



The A+FlowTek BVM, BFM & BRO

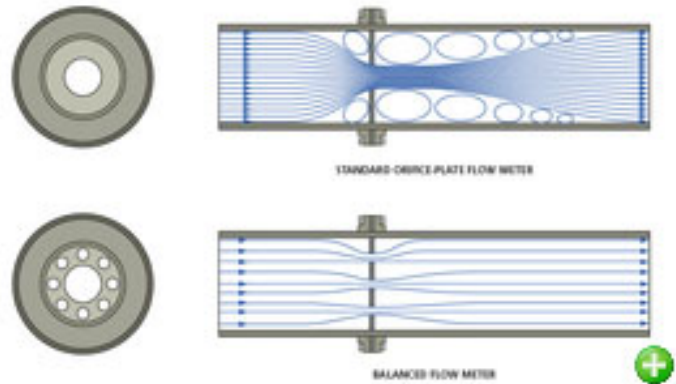
Patented by NASA/A+ (U.S. Patent No. 7,051,765)

The multi-holed A+ Balanced Flow Meters (BFM) are recent additions to head-meters, an established class of simple, rugged flow meters that contain no moving parts, in contact with flow and are based on measurement of pressure drop across the plate placed in flow paths. These advanced flow meters are accurate and provide minimal (or no) pressure loss. The A+ BVM provides Venturi flow meter performance in a single plate. The multi-holed A+ Balanced Restriction Orifice (BRO) plate is also a recent addition for flow limiting devices used to take extreme pressure drops while limiting the flow to a specified value. All the A+ BVM, BFM and BRO provide silencing (very low noise <80 dB) and flow-conditioning, not affected by upstream or downstream disturbances (< 1D), easily manufactured, easily installed and maintained, reliable, and long lived (> 12x conventional orifice). They can be easily mounted in a flow path by bolting between conventional pipe flanges. The multi-



holed A+ BVM/BFM and BRO are currently used to measure or limit the flow of any of a variety of liquids, gases, and two-phase flows.

The innovative aspects and advantages of a balanced flow/restriction plate design are most easily understood by comparing it with its most closely related predecessor, a standard single-holed orifice-plate flow meter (see figure). Any flow device based on the Bernoulli flow pressure-velocity head principle necessarily introduces some turbulence, permanent pressure loss, and simultaneous dissipation of kinetic energy of flow. The turbulence, in turn, introduces a degree of non-repeatability into the local pressure and increases the degree of uncertainty of the relation between differential pressure and the flow rate. Relative to the standard orifice-plate, the balanced flow plate introduces far less turbulence and uniform flow profiles and is therefore capable of offering 10 times greater accuracy and repeatability with much less chaotic eddy turbulent energy. A



secondary benefit of the reduction of turbulence is the reduction of vibration and up to 15 times *less* acoustic noise generation while conditioning the flow with a uniform velocity profile, providing another valuable benefit. All benefits are confirmed by the many thousands of successful applications worldwide.

A+ Multi-Holed Balanced Flow/Venturi Meter (BFM)/(BVM) and Balanced-Restriction Orifice (BRO) Benefits

<ul style="list-style-type: none"> Flow Error < 0.25% Repeatability Error < 0.05% < 1 D Upstream/Downstream Fitting Requirements No/Low Pressure Drop 15x Reduction in Noise Power Plate Noise <80 dB with Patented Hole Designs Over 12x Life of Single-Holed Thin Plate Designed for Single or 2-Phase Flows Thick Plate to Handle dP Stresses and Longer Life Lower Pipe Noise, Thrusts and Vibrations Designed for Hydraulic Transient/Water-Hammer 	<ul style="list-style-type: none"> Uniform Pipe Velocity and Pressure Profiles No Harmful Eddies and Vibrations Pipe & Plate Erosion Virtually Eliminated Higher Tolerance to Corrosion and Cavitation Rugged and Durable Compared To Thin Plates High & Uniform Hole Mach Numbers Self Cleaning, Draining and Venting Plate Design Fouling Tolerant - Keeps Pipe/Taps Clean Provides Pipe "Flow-Conditioning" Pipe & Plate Flow Acoustic "Noise-Silencer" Energy Savings Payback Typically < 1 Week
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