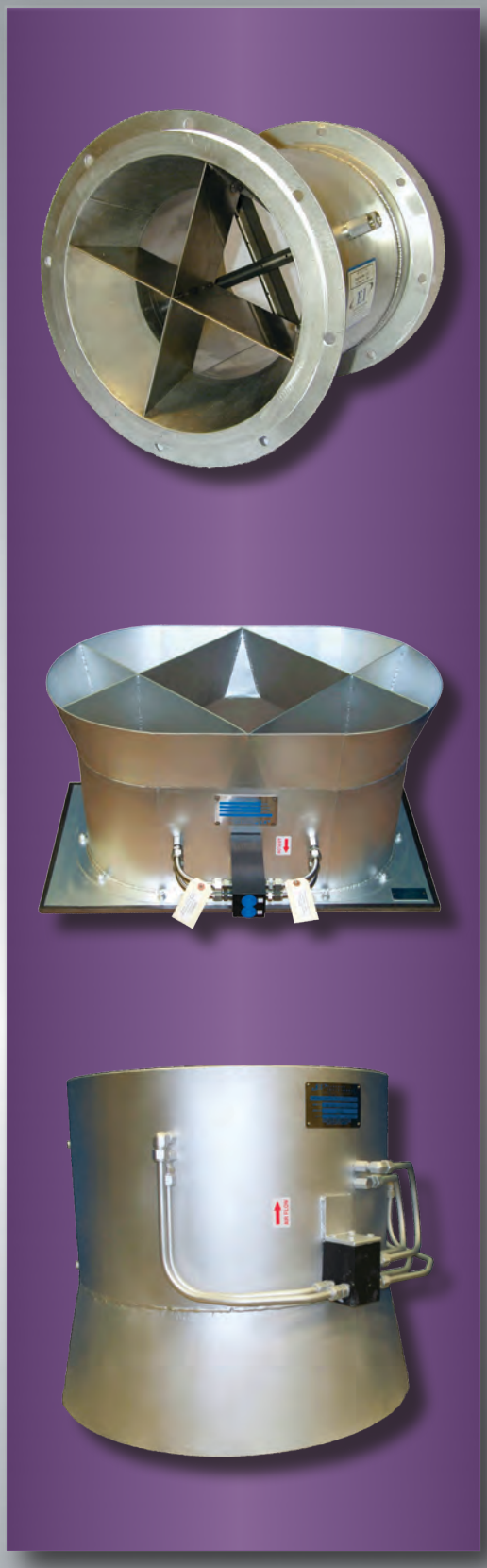
EASTERN INSTRUMENTS



HIGH BETA® FLOW CONDITIONER

Precision Air Flow Measurement

Eastern Instruments
Precision Flow Measurement

About Eastern Instruments

Eastern Instruments, a Certified Women's Business Enterprise, is an engineered solutions company located adjacent to the North Carolina International State Port in Wilmington, North Carolina. Since 1984, we have been engaged in the design and manufacture of devices that accurately measure and profile the flow of air and gases in the industrial and power sectors. These devices have been integrated into a variety of systems for regulating operations and improving efficiency across nearly every industry. Every device within Eastern Instruments' air flow measurement product line provides a high degree of accuracy, easy installation and an extremely simple and intuitive operation and maintenance schedule that is perfect for nearly every application. The following catalog is an overview of our High Beta Flow Conditioning devices, however we also offer a complete line of insertion pitots, duct mounted pitots and other flow measurement equipment for the industrial as well as power industries. We also manufacture a complete line of solids flow meters, feeders and fillers, so if you are in need of equipment other than those found within this catalog, Eastern Instruments can help. Contact us today.

Mildred R. Brandt
President and CEO

FOR MORE INFORMATION
CALL (910) 392-2490

EASTERN INSTRUMENTS

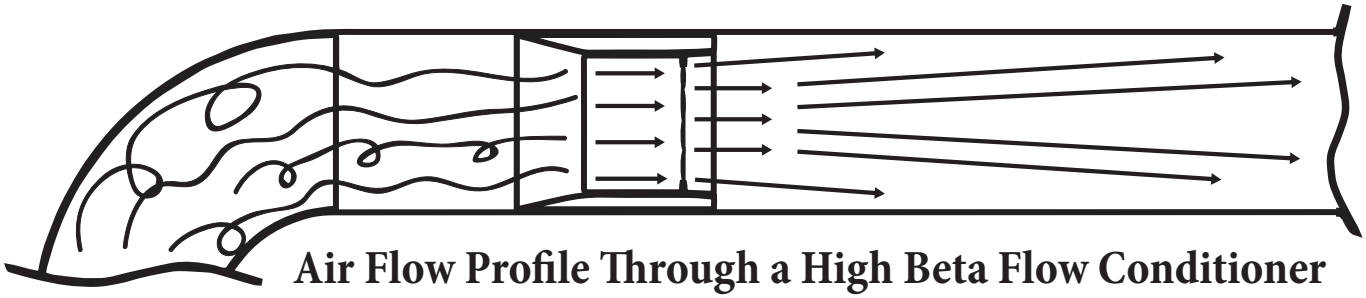
416 Landmark Drive
Wilmington, NC 28412
Phone: 910.392.2490
Fax: 910.392.2123
www.easterninstruments.com

Accurate Air Flow Measurement and the High Beta® Flow Conditioner

Air flow measurement is most accurate when the flow within a duct has no turbulent, reverse or cyclonic flow patterns and is evenly profiled across the full duct. For most ducts, this type of profiling requires up to 10 duct diameters' worth of straight run prior to the measurement point (and may require even longer straight runs in circular ducts in order to remove cyclonic flow. In smaller ducts, these types of straight runs may be readily available, but for larger ducts, finding the adequate straight runs for an accurate flow measurement can be nearly impossible.

The High Beta® Flow Conditioner eliminates the need for excessive straight runs by profiling the air and measuring it within the element itself. The High Beta can be installed directly after bends or elbows and still achieves exceedingly accurate flow measurement. The secret to the success of the High Beta lies in the positioning and combination of a converging duct section, straightening vanes and flow measurement pitots within a single device. The converging duct section or nozzling section ensures that the flow is profiled across the entirety of the duct. While most nozzling devices, such as Venturis, will have a low beta ratio (.3 beta ratio or 91% duct area reduction) the High Beta has a beta ratio of only .707 which translates into a 50% duct area reduction. The High Beta, then, is able to straighten flow without producing a sizable pressure drop. The High Beta typically yields a pressure drop of less than 33% of the DP and can be much less considering that the High Beta eliminates many of the energy depleting characteristics of the flow such as turbulence, cyclonic flow and reverse flow. Flow straightening vanes are also utilized and placed directly within the converging section. This placement reduces the required footprint even more. The straightening vanes eliminate cyclonic flow and keep the flow moving in a parallel direction to the duct itself.

The final aspect of the High Beta's accuracy is the pitots themselves. Each High Beta contains an integral array of VAP pitot tubes. The VAP[3]® Pitot technology from Eastern Instruments ensures that each pitot installation has multiple sensing ports which average the velocity across the entire traverse of the duct, thus providing a more representative sample of duct velocity. Moreover, the VAP Pitot is plug resistant in that they are mounted so that the high port is in-line with the airflow, not facing it, so that the pitot has no impact ports. Because the pitot has no impact ports when mounted in this orientation, it is not subject to plugging and so costly purge systems are rarely required.



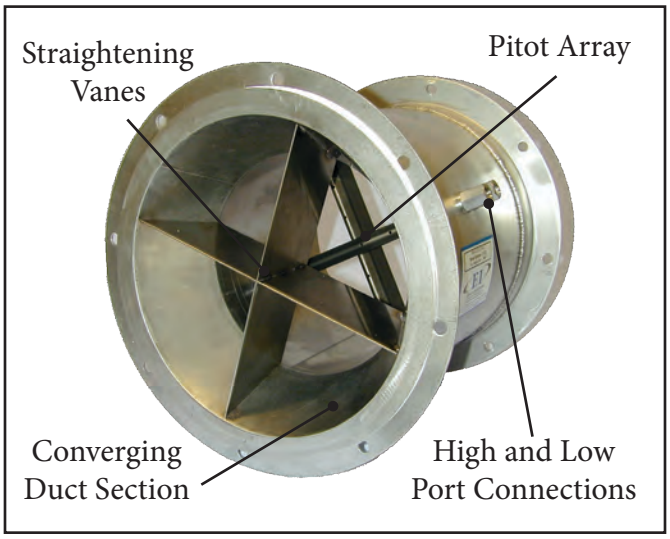
Air Flow Profile Through a High Beta Flow Conditioner

- **Plug Resistant Pitot Design**
- **Converging Section for Flow Profiling**
- **Integral Pitot Array**
- **Flow Straighteners to Eliminate Cyclonic Flow**

Flow Conditioners

What is a High Beta?

The High Beta® Flow Conditioner incorporates both a nozzled duct section for flow profiling, as well as an integral flow straightener in order to eliminate cyclonic flow at the point of measurement. The air, once straightened, passes through the element to the integral pitot array which accurately measures the flow of air in any circular duct in a fraction of the space that alternative technologies require. With the High Beta® Flow Conditioner, you can accurately measure flow with virtually no upstream or downstream straight duct runs.



Process Applications

- Coating/Drying
- Process Exhaust
- Dust Collection
- Pneumatic Systems
- Cooling
- Ventilation
- Fluid Bed Dryers
- Stack Flow

Industries Served

- Food Industry
- Petrochemical Industry
- Industrial Chemicals
- Pet Product Industry
- Agricultural Industry
- Recycled Materials

Power Applications

- Burner Flow
- Primary Air
- Secondary Air
- Stack Flow
- Tempering Air
- Overfire Air
- HVAC

Industries Served

- Coal-Fired Power
- Waste-To-Energy
- Oil-Fired
- Nuclear
- Cyclone Burner

Exceeding Expectations in Every Industry!

Why choose Eastern Instruments Devices?

Accuracy

Building upon the high level of accuracy and repeatability achieved by the VAP[3®] Pitot, the High Beta® Flow Conditioner achieves ±2.0% accuracy with a repeatability to within ±0.1%. For accuracy to within ±0.5% testing within an AMCA rated test chamber is available.

Integral Straightening Vanes

The High Beta® Flow Conditioner contains integral flow straightening vanes which eliminate cyclonic flow.

Converging Duct Section

A VAP[3®] Pitot array is installed directly after a converging duct section which profiles the air while the straightening vanes eliminate cyclonic flows. The combination of the straightening vanes and the converging duct section greatly reduce the required straight duct runs needed to install the High Beta®.

Install Almost Anywhere

The High Beta® is designed for installations with relatively no straight duct runs either upstream or downstream and can typically be installed with under a single duct diameter of straight duct run.

Material of Construction

The High Beta® is constructed out of Aluminum or Stainless steel with either a 6063 Anodized Aluminum VAP[3®] Pitot array or a Stainless Steel pitot array.

No Maintenance

The High Beta® contains no moving parts and there are no active or electronic components that are installed within the flow stream, thus virtually eliminating maintenance costs and ensuring the reliability of the system. With no moving parts, the requirement for spare parts is dramatically reduced as well.

Low Unrecovered Pressure Loss

The High Beta straightens flow without a sizable pressure drop. Typically yielding a pressure drop of less than 33% of DP, the High Beta eliminates many of the energy depleting characteristics of flow like turbulence, cyclonic flow and reverse flow.

Special Engineered Solutions

Specially engineered High Beta® Flow Conditioners can be designed and installed in nearly any duct including the square, rectangular or irregularly shaped duct work found in power plants.

High Beta

The High Beta® Flow Conditioner is a device that conditions air flow for extremely accurate flow measurement of air or gas. For round duct work, the High Beta can either be welded to the interior of the duct via a mounting plate, or it can be pre-mounted within a flanged spool section for simple installation. When pre-mounted within a flanged spool section, the flow element is called the High Beta HBP. The HBP features a Stainless Steel, flanged spool section with measurement pitots manufactured from a variety of materials including Stainless Steel, Anodized Aluminum or even PVC. The HBP is available in standard duct sizes ranging from 6" to 36" in diamater.

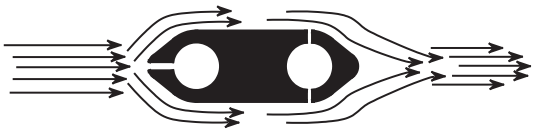
HIGH BETA PROCESS

HBP - Round Ducts

- **Spool Section:** SS
- **Pitot Array:** PVC, SS, Anodized Aluminum
- Converging Duct Section
- Flow Straighteners
- Low Unrecovered Pressure Drop

VAP³®/SA CLEAN AIR

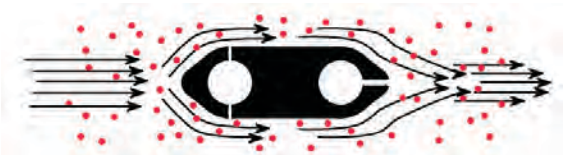
When mounted in SA (Superior Accuracy) mode, all of the models mentioned above will accurately measure the flow of relatively clean air through nearly any duct. While positioning the High Port so that it faces into the air stream (shown below) makes the measurement more accurate, it also limits the use of SA mode to particulate-free air. Mounted in SA mode, VAP³® pitots provide an accurate differential pressure output that allows for precise air flow measurement and control of your process.



VAP³®/SA PITOT PROFILE: "CLEAN" AIR

VAP³®/PA PARTICULATE-LADEN AIR

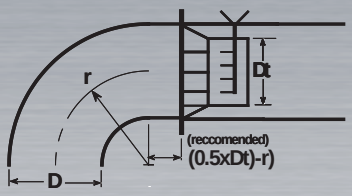
When mounted in PA (Particulate-laden Air) mode, all of the models mentioned above will accurately measure the flow of "dirty" or particulate-laden air through nearly any duct. In PA mode, the High Port is positioned so that it faces away from the oncoming air stream, making the pitot resistant to plugging. Mounted in PA mode, VAP³® pitots provide an accurate differential pressure output which allows for precise air flow measurement and control of your process.



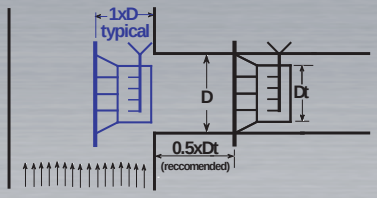
VAP³®/PA PITOT PROFILE: "DIRTY" AIR

HBP Installation: Round Ducts

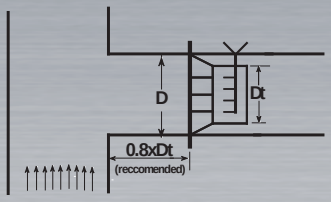
Recommended Upstream Duct Run Requirements



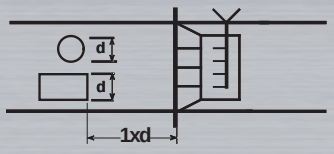
Upstream Radius 45° or 90°



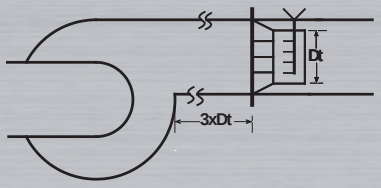
Upstream Plenum



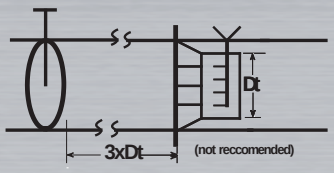
Upstream Tee



Upstream Obstruction

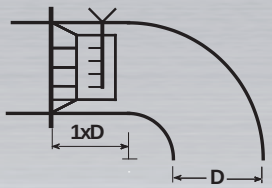


Upstream Fan

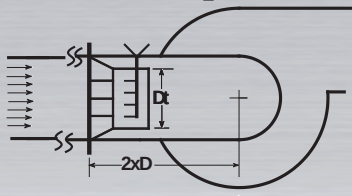


Upstream Damper

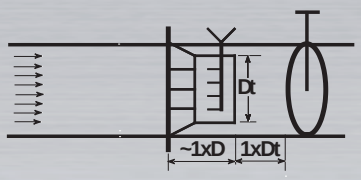
Recommended Downstream Duct Run Requirements



Downstream Radius 45° or 90°



Downstream Fan



Downstream Damper

High Beta Process

The HBP is designed for round duct installations and is for standard duct sizes ranging from 6" up to 36" in diameter. The HBP is a flanged duct section which contains both straightening vanes for profiling turbulent air, as well as a converging duct section which straightens the air, readying it for accurate flow measurement by the integral pitot array. With accuracy much better than pitots alone, The HBP is easy to install and simple to operate. When equipped with any DP or Multivariable Transmitter, the HBP will output an extremely accurate Differential Pressure based flow signal.

ROUND DUCTS

FEATURES AND BENEFITS

- Integral Straightening Vanes that Reduce Cyclonic Flow
- Converging Duct Section that straightens flow for measurement
- Can be mounted directly after bends, duct distubances or even fans
- Standard Angle Ring Flanges for easy installation (Custom Flanges also available)
- Perfect for Clean Air/Particulate-laden Air Streams

DESIGN SPECIFICATIONS

- Stainless Steel Spool Section
- Small Footprint: most units are under 2 duct diameters in length
- Integral Pitot Array with Sensing ports for full duct traversal
- Pitots are tubed together and customer connections are made via a single manifold for simple, easy installation
- Customizable Flange Patterns, Materials of Construction and Pitot Material

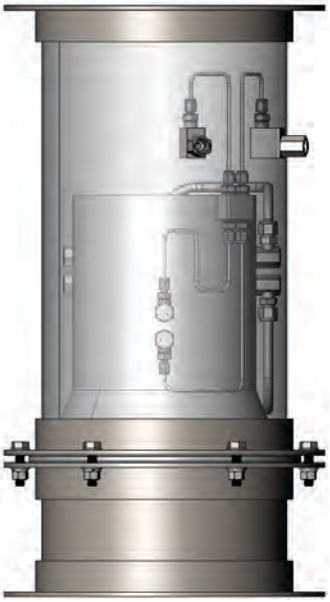
System Requirements: "Clean" Air

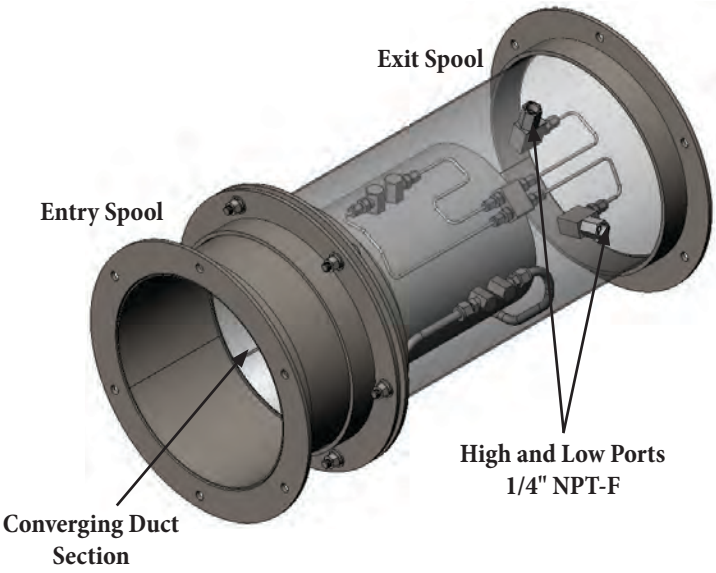
- **Duct Configuration:** Round
- **Duct Size**: 6” to 36” Diameter
- **MOC**: Stainless Steel
- **Duct Pressure**: -7 to 7 PSI (-48 to 48 kPa)
- **Temperature**: -40 to 1500 F (-40 to 815 C)
- **Medium**: Clean Air or Gas
- **Velocity Clean Air**: (250 - 12,500 ft/min)

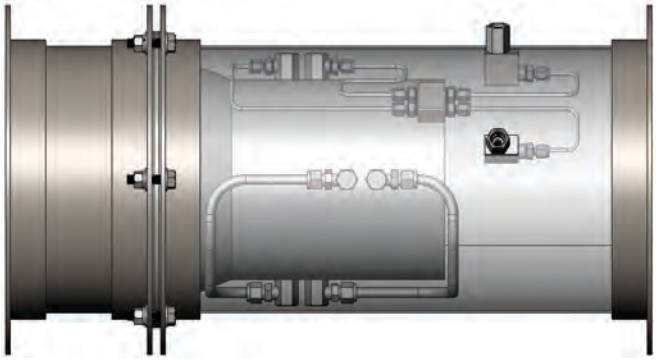
System Requirements: "Dirty" Air

- **Duct Configuration:** Round
- **Duct Size**: 6” to 36” Diameter
- **MOC**: Stainless Steel
- **Duct Pressure**: -7 to 7 PSI (-48 to 48 kPa)
- **Temperature**: -40 to 1500 F (-40 to 815 C)
- **Medium**: Particulate-Laden Air or Gas
- **Velocity Air**: (1,500 - 12,500 ft/min)

HBP STAINLESS STEEL - SPECS







HBP SPECIFICATIONS							
HBP Size	Throat Diameter	No. of Pitots	HBP Length	**HBP Size**	Throat Diameter	No. of Pitots	HBP Length
6"	4.49"	1	24.25"	**22"**	15.79"	2	34.25"
8"	5.90"	1	24.25"	**24"**	17.20"	2	36.25"
10"	7.31"	2	24.25"	**26"**	18.62"	2	38.25"
12"	8.72"	2	24.25"	**28"**	20.03"	2	40.25"
14"	10.13"	2	24.25"	**30"**	21.45"	2	42.25"
16"	11.55"	2	24.25"	**32"**	22.86"	2	44.25"
18"	12.96"	2	24.25"	**34"**	24.28"	2	46.25"
20"	14.37"	2	31.25"	**36"**	25.69"	2	48.25"

High Beta Engineered

Much like the High Beta® Process, the HBE or High Beta Engineered is a flow measurement device with an integrated flow conditioner for the accurate measurement of turbulent air flow within duct work with little or no straight duct runs. It consists of a VAP3® Pitot array, flow straightening vanes that eliminate cyclonic flow and a converging duct section which profiles the air for maximum accuracy at the point of measurement.

Because the HBE is engineered for each application, in can be mounted within a duct section like the HBP, or it can be mounted to a mount plate that can be welded directly to the interior of existing duct work. The High Beta Engineered can fit in ducts as small as 6" or large enough that people can walk through. The pictures below are just a few examples of installations for the High Beta Engineered. Because the HBE is engineered to your specific needs, it is perfect for unique duct arrangements or irregular duct work. HBE can be customized for material of construction, coatings and even the size or shape of the High Beta. The HBE can easily be mounted in both round and square/rectangular ducts and several mounting options are available for each type.

Flow Conditioner Installations

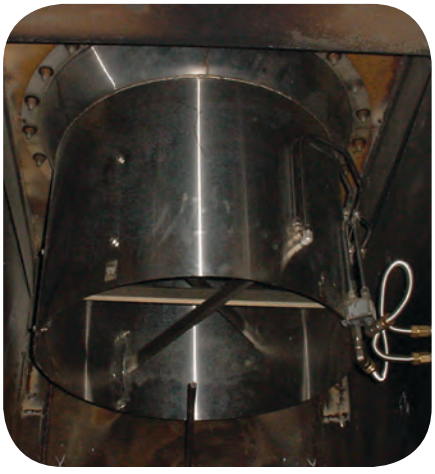
HBE: Round Duct

- For Custom Applications
- Customizable Material of Construction
- For ducts over 36" in diameter
- For Clean or Particulate-laden Air or Gas
- Can be used with either Aluminum or SS Pitots

HBE: Custom Rectangular Duct

- For any size rectangular duct work
- Mounting Plate welds inside duct
- For Clean or Particulate-laden Air or Gas
- Can be used with either Aluminum or SS Pitots

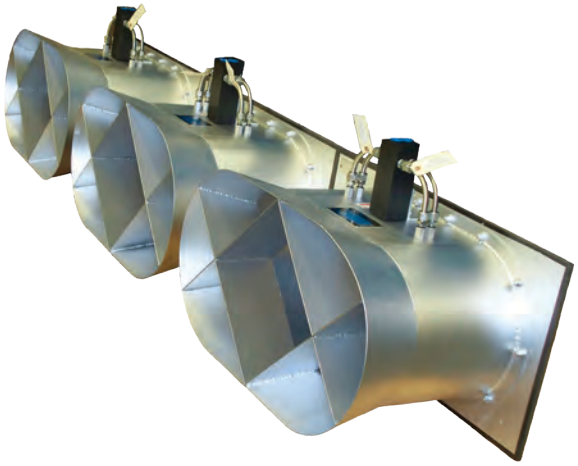
High Beta Installations

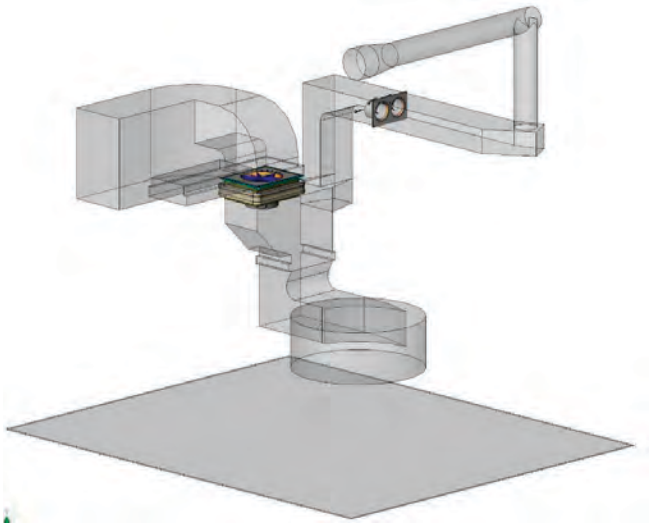


Applications

HBE: Power Industry

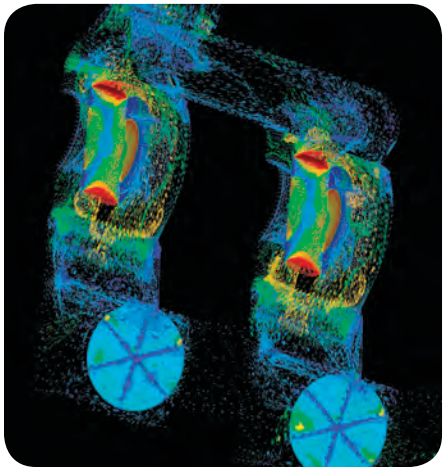
In response to the need for accurate flow measurement in the power industry, Eastern Instruments engineered a full line of power air flow equipment to compliment its industrial air flow measurement equipment. This product line includes specially designed High Beta® Flow Conditioners that are perfect for the irregularly shaped duct work often found in power plants. Typical installations include installation in:

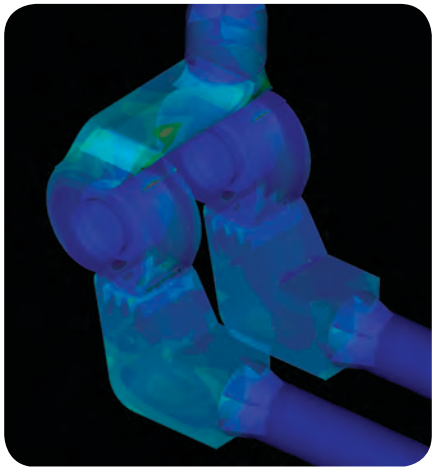


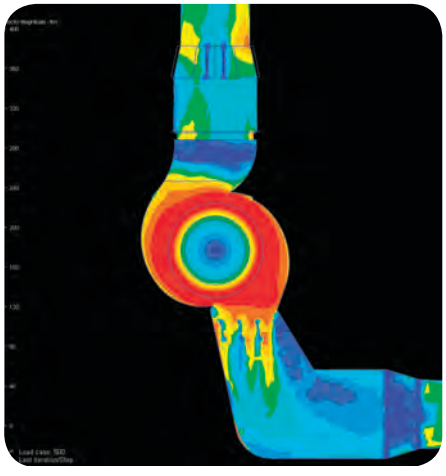


Originally designed for the power industry and specifically for installation at the inlet of cyclone burners, the Oval Beta® is a modification of the standard High Beta® Flow Conditioner that both profiles and measures the flow of air or gas within a duct. The Oval Beta® is perfect for irregular duct work and especially for rectangular ducts where the width of the duct is much larger than the height. The Oval Beta® can be used as either a single stand alone unit or in a series for wider ducts.

Engineered Solutions



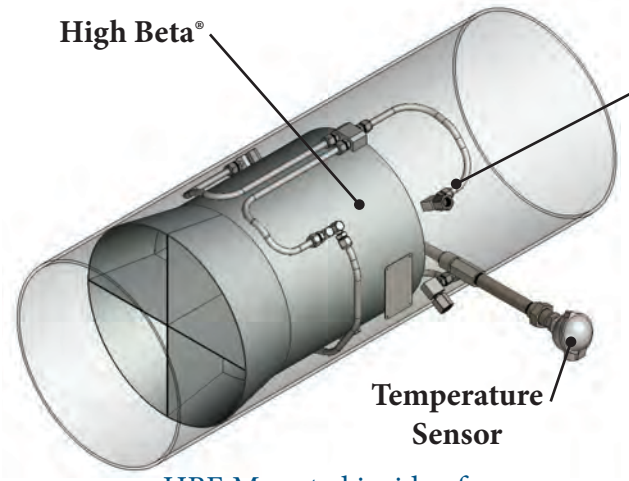




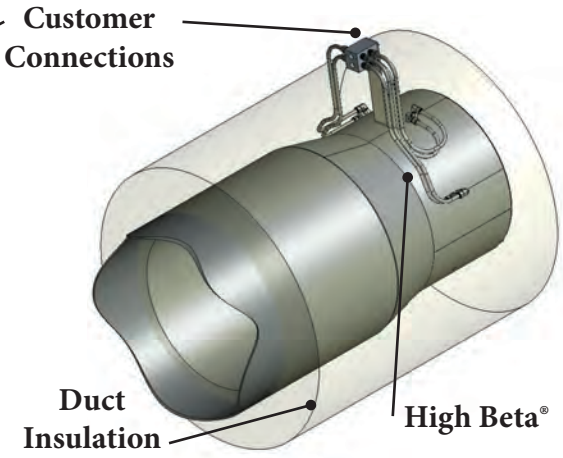
HBE - Round Ducts

While the HBP typically consists of a High Beta Flow Conditioner within a flanged spool section provided by Eastern Instruments, the HBE is often designed without the spool section so that the High Beta can be inserted directly into existing ductwork or welded inline to couple into existing duct layouts. Not only is the installation of the HBE customizable, but so is the material of construction. Our engineering team has designed HBEs from a variety of materials including Aluminum, Stainless Steel, Corten and many more. Many corrosive resistant coatings are also available.

High Beta® Installation: Round Ducts



HBE Mounted inside of Existing Ductwork. Temperature Sensor installed at discharge of the HBE.



HBE mounted inline with existing ductwork. The customer connections have been raised in order to clear insulation.

System Requirements: "Clean" Air

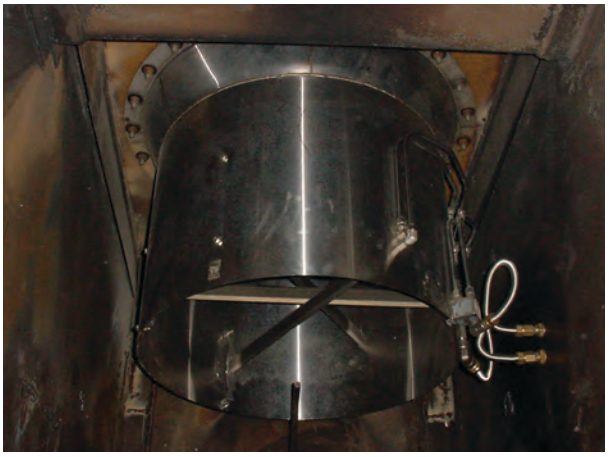
- **Duct Configuration:** Round Ducts
- **Duct Size**: Any Diameter Duct
- **MOC**: Customizable
- **Duct Pressure**: -7 to 7 PSI (-48 to 48 kPa)
- **Temperature**: -40 to 1500 F (-40 to 815 C)
- **Medium**: Clean Air or Gas
- **Velocity Clean Air**: (250 - 12,500 ft/min)

System Requirements: "Dirty" Air

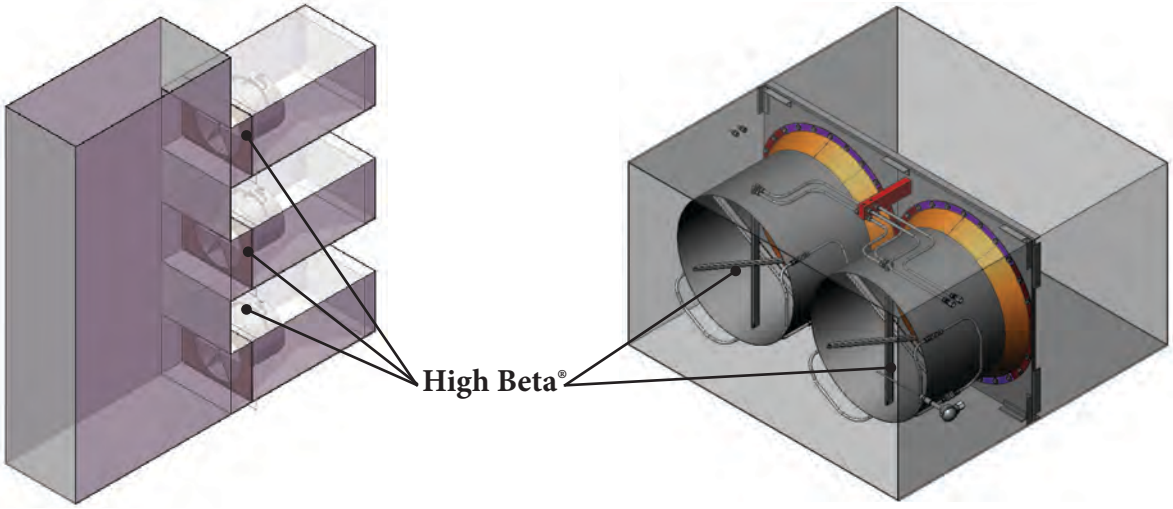
- **Duct Configuration:** Round Ducts
- **Duct Size**: Any Diameter Duct
- **MOC**: Customizable
- **Duct Pressure**: -7 to 7 PSI (-48 to 48 kPa)
- **Temperature**: -40 to 1500 F (-40 to 815 C)
- **Medium**: Particulate-Laden Air or Gas
- **Velocity Air**: (1,500 - 12,500 ft/min)

HBE - Rectangular Ducts

While the HBP typically consists of a High Beta Flow Conditioner within a flanged spool section provided by Eastern Instruments, the HBE is often designed without the spool section so that the High Beta can be inserted directly into existing ductwork and welded inline to couple into existing duct layouts. For installation within square or rectangular ducts, custom mounting plates are provided so that the units can be welded directly to the duct walls. Many materials of construction as well as a variety of corrosive resistant coatings are available upon request.



HBE Installation: Rectangular Ducts



HBEs with Mounting Plates mounted into Square Ducts

Dual HBEs with Mounting Plates mounted into a single duct

System Requirements: "Clean" Air

- **Duct Configuration:** Rectangular Ducts
- **Duct Size**: Any Size Duct
- **MOC**: Customizable
- **Duct Pressure**: -7 to 7 PSI (-48 to 48 kPa)
- **Temperature**: -40 to 1500 F (-40 to 815 C)
- **Medium**: Clean Air or Gas
- **Velocity Clean Air**: (250 - 12,500 ft/min)

System Requirements: "Dirty" Air

- **Duct Configuration:** Rectangular Ducts
- **Duct Size**: Any Size Duct
- **MOC**: Customizable
- **Duct Pressure**: -7 to 7 PSI (-48 to 48 kPa)
- **Temperature**: -40 to 1500 F (-40 to 815 C)
- **Medium**: Particulate-Laden Air or Gas
- **Velocity Air**: (1,500 - 12,500 ft/min)

Options

MATERIAL OF CONSTRUCTION

Pitots and Spool Section

Depending on the application, most of the DP Based flow measurement devices, spool sections or pitots found in this catalog can be constructed out of Aluminum, Carbon Steel, Stainless Steel (either 304 or 316), or PVC. If your ducts are constructed of another material or if your flows contain caustic materials that will react with these materials, other materials of construction may be available.

Coatings

A variety of coatings are also available for coating the spool sections of the various elements for increased corrosion resistance or increased heat tolerance.

Various Materials of Construction

AIRBORNE PARTICULATE

Line Mounted Purge

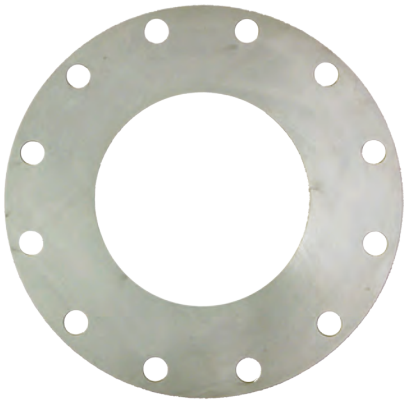
For heavily particulate-laden air streams a line mounted purge is available. The line mounted purge discharges a steady stream of clean, dry instrument air either through the impulse lines of the transmitter, or as positive pressure through the ports of the pitots in order to reduce the possibility of particulate or moisture disrupting the measurement devices' measurement accuracy.

Line Mounted Purge Block

EASY INSTALLATION

Custom Flanges

The flanges that come standard with our round, spooled flow measurement devices such as the HBP are angle ring flanges with a standard angle ring hole pattern. Custom Flanges for any of the devices are available upon request. Please let us know the desired hole pattern and we will be happy to customize the flanges for easy installation into your process. For easy installation of electronics such as transmitters or temperature sensors, a variety of customizable mounts are also available.



Custom Flanges Available Upon Request

QVT Multivariable Transmitter

The QVT Multivariable Transmitter from Eastern Instruments is a Smart Transmitter that can be used for the accurate measurement of up to four separate process variables including Differential Pressure, Temperature and Absolute Pressure. When coupled with any DP based flow measurement element, the QVT will calculate the fully compensated mass flow of air/gas travelling through any process which is at or near atmospheric pressure (5 - 25 psia). The QVT is uniquely designed for high accuracy at ultra low DP ranges and can accurately measure differential pressures from 0.001 up to 10 in WC. This broad operating range is unique among multivariable transmitters and allows a single QVT transmitter to replace multiple transmitters when covering this large range. Another feature of the QVT is its unique process seal that requires no diaphragm seal. Diaphragm seals often cause inaccuracies in transmitter's sensor readings due to condensate.

FEATURES AND BENEFITS

- **Modes of Operation:** Multivariable Transmitter (Measurement of two or more of DP, Temperature and Absolute Pressure), DP Transmitter (DP Measurement only)
- **DP Measurement:** Operating Range is 10000:1 (0.0009 in WC to 9.0 in WC)measuring Differential Pressure across any primary flow element such as VAP Averaging Pitot or HBP Flow Conditioner
- **AP Measurement:** Measurement of Absolute Pressure (integral sensor tied to low port of primary flow element)
- **Temperature Measurement:** Measurement of Temperature via 100 ohm 3-Wire Class A DIN RTD
- **Process Seal:** Our unique method of isolating sensors from the process requires no diaphragm seal and can be further enhanced with a Purge Seal (Low Volume Continuous Purge coupled directly to transmitter)
- **Simplicity:** Ae and the 4-20 mA full scale value are set from LCD panel's push buttons
- **Rangeability:** the span of the 4-20 mA signal corresponding to DP can be ranged from 0 to 0.05 in WC up to 0 to 8 in WC (160:1)
- **Response Time:** Updates flow calculation 10 times a second
- **Functionality:** All measured and calculated variables are available on LCD panel
- **Output:** 4-20 mA Compensated flow output using measured/input values for Differential Pressure, Absolute Pressure and Temperature (Can also be a single variable output only)
- **Flow Accuracy:** The accuracy of the flow measurement can be as high as ±0.50% of Reading over 100:1 DP (10:1 flow) range
- **Zero:** Differential pressure can be zeroed from the LCD/push button interface
- **Power Supply:** Loop Power 8.8 - 42.5 vDC range
- **Versatility:** LCD can be rotated independently of the head (LCD rotates 270° and head can rotate 180°) for ultimate adjustability

EASTERN
INSTRUMENTS

416 Landmark Drive
Wilmington, NC 28412
Phone: 910.392.2490
Fax: 910.392.2123

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6,640,158; 6,814,108; 6,679,125. Other patents pending.

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