APlus-QMC LLC

Catalog 2017

A+FLOWTEK© Balanced Flow Meter
NASA 2006 Invention of the Year
NASA 2010 Award for Excellence in Technology Transfer
NASA 2010 and 2011 Nominee for Space Technology Hall of Fame

APlus-QMC

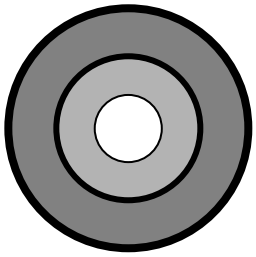
A+ FlowTek©

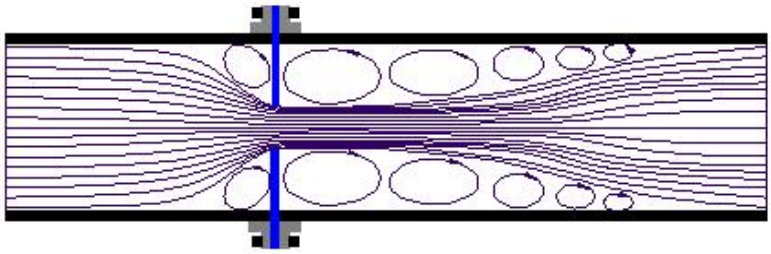
Fluid Flow Metering Specialists

Patent US 7,051,765 B1

ISSUES

Current orifice meter technology is known to generate a large permanent loss of pressure. The pressure potential is consumed by the eddy turbulence. Accuracy lost is due to linearity and repeatability issues that are a direct result of the random and chaotic eddy turbulence formations.

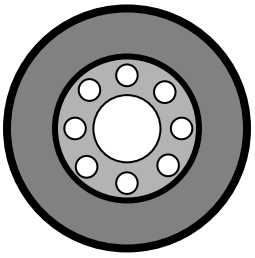


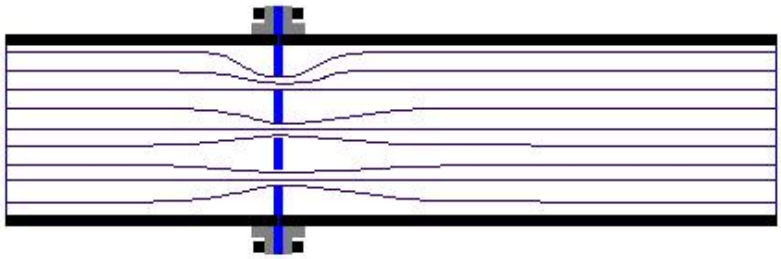


Standard Orifice Generates Random Eddy Turbulence

SOLUTION

A+ FlowTek minimizes eddy's and provides higher accuracy over current orifice plate technology. With features worthy of a NASA patent, the A+ FlowTek's Balanced Flow Meter has a 34% accuracy improvement and minimizes energy (pressure) loss by 50%. Accurate measurements are critical to improve plant operational efficiency. The difference between an accurate and an inaccurate flow reading can mean a significant cost savings. Additionally, lower pressure loss conserves energy and saves money.





A+ FlowTek Balanced Flow Meter - A Cost Effective Solution

TECHNOLOGY

Testing and measurement were conducted by NASA personnel and technology validated through Texas A&M University - Kingsville. The A+ FlowTek Balanced Flow Meter provides balanced kinetic energy and momentum across the fluid flow region. The A+ FlowTek technology significantly reduces turbulent shear, fluid flow stresses and associated eddy formations.

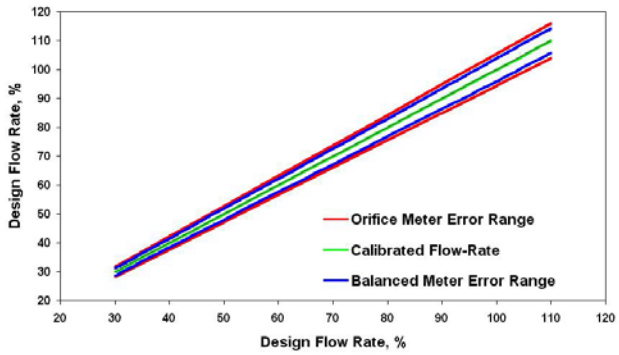
ACCURACY

The eddy turbulence, generated by the orifice plate, interferes with the repeatability and linearity. The balanced meter increased reliability results in better flow measurement accuracy.

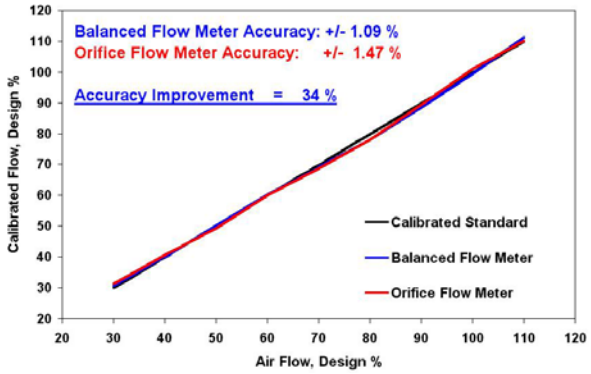
Repeatability - The A+ Balanced Flow Meter provides 54% repeatability (deviation) improvement, as compared to the orifice plate.

Linearity - The A+ Balanced Flow Meter produces 34% improvement in overall accuracy (linearity), versus the orifice plate technology.
Note: These are pre-calibration accuracies.
Post calibration accuracies are within 1/100,000.

A+ Balanced and Orifice Meter Repeatability @ 99.9% Confidence Intervals



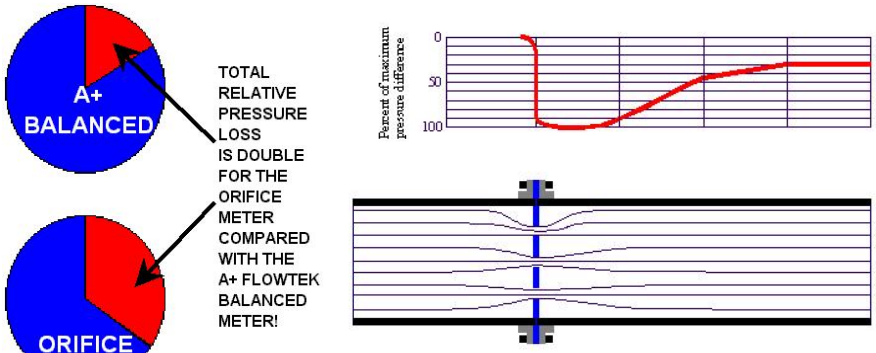
A+ Balanced & Orifice Meter Calibrations

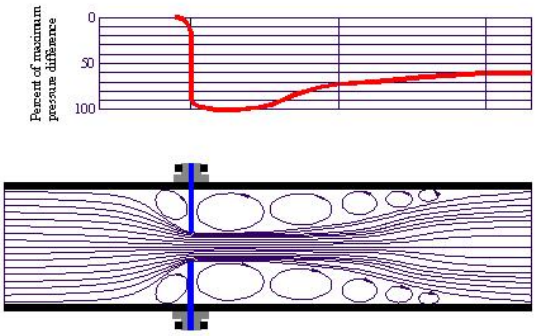


PRESSURE LOSS

The A+ Balanced Flow Meter provides a 50% reduction in pressure loss, saving substantial energy costs.

A+ FlowTek Balanced Flow Meter





Standard Orifice

BENEFITS

This new A+ FlowTek balanced metering technology provides many benefits when compared to orifice plate design.

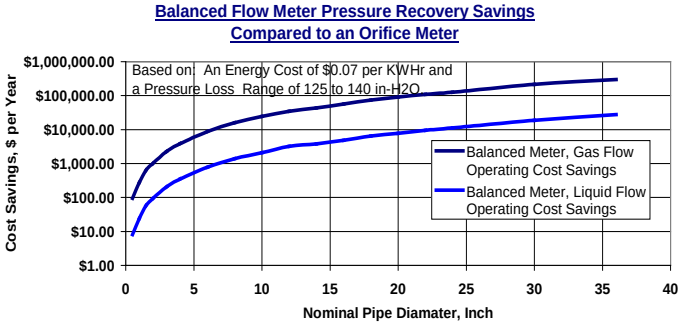
- Reduced pressure loss
- Improved accuracy
- Enhanced repeatability
- Increased rangeability
- Self venting & Draining
- Lower vibration
- Reduced noise
- Straightens flow

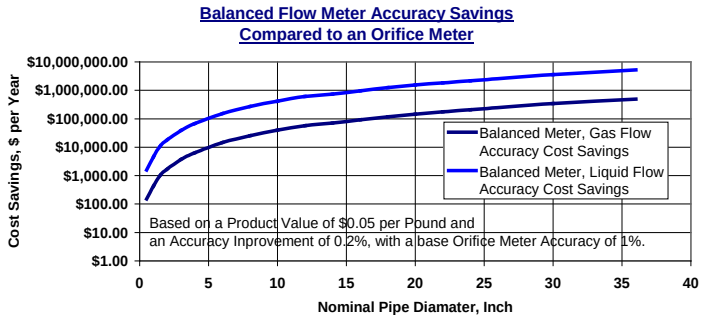
- Cost effective
- Reduces pipe erosion
- Improved solids handling
- Direct orifice replacement
- No piping changes
- No instrumentation changes
- Same calculation method
- Reduced installation length

TOTAL COST SAVINGS

The payback period for replacing a standard orifice plate with the A+ Balanced Flow Meter plate is highly motivating. For typical sizes of 2 inches and more, based on total cost, the payback is no more than six (6) weeks. For incremental replacement costs, the payback is less than one week. With liquids, accuracy is more important than pumping costs. With gases, compression costs are comparable with accuracy costs. Energy cost savings alone make the A+ FlowTek's Balanced Flow Meter preferable to the current orifice meter design. The estimated total accuracy and energy cost savings for gasses and liquids in many applications are shown below.

A+ FlowTek Balanced Flow Meter Savings as Compared to an Orifice Meter



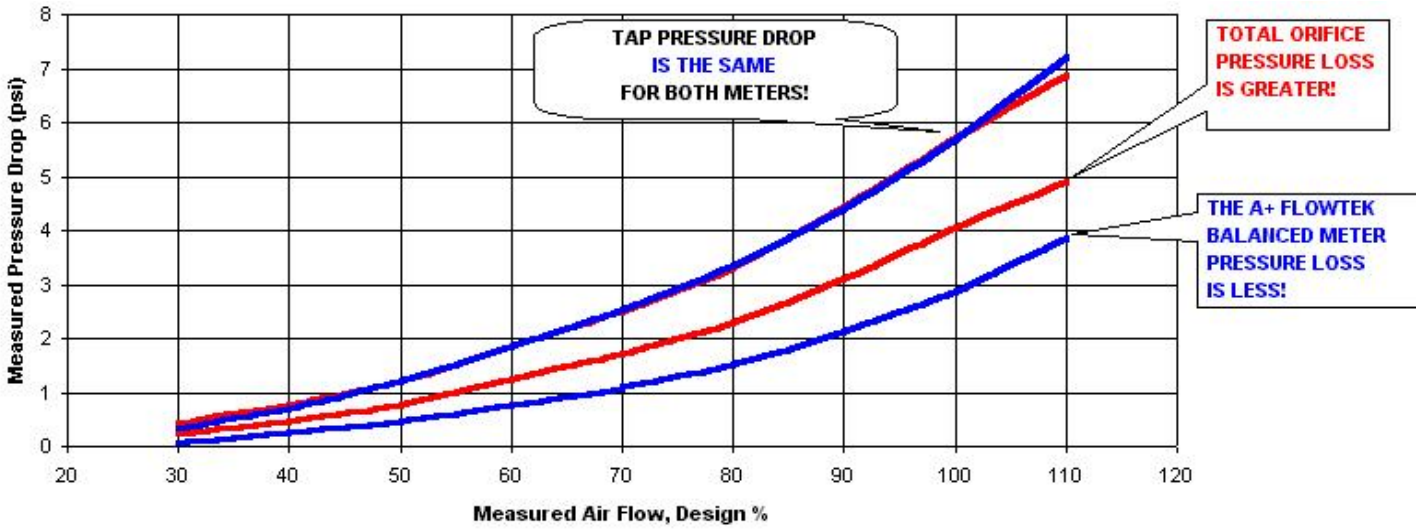


The cost benefits may vary dependent on the particular application. However, for any application, the A+ Balanced flow meter will provide superior performance over a standard orifice plate for accuracy, repeatability, rangeability, control-stability, quality, energy savings, and other improvements

LOW COST INSTALLATION

The A+ Balanced Flow Meter is competitively priced to the cost of standard orifice plates. Simply replace your current orifice plate with the A+ Balanced Flow Meter plate during normal maintenance cycles and start saving money through accuracy and energy cost improvements, while using all existing equipment. The A+ Balanced Flow Meter plate dimensions and fittings are the same as your existing orifice and the sensor differential pressure curves are equivalent. Additionally, your flow calculations will not need to be changed.

A+ FlowTek Balanced & Orifice Meters Total & Tap Pressure Drops



PRODUCT CODE CHART

The A+ Balanced Flow Meter is available with other A+ FlowTek meter designs to meet specific flow conditions and customer requirements. These designs include flow metering, critical flow, flow straightening, conditioning, mixing, and restriction orifices. For all gas and liquid flow measurements, the A+ Balanced Flow Meter is recommended for superior performance. Use the following A+ FlowTek Product Code Chart for flow meter selection and pricing specifications.

CODE	A+ FlowTek Plate Type	CODE	Pipe Diameter (inch)	CODE	Pipe Schedule Nominal	CODE	Materials of Construction Type, Code
A	BFM	**D0050**	0.5”	**S005**	5	**MA**	13% chromium stainless
B	Std. Orifice	**D0010**	1”	**S010**	10	**MB**	18-8 stainless type 304
C	Segmental	**D0150**	1.5”	**S020**	20	**MC**	18-8 stainless type 304L
D	Slotted	**D0200**	2”	**S030**	30	**MD**	18-8-3 stainless type 316
E	Star	**D0300**	3”	**S040**	40	**ME**	18-8-3 stainless type 316L
F	Multi-Hole	**D0400**	4”	**S060**	60	**MF**	Aluminum
G	Re Matching	**D0600**	6”	**S080**	80	**MG**	Aluminum alloys
H	Tau Matching	**D0800**	8”	**S100**	100	**MH**	Aluminum bronze
I	Restriction	**D1000**	10”	**S120**	120	**MI**	Carbon Steel
J	Flow Nozzle	**D1200**	12”	**S140**	140	**MJ**	Copper
K	Venturi	**D1400**	14”	**S160**	160	**MK**	Copper and copper alloys
		D1600	16”			**ML**	Inconel 600
		D1800	18”			**MM**	Monel 400
		D2000	20”			**MN**	Naval brass
		D2200	22”			**MO**	Nickel and nickel-base alloys
		D2400	24”			**MP**	Nylon
		D3000	30”			**MQ**	Poly (vinyl chloride)
		D3600	36”			**MR**	Polyethylene
						MS	Polypropylene
						MT	Titanium and titanium alloys

Product Code Example: **A-D0400-S040ME:5000** product code is an A+ FlowTek Balanced Flow Meter (**A**) with a 4” (**D0400**), schedule 40 pipe (**S040**), made of 316L stainless steel (**ME**).
The beta ratio code (5000) should be provided for complete plate specifications, in this example the beta ratio is 0.5000, (e.g. 1/2).

Please contact APlus-QMC LLC or an authorized representative to assist with sizing and competitive flow meter pricing…

APlus-QMC LLC

A+ FlowTek©

Fluid Flow Metering Specialists

Email: Paul@APlusFlowTek.com **www.APlusFlowTek.com** **(832) 515-5464**

PIPING REQUIREMENTS @+0 D,-0 D

NASA testing has shown maximum accuracy, minimum noise and optimum pressure recovery with 10 diameter upstream and 5 diameter downstream piping configurations. Testing with an elbow immediately on the upstream side of the plate and immediately on the downstream side of the plate shows only a slight reduction in accuracy, typically much less than 1%. Sensor noise levels will increase by approx. 2% and pressure recovery will be reduced by approx. 20%.

Fouling effects are minimal. Fouling with dense phase materials did not show an appreciable effect on performance. The fouling material passed directly through the plate without build-up.

Flow range for testing was from 5% of rated flow to sonic flow conditions. Beta factors used in this NASA testing range from 0.25 to over 0.9 with various hole/area layout configurations. For all test results, the Balanced Flow Meter outperformed the standard orifice plate design in terms of accuracy, repeatability, noise, and pressure recovery. Equations to be used with the Balanced Flow Meter plate are the standard venturi or orifice flow equations.

Based on the NASA testing and accuracies expected, (plus or minus .75% to less than 0.25%, dependent on calibration and sensor measurement accuracy), the A+ FlowTek Balanced Flow Meter can be used with minimal upstream and downstream piping runs in most applications.



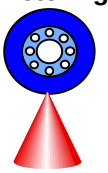





GENERAL SPECIFICATIONS

A+ FlowTek

Fluid Flow Metering Specialists



Balanced Plate General Specifications

No	By	Date	Rev	Sheet		of	
				Spec No.		Revision	
				Project No.		Date	
Client Information:				P.O:			
				By	Chk'd	Approved	

BALANCED ORIFICE PLATES			ORIFICE FLANGES		
1 In-Line			7 Taps:	Flange Pipe Vena Other:	
2 Staggered			8 Tap Size:		9 Thread Type:
3 In-Line & Staggered			10 Type:	Weld Neck Slip On Threaded	
4 Material:	316 Other:		11 Material:	Steel 304 316 Other:	
5 Reference Dwg.			12 Tap Orientation:	Top Bottom Other:	
6 Part No. / Ser No.			13 Flange Rating:	150# 300# Other:	

BASIC DATA	14	Tag Number		
	15	Service		
	16	Sizing Option	1 2 3 4 Other:	1 2 3 4 Other:
FLUID AND PROC DATA	17	Fluid		
	18	Fluid State	Gas Liquid 2-Phase	Gas Liquid 2-Phase
	19	Temperature		
	20	Pressure		
	21	Standard or Actual Flow		
	22	Min Flow		
	23	Normal Flow		
	24	Max Flow		
	25	Tap DP @ Max Flow		
	26	Fluid Composition (attach list)		
	27	Phase	Gas Liquid 2-Phase	Gas Liquid 2-Phase
	28	Fouling	High Medium Low	High Medium Low
	29	Specific Gravity at Base		
	30	Operating Spec. Gravity		
	31	Super Compressibility Factor		
	32	Base Press. / Base Temp.		
PLATE AND PIPE DATA	29	Installation Type	Replacement New Design	Replacement New Design
	30	Pressure Recovery	High Nominal	High Nominal
	31	Accuracy	High Nominal	High Nominal
	32	Noise Level	N/A Medium Low	N/A Medium Low
	33	Plate Thickness	1/4 3/8 1/2 Other:	1/4 3/8 1/2 Other:
	34	Clearance to Pipe Wall	Min Nominal	Min Nominal
	35	Pipe Schedule		
	36	Pipe Nominal Diameter		
	37	Pipe ID		
	38	Insulation Thickness		
	39	Flange Schedule		
	40	Flange Rating		
	41	Matl of Construction Plate	316 Other:	316 Other:
	42	Matl of Construction Pipe	Steel Other:	Steel Other:
	43	Tap Types	Flange Center Other:	Flange Center Other:
	44	Tap Orientation	Top Bottom Other:	Top Bottom Other:
	45	Flow Loop Gain Factor	1.5 Other:	1.5 Other:
	46	Calibration Requirements	Yes No	Yes No
NOTES:				

DETAILED SPECIFICATIONS

A+ FlowTek

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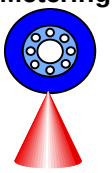

Balanced Plate Detailed Specifications

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4 Material:	316 Other:	11 Material:	Steel 304 316 Other:
5 Reference Dwg.		12 Tap Orientation:	Top Bottom Other:
6 Part No. / Ser No.		13 Flange Rating:	150# 300# Other:

BASIC DATA	14	Tag Number						
	15	Service						
	16	Sizing Option (1, 2, 3, 4 or other)						
FLUID DATA	17	Fluid						
	18	Fluid State						
	19	Maximum Flow						
	20	Normal Flow						
	21	Pressure						
	22	Temperature						
	23	Composition (attach list)						
	24	Specific Gravity at Base						
	25	Operating Spec. Gravity						
	26	Super Compressibility Factor						
	27	Mol. Wt / C_p / C_v						
	28	Operating Viscosity						
	29	Quality % or º Superheat						
	30	Base Press. / Base Temp.						
METER DATA	31	Type of Meter						
	32	Diff. Range - Dry						
	33	Seal Sp. Gr. at 60ºF						
	34	Static Pressure range						
	35	Chart or Scale Range						
	36	Chart Multiplier						
	37	Equiv.Beta=d/D						
	38	Center Hole Diameter						
	39	Hole Dia - Ring # 1						
	40	Hole Dia - Ring # 2						
	41	Attach list if addl rings						
	42	Hole-to-Pipe Wall Clearance						
PLATE AND FLANGE DATA	43	Line I.D.						
	44	Flange Rating						
	45	Vent or Drain Hole						
	46	Plate Thickness						
PIPE DATA	47	Schedule						
	48	Materials of Construction						
	49	Nominal Diameter						
	50	Internal Diameter						
	51	Insulation Thickness						
	52	Maximum Pressure (MAWP)						
	53	Maximum Temperature (MAWT)						
NOTES:								

