude of flow measurement applications. The versatility of measurable fluids, line sizes, and material of construction available to a Venturi tube flow meter has made it a highly recognized differential pressure flow element.

Armstrong offers classical style Venturi tubes – short form and long form – manufactured in accordance with applicable ASME codes. Also available is the Halmi Venturi tube which features superior performance and design with shorter laying lengths and reduced cost.

General Venturi Specifications	
Accuracy	±0.5% up to ±0.25% with calibration
Beta Ratio	Customizable between 0.30 through 0.75
Permanent Pressure Loss	5% to 20% dependent on Beta Ratio
Line Size	3/8” through 144” (9.525mm through 3657.6mm)
End Connection	Flange, weld, plain end, mechanical joint, or other
Material of Construction	CS, SS, Duplex SS, Chrome Moly, Aluminum, Hastelloy, Monel, Inconel, Zirconium, Titanium, Tantalum, Cast and Ductile Iron
Operating Pressure and Temperature	As limited by the materials of construction

Common Applications

- Clean gases and liquids
- Potable water
- High pressure steam
- Combustion air
- Compressor surge control
- Process measurement (alcohol, ethylene, chlorine, etc.)
- Gas oxygenation
- Storm sewage
- Solids-bearing fluids
- Higher viscosity liquids



Available Models and Configurations

Classical Venturi

- In-line, insert, and eccentric designs
- Flanged, weld-in, socket weld, butt weld connections
- Meter runs

Bi-Directional Venturi

- Classical and Halmi designs
- Cast, fabricated, plastic
- In-line, insert
- Flanged, weld-in, butt weld

Halmi Venturi

- Fabricated
- In-line, insert
- Flanged, weld-in, socket weld, butt weld, threaded, grout-in, wafer
- Meter runs, static tap, low flow, elbow mount

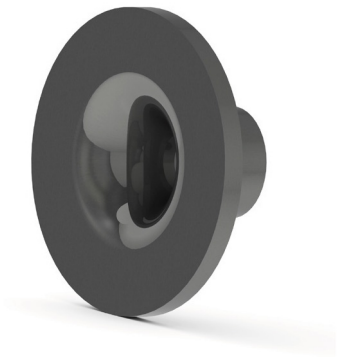
Plastic Venturi

- Insert
- Flanged, weld-in, grout-in
- Meter runs, static tap

Armstrong ASME Flow Nozzle

The ASME flow nozzle is a high performance, reliable measurement device, that can be installed in various design and material configurations with conformance to ASME MFC-3M, ASME PTC-6, and ASME PTC 19.5 codes.

<table>
<tr><th colspan="3">General Features</th></tr>
<tr><td>Line Size</td><td>Discharge Coefficient</td><td>ASME Design Standards</td></tr>
<tr><td>2” to 24” (50.8mm to 609.6mm)</td><td rowspan="3">±2.0% wall tapped nozzle (ASME MFC standard)
±1.0% wall tapped nozzle (ASME PTC 19.5 standard)
±0.25% throat tapped nozzle (ASME PTC 6 standard)</td><td rowspan="3">ASME PTC-6
ASME PTC 19.5
ASME MFC-3M
ISO-5167</td></tr>
<tr><td>Beta Ratio</td></tr>
<tr><td>0.20 to 0.80</td></tr>
<tr><td>Nozzle Material</td><td>End Connections</td><td></td></tr>
<tr><td rowspan="2">300 series stainless steel
Other materials available</td><td>Flanged or Welded</td><td>ASME Fabrication Standards</td></tr>
<tr><td>Pressure Taps</td><td rowspan="3">ASME Section 1
ASME B31.1 – power piping
ASME B31.3 – process piping</td></tr>
<tr><td>Piping Requirements</td><td>Wall Tap – 1D upstream, 0.5D downstream</td></tr>
<tr><td>ASME specified</td><td>Throat Tap – 1D upstream, code spec’d downstream</td></tr>
</table>



ANZF – Nozzle Flanged

Nozzle designed to be mounted between two flanges. ANZW model available to be welded-in between upstream and downstream pipe sections.

ANZFFR – Flanged Nozzle, Flanged Meter Run

Flow nozzle machined with a holding flange. The nozzle is mounted concentrically with the process flange of two pipe sections.

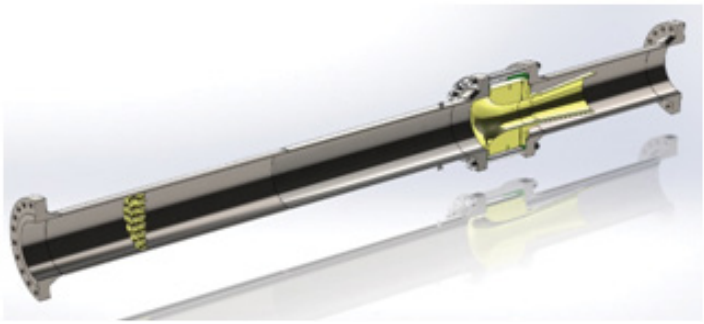
ANZWFR – Welded Nozzle, Welded Meter Run

Flow nozzle installed within a meter run by welding. Used regularly in high pressure and temperature feedwater and steam applications within power plants where flanged mounting is precluded.

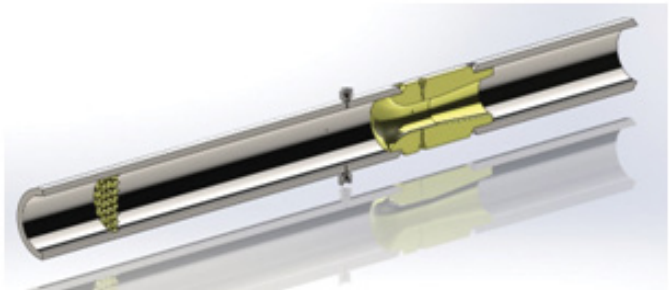
Armstrong PTC-6 ASME Flow Nozzle

PTC-6 ASME Flow Nozzle

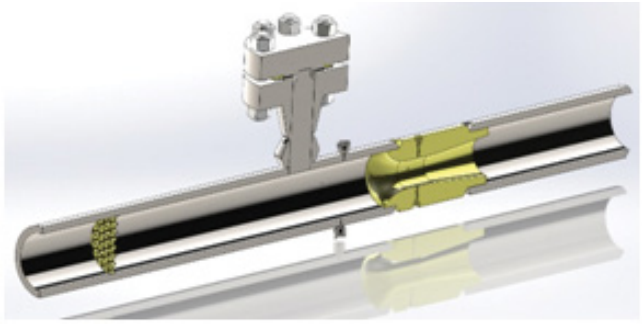
This flow nozzle provides high accuracy and precision required by ASME PTC-6 in steam turbine testing applications. The assembly consists of a flow conditioner for added accuracy, a diffuser cone for reduced pressure loss, and either a flanged or weld-in flow nozzle. Available in line sizes 4” to 24” with perforated plate or tube bundle flow conditioner, flanged-in or weld-in end connections, and four integrally machined throat pressure taps that are precision-machined and polished. Design standard ASME PTC-6 or ASME PTC 19.5.



Model APTFFR – PTC-6 flanged nozzle in a flanged meter run



Model APTWWR – PTC-6 welded nozzle in a welded meter run



Model APTWWR – PTC-6 welded nozzle in a welded meter run with inspection port

Flow Nozzle Meter Offerings - Model Numbers	
AHN	Halmi Nozzle
ANZF	Nozzle Flanged
ANZFFR	Nozzle Flanged, Flanged, Meter Run
ANZFWR	Nozzle Flanged, Welded, Meter Run
ANZW	Nozzle Weld-In
ANZWFR	Nozzle Weld-In, Flanged, Meter Run
ANZWWR	Nozzle Weld-In, Welded, Meter Run
APTFFR	PTC-6 Flanged Nozzle, Flanged, Meter Run
APTFWR	PTC-6 Flanged Nozzle, Welded, Meter Run
APTWFR	PTC-6 Welded Nozzle, Flanged, Meter Run
APTWWR	PTC-6 Welded Nozzle, Welded, Meter Run

Armstrong Wedge Flow Meter

Accurate Measurement for Challenging Fluids

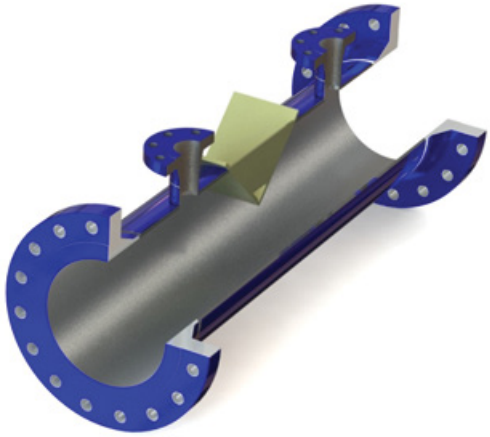
Armstrong's Wedge Meter imparts all the benefits of differential pressure measurement in difficult fluid applications. The meter can be used with high viscosity fluids, slurries, asphalt, tar-sands, fracking fluids, spent water, sludge, bottoms flow, cement, or other contaminated or abrasive fluids.

Within the cylindrical meter body, an embedded wedge constricts flow and produces a differential pressure. The subsequent measurement from the meter can be accurate to ±0.5% and ±0.2% repeatability. This includes measurements throughout the operating range and low Reynolds numbers.

Wedge & WedgeX Key Features

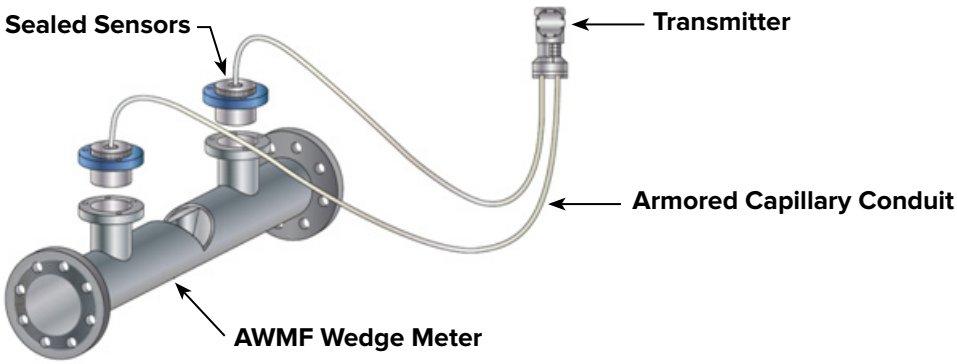
- ±0.5% accuracy, ±0.2% repeatability
- Available in virtually any line size
- Numerous materials of construction including: 316SS, 304SS, CS, Hastelloy, Monel, and PVC
- Flanged ends, threaded ends, weld ends, mechanical joint, and other connection types available
- Working pressure limitations per ANSI B16.5

Straight Run Requirements	Preferred		Minimum	
	Up	Down	Up	Down
Concentric expander/reducer	10D	5D	5D	3D
One elbow	10D	5D	5D	3D
Two elbows in-plane	10D	5D	5D	3D
Two elbows out-of-plane	10D	5D	10D	3D
Partially open gate valve	10D	5D	10D	3D



AWMF Wedge Meter

Typical Meter Configuration



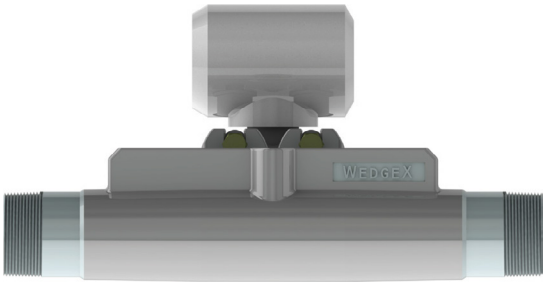
Armstrong WedgeX Flow Meter

Wedge Meter Benefits in a Compact Design

The Armstrong WedgeX meter utilizes the same technology and benefits inherent with a traditional wedge meter all within a compact, cost effective unit. The direct coupling of the transmitter to the pressure taps virtually eliminates measurement errors caused by the gauge line or plugged taps.

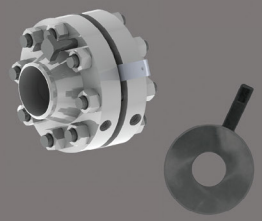
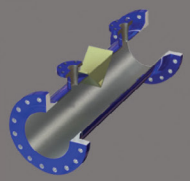
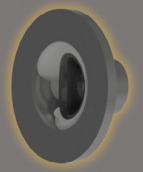
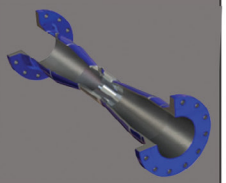
The WedgeX holds the same advantages in accuracy, performance, construction, and fluid capabilities as the standard wedge meter.

Wedge Meter Model Codes	
AWMF	Wedge Meter, Flanged
AWMT	Wedge Meter, Threaded
AWMWFR	Wedge Meter, Wafer
AWMV	Wedge Meter, Victaulic
AWMW	Wedge Meter, Butt Weld
AWX	WedgeX, Studs & O-Rings
AWXT	WedgeX, Threaded
AWXT3V	WedgeX, Threaded, 3-Valve Manifold
AWXTT3V	WedgeX, Threaded, Transmitter, 3-Valve Manifold
AWXTT	WedgeX, Threaded, Transmitter
AWXTHTT	WedgeX, Threaded, High Temp, Transmitter
AWXF	WedgeX, Flanged
AWXF3V	WedgeX, Flanged, 3-Valve Manifold
AWXFT3V	WedgeX, Flanged, Transmitter, 3-Valve Manifold
AWXFT	WedgeX, Flanged, Transmitter
AWXFHTT	WedgeX, Flanged, High Temp, Transmitter
AWXW	WedgeX, Wafer
AWXW3V	WedgeX, Wafer, 3-Valve Manifold
AWXWT3V	WedgeX, Wafer, Transmitter, 3-Valve Manifold
AWXWT	WedgeX, Wafer, Transmitter
AWXWHTT	WedgeX, Wafer, High Temp, Transmitter
AWXV	WedgeX, Victaulic
AWXV3V	WedgeX, Victaulic, 3-Valve Manifold
AWXVT3V	WedgeX, Victaulic, Transmitter, 3-Valve Manifold
AWXVT	WedgeX, Victaulir, Transmitter
AWXVHTT	WedgeX, Victaulic, High Temp, Transmitter



AWXTT WedgeX Meter

Armstrong Flow Measurement Product Matrix

Meter Type	 Accelabar®	 Verabar®	 Vortex Meter	 Orifice	 Wedge	 Flow Nozzle (Long & Short Radius)	 Classical Venturi
Line Size Range (Inches)	1" to 12"	≥ 1.5"	0.5" to 12"	≥ 0.5"	≥ 1/2"	≥ 2.0"	≥ 1"
Permanent Pressure Loss	33 - 35% of Generated Differential	3 - 4% of Generated Differential	AVI = Negligible AVF = Δ P = .00024 pV^2 * Δ P = .000011 pV^2 **	50 to 70% of Generated Differential	30 to 60% of Generated Differential	40 to 95% of Generated Differential Depending on Beta and R_e	12 to 30% of Generated Differential Depending on Beta and R_e
Accuracy of Flow Coefficient (% of Measured Rate)	± 0.5%	± 1.0%	± 0.7 to 1.5%	± 1.0 to 2.0%	± 2.0 to 4.0%	± 1.0 to 2.0%	± 0.75 to 2.0%
Required Straight Run of Piping	No straight run required	Upstream and Downstream required (Depending on Disturbance)	Upstream and Downstream required (Depending on Disturbance)	Upstream and Downstream required (3D to 75D Upstream Depending upon Beta Ratio and Disturbance, 2D to 9D Downstream)	Upstream and Downstream required (10D to 2D Upstream Depending on Disturbance)	Upstream and Downstream required (3D to 80D Upstream Depending upon Beta Ratio and Disturbance, 2D to 8D Downstream)	Upstream and Downstream required (3D to 30D Upstream Depending upon Beta Ratio and Disturbance, 2D to 8D Downstream)
Rangeability (Turndown in Flow)	20 : 1+	10 : 1	20 : 1	3 : 1	5 : 1	5 : 1	10 : 1
Gas							
Liquid							
Steam							
Slurry							

* English (Δ P in psi, p in lb/ft^3, V in ft/sec)

** Metric (Δ P in bar, p in kg/m^3, V in m/sec)

Ideal **Acceptable** **Not Recommended or Least Favorable**

Fill in the form below, complete sections 1 through 7 and email to: veris-sales@armstrongintenational.com

*Requested By:*_____

Date: _____ Tag#: _____ E-mail: _____

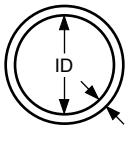
Phone: _____ Fax: _____

Company: _____ Address: _____ City, State, Zip: _____

End User:

Company Name: _____ City: _____ State, Zip: _____

1. Enter Pipe Dimensions



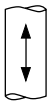
Pipe Size _____ Sch _____

Pipe ID _____ Wall _____ Pipe Mat'l _____

2. Pipe Orientation

(Check one box)

☐ (H) Horizontal



☐ (V) Vertical

3. Enter Flow Conditions

Fluid Name:		Maximum	Normal	Minimum	Units
Flow Rate					
All Fluids	Pressure @ Flow				
	Temperature @ Flow				
Gas	Specific Gravity, or				
	Molecular Weight				
Liquid	Specific Gravity				
Steam	VeraCalc Program can calculate Density from Temperature and Pressure				

Special Instructions

4. Select Model Accelabar 316SS

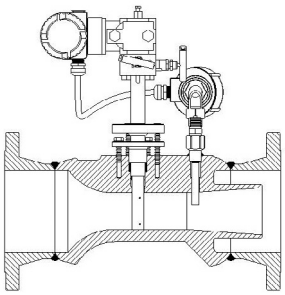
(Check one box in each category)

AFS Flanged (ANSI):

☐ 150# ☐ 300#
☐ 600# ☐ ABS Bevel for Weld
☐ ATS MNPT Threaded Ends (1" and 2" meter only)

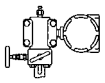
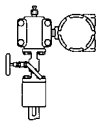
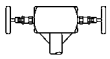
Specify Accelabar Meter Size:

☐ 1" (DN25) ☐ 6" (DN150)
☐ 2" (DN50) ☐ 8" (DN200)
☐ 3" (DN75) ☐ 10" (DN250)
☐ 4" (DN100) ☐ 12" (DN300)



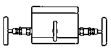
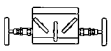
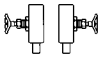
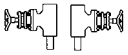
5. Select Instrument Head (Check one box)

Instrument Head Connections
(Select Remote or Direct Mount Transmitter — Sold Separately)

Direct Mount Transmitter (Flanged 450°F/232°C Max.)		Remote Mount Transmitter (1/2" NPT)		
Manifold	Transmount	Valve	Regular	Parallel
 Integral		 Integral		
☐ M	☐ F	☐ T	☐ R	☐ P

6. Select Instrument Valves or Manifold, RTD & Cable

(Optional)

Manifolds (Optional)				Instrument Valves (Optional)	
Direct Mount				Remote Mount	
3-Valve		5-Valve		Needle	Gate
					
Soft Seat	Hard Seat	Soft Seat	Hard Seat	1/2" NPT	1/2" NPT
☐ F3SC (CS) ☐ F3SS (SS)	☐ F3HC (CS) ☐ F3HS (SS)	☐ F5SC (CS) ☐ F5SS (SS)	☐ F5HC (CS) ☐ F5HS (SS)	☐ C2NC (CS) ☐ C2NS (SS)	☐ C2GC (CS) ☐ C2GS (SS)

Code	RTD in Thermowell
☐ H1	Standard Temperature, 500*F (260*C) Max., Explosion Resistant
☐ HT	High Temperature, 900*F (482*C) Max., Moisture and Dust Resistant

Code	Connection Cable to Transmitter (Direct Mount Only)
☐ XP	Explosion Resistant
☐ N4	Moisture and Dust Resistant

7. Transmitter

Supplied By
☐ Veris ☐ Others

VERIS Verabar®

Quick Model Selection · RFQ

Fill in the form below, complete sections 1 through 7 and email to: veris-sales@**armstrong**international.com

*Requested By:*_____

Date: _____ Tag#: _____ E-mail: _____

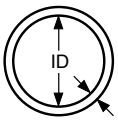
Phone: _____ Fax: _____

Company: _____ Address: _____ City, State, Zip: _____

End User:

Company Name: _____ City: _____ State, Zip: _____

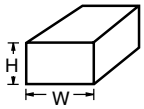
1. Enter Pipe Dimensions or Duct Dimensions



Pipe Size _____ Sch _____

Pipe ID _____ and

Wall _____ Pipe Mat'l _____



Dimension Verabar spans (H) or (W)

Height (H) _____

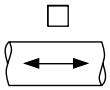
Width (W) _____

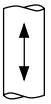
Wall _____

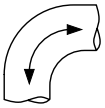
Duct Mat'l _____

2. Pipe or Duct Orientation

(Check one box)

☐ 
(H) Horizontal

☐ 
(V) Vertical

☐ 
Short Straight Run
Consult Factory

3. Enter Flow Conditions

Fluid Name:		Maximum	Normal	Minimum	Units
Flow Rate					
All Fluids	Pressure @ Flow				
	Temperature @ Flow				
Gas	Specific Gravity, or				
	Molecular Weight				
Liquid	Specific Gravity				
Steam	VeraCalc Program can calculate Density from Temperature and Pressure				

Special Instructions

_____

_____

_____

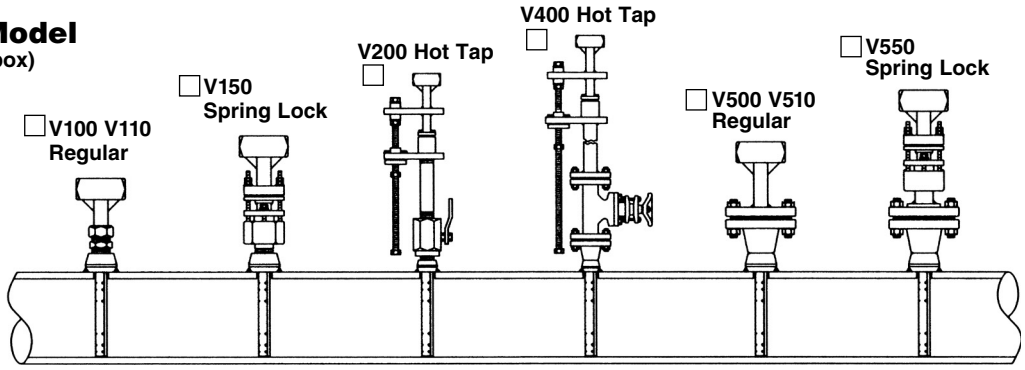
_____

_____

_____

4. Select Model

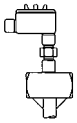
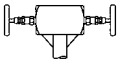
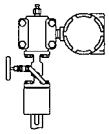
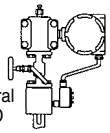
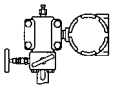
(Check one box)



5. Select Instrument Head

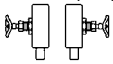
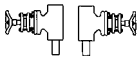
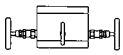
Instrument Connections (Select Remote or Direct Mount. Transmitter sold separately.)

Remote Mount Transmitter (1/2" NPT) | **Direct Mount Transmitter** (Flanged 450°F/232°C Max.)

Parallel	Regular	RTD	Valve	Transmount	Mass Transmount	Manifold
☐ **P**	☐ **R**	☐ **D**	☐ **T**	☐ **F**	☐ **G**	☐ **M**
			 Integral		 Integral RTD	 Integral

6. Select Instrument Valves or Manifold

(Optional)

Instrument Valves (Opt.) Remote Mount		Manifolds (Optional) Direct Mount			
Needle	Gate	3-Valve		5-Valve	
☐ **C2NC** (CS) ☐ **C2NS** (SS)	☐ **C2GC** (CS) ☐ **C2GS** (SS)	☐ **F3SC** (CS) ☐ **F3SS** (SS)	☐ **F3HC** (CS) ☐ **F3HS** (SS)	☐ **F5SC** (CS) ☐ **F5SS** (SS)	☐ **F5HC** (CS) ☐ **F5HS** (SS)
 1/2" NPT	 1/2" NPT	 Soft Seat	Hard Seat	 Soft Seat	Hard Seat

7. Transmitter

Supplied By	
☐ Veris	☐ Others

Vortex Meter

Fill in the form below, complete sections 1 through 5 and email to: veris-sales@**armstrong**international.com

*Requested By:*_____

Date: _____ Tag#: _____ E-mail: _____

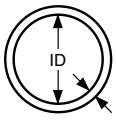
Phone: _____ Fax: _____

Company: _____ Address: _____ City, State, Zip: _____

End User:

Company Name: _____ City: _____ State, Zip: _____

1. Enter Pipe Dimensions

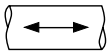


Pipe Size _____ Sch _____

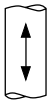
Pipe ID _____ Wall _____ Pipe Mat'l _____

2. Pipe Orientation

(Check one box)



☐ (H) Horizontal



☐ (V) Vertical

3. Enter Flow Conditions

Fluid Name:		Maximum	Normal	Minimum	Units
Flow Rate					
All Fluids	Pressure @ Flow				
	Temperature @ Flow				
Gas	Specific Gravity, or				
	Molecular Weight				
Liquid	Specific Gravity				
Steam	Vortex Sizing Program can calculate Density from Temperature and Pressure				

Special Instructions

Complete Section 4 for AVF *OR* Section 5 for AVI

4. AVF Inline Vortex Meter

(Check one box in each category)

Process Connection:

- ☐ 150# Flange
- ☐ 300# Flange
- ☐ 600# Flange
- ☐ 600# Wafer
- ☐ PN16
- ☐ PN40
- ☐ PN64

Electronics:

- ☐ NEMA 4X Enclosure
- ☐ Remote NEMA 4X Enclosure, 50 ft cable
- ☐ Remote NEMA 4X Enclosure, 25 ft cable

Multivariable Options:

- ☐ Volumetric
- ☐ Velocity, Temperature
- ☐ Velocity, Temperature, Pressure
- ☐ Velocity, Temperature, External Pressure
- ☐ Energy
- ☐ Energy, Pressure

Output:

- ☐ One analog, frequency, one pulse, HART, LP power only
- ☐ One analog, frequency, one alarm, one pulse, HART, DC or AC power
- ☐ One analog, frequency, one alarm, one pulse, Modbus, DC or AC power
- ☐ One analog, frequency, one alarm, one pulse, BACnet™, DC or AC power
- ☐ Three analog, frequency, three alarms, one pulse, HART, DC or AC power
- ☐ Three analog, frequency, three alarms, one pulse, Modbus, DC or AC power
- ☐ Three analog, frequency, three alarms, one pulse, BACnet™, DC or AC power

Input Power:

- ☐ 12-36VDC, 25mA, 1W max, loop powered, output option 1 only
- ☐ 12-36VDC, 300mA, 9W max, output options 2, 3, 4, 5, 6, 7
- ☐ 10-240VAC, 5W max, output options 2, 3, 4, 5, 6, 7

5. AVI Insertion Vortex Meter

(Check one box in each category)

Process Connection:

- ☐ Compression Fitting
- ☐ Packing Gland

Retractor (optional):

- ☐ Permanent Retractor
- ☐ Removeable Retractor

Connection Type (2 inch, DN50):

- ☐ 150# Flange
- ☐ 300# Flange
- ☐ 600# Flange
- ☐ NPT
- ☐ PN16
- ☐ PN40
- ☐ PN64

Electronics:

- ☐ NEMA 4X Enclosure
- ☐ Remote NEMA 4X Enclosure, 50 ft cable
- ☐ Remote NEMA 4X Enclosure, 25 ft cable

Multivariable Options:

- ☐ Volumetric
- ☐ Velocity, Temperature
- ☐ Velocity, Temperature, Pressure
- ☐ Velocity, Temperature, External Pressure
- ☐ Energy
- ☐ Energy, Pressure

Output:

- ☐ One analog, frequency, one pulse, HART, LP power only
- ☐ One analog, frequency, one alarm, one pulse, HART, DC or AC power
- ☐ One analog, frequency, one alarm, one pulse, Modbus, DC or AC power
- ☐ One analog, frequency, one alarm, one pulse, BACnet™, DC or AC power
- ☐ Three analog, frequency, three alarms, one pulse, HART, DC or AC power
- ☐ Three analog, frequency, three alarms, one pulse, Modbus, DC or AC power
- ☐ Three analog, frequency, three alarms, one pulse, BACnet™, DC or AC power

Input Power:

- ☐ 12-36VDC, 25mA, 1W max, loop powered, output option 1 only
- ☐ 12-36VDC, 300mA, 9W max, output options 2, 3, 4, 5, 6, 7
- ☐ 10-240VAC, 5W max, output options 2, 3, 4, 5, 6, 7

Differential Pressure Flow Element • RFQ

Fill in the form below, complete sections 1 through 4 and email to: veris-sales@**armstrong**international.com

*Requested By:*_____

Date: _____ Tag#: _____ E-mail: _____

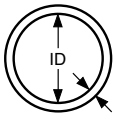
Phone: _____ Fax: _____

Company: _____ Address: _____ City, State, Zip: _____

End User:

Company Name: _____ City: _____ State, Zip: _____

1. Enter Pipe Dimensions

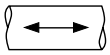


Pipe Size _____ Sch _____

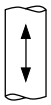
Pipe ID _____ Wall _____ Pipe Mat'l _____

2. Pipe Orientation

(Check one box)



☐ (H) Horizontal



☐ (V) Vertical

3. Enter Flow Conditions

Fluid Name:		Maximum	Normal	Minimum	Units
Flow Rate					
All Fluids	Pressure @ Flow				
	Temperature @ Flow				
Gas	Specific Gravity, or				
	Molecular Weight				
Liquid	Specific Gravity				
Steam	Flow Element Sizing Program can calculate Density from Temperature and Pressure				

Special Instructions

4. Primary Element

☐ **Orifice Plate**
☐ **Venturi**
☐ **Flow Nozzle**
☐ **Wedge**

Desired Differential Pressure at Max Flow: _____

Desired Beta Ratio (if applicable): _____

Meter Run:
☐ **Yes**
☐ **No**

Orifice Plate:

☐ **Concentric**
☐ **Eccentric**
☐ **Quadrant Edged**
☐ **Segmented Bore**

Tap Type:
☐ **Flange**
☐ **Radius**
☐ **Vena Contracta**
☐ **Pipe**

Flange Rating (if applicable):
☐ **300#**
☐ **600#**

Venturi/Flow Nozzle:

☐ **Flanged**
☐ **Weld-In**
☐ **Insert**

Flange Rating (if applicable):
☐ **150#**
☐ **300#**
☐ **600#**
☐ **Other**

Material of Construction:

Throat _____

Body _____

Notes:

INTELLIGENT SOLUTIONS IN STEAM, AIR, AND HOT WATER

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