SCC Inc.

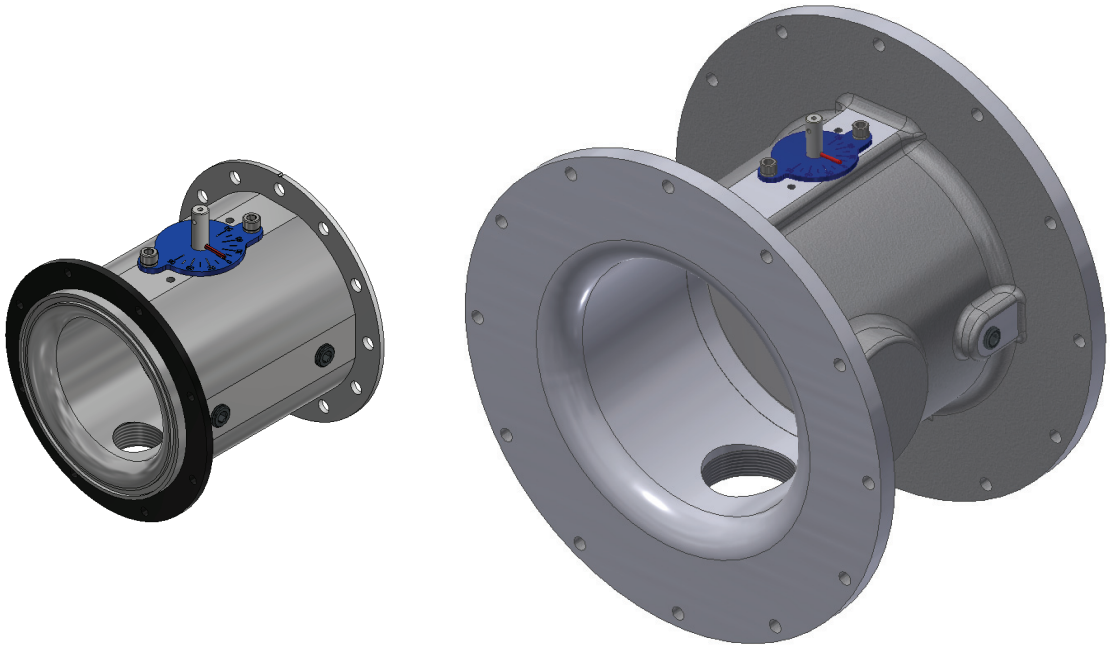
Technical Instructions

Document No. CVLV-9000

November 30, 2022

PBA… Series

PBA… Valve Manifolds



Description

PBA… series valve manifolds precisely control the flow of air and introduce fuel gas before a premix blower.

Features

- Supports high burner turndown such as 40 to 1
- Multiple sizes for optimal pressure drop and flow control
- Shaft supported by precision bearings for repeatable performance
- Swing through design with low leakage rate at full closed position
- Low pressure drop at the full open position
- Corrosion-resistant housing and internals
- Clear position indication on a 2” laser-etched anodized dial
- Valve actuator assemblies available (Document No. VA-9000)
- Gas inlet available upstream or downstream of the valve disc

Application

PBA… series valve manifolds precisely control the flow of air and provide a means to introduce fuel gas upstream of a premix – rated blower. The PBA… series valve disc is positioned with a high accuracy rotary actuator.

When the PBA… series valve manifolds are applied in combination with precise fuel gas flow control, high burner turndowns such as 40 to 1 may be accomplished. This high burner turndown can also be achieved “on ratio” which means that the burner is not run excessively rich or lean at any point in the operating range.

Installation

- Use suitable pipe thread sealant on all piping connections.
- Valve can be mounted in any orientation.
- Do not interfere with or modify the valve.
- All activities (mounting, installation, service work, etc.) must be performed by qualified staff.
- Fall or shock can adversely affect the function of these valves. Such valves must not be put into operation, even if they do not exhibit any damage.
- No special tools are required.
- Ensure the installation complies with relevant local and national codes.
- PBA… valve manifolds do not require any maintenance.
- From the full closed position, disc may turn in either direction to increase flow.

Product Part Numbers

The following chart provides PBA… valve manifold part number identification only. Not all possible part number combinations are available. See Table 1 on the following page for available part number combinations.

PBA 10 . 089 A - U 6 220 A X - 925

Premix Blower Adapter

Valve Manifold Series

10 = Standard

Valve Bore Size

(mm)	(inches)
089	= 3.50" bore
111	= 4.38" bore
137	= 5.38" bore
168	= 6.60" bore

Inlet Flange

A = Standard bolt circle

Gas Inlet Position

U = Upstream of the disc (valve bore 089 and 111 only)
D = Downstream of the disc (valve bore 089 and 111 only)
R = Reversible valve (required for valve bore 137 and 168)

Gas Inlet Orientation

6 = Standard orientation (opposite of valve shaft)

Blower Bolt Circle

140 = 140mm bolt circle (valve bore 089 only)
- Ametek 8.9, EBM RG175, EBM G1G170, EBM G3G200[1] blower or similar

220 = 220mm bolt circle (valve bore 089 and 111 only)
- Ametek 12.3, EBM G3G200, EBM G3G250, AF10, AF12[2] blower or similar

241 = 241mm bolt circle (valve bore 168 only)
- AF12 blower or similar

294 = 294mm bolt circle (valve bore 168 only)
- EBM G3G315 blower or similar

2XX = 220mm and 241mm bolt circles (valve bore 137 only)
- Ametek 12.3, EBM G3G250, AF10, AF12 blower or similar

Additional Descriptor

A = Standard

Bracket/Coupling Orientation

X = No bracket/coupling (for AGA92.5 manual kit)
9 = Standard orientation (actuator conduit ports will face valve label)

Accessories

Blank = No accessories
-925 = AGA92.5 kit installed on PBA… Valve Manifold

[1]The EBM G3G200 has the 8.66" (220mm) bolt circle on every model, one model has the 5.51" (140mm) bolt circle

[2]The American Fans AF-12 has the 9.50" (241mm) bolt circle on every model, one model has the 8.66" (220mm)

Product Part Numbers (continued)

Available PBA… valve manifold part numbers are listed in Table 1.

Table 1: Summary of Available PBA… Valve Manifolds

PBA Part Number	Maximum Burner Size[2]		Bore Size		Gas Inlet		Inlet Flange				Blower Flange Bolt Circle[4]	
					NPT	Entry Point[3]	Bolt Circle		Fastener	Sealing		
	MBH	kW	inch	mm	inch		inch	mm			inch	mm
PBA10.089A-U6140Ax	1637	479	3.50	89	1	Upstream	5.75	146	#10 or M5 (x8)	O-ring (-157)	5.51	140
PBA10.089A-D6140Ax						Downstream						
PBA10.089A-U6220Ax						Upstream					8.66	220
PBA10.089A-D6220Ax						Downstream						
PBA10.111A-U6220Ax	2583	756	4.38	111	1.25	Upstream	6.72	171	1/4" or M6 (x8)	O-ring (-161)	8.66	220
PBA10.111A-D6220Ax						Downstream						
PBA10.137A-R62XXAx[1]	3630	1063	5.38	137	1.50	Reversible	8.66	220	M8 (x8)	Gasket	8.66	220
							9.50	241	7/16" (x8)		9.50	241
PBA10.168A-R6241Ax	6126	1794	6.60	168	2	Reversible	9.50	241	7/16" (x8)	Gasket	9.50	241
PBA10.168A-R6294Ax							11.6	294	M8 (x8)		11.6	294

Specific Notes:
1. The PBA10.137 has two bolt circles on the inlet flange and two bolt circles on the blower flange.
2. Maximum burner size assumes the following: 3" WC pressure drop across the PBA, 14.35 air / fuel ratio, and natural gas that is 1000 BTU / SCF.
3. The gas inlet entry point can be upstream of the disc, downstream of the disc, or reversible.
4. See compatibility section for specific information concerning PBA to blower compatibility.

General Notes:
Additional dimensional information is available in the Dimensions section of this literature.
Additional flow data is available in the Flow Data section of this literature.
When firing natural gas, an air / fuel ratio of 14.35 to 1 results in approximately 6% O_2 (dry) in the boiler exhaust.
When firing natural gas, 6% O_2 (dry) in the boiler exhaust is approximately equal to 8.6% CO_2 (dry).
PBA assemblies are not supplied with gaskets, O-rings, or fasteners needed for connection to the inlet side of the PBA.
Thread locking hardware (locknuts, lock washers, Loctite, etc.) is recommended for inlet flange connection.
A lower air / fuel ratio (richer) will increase the maximum burner size, reduce the % O_2, and increase the % CO_2.

Compatibility

The PBA… series valve manifolds have a flange on either end. Valve manifolds with a bore size of 89mm and 111mm will have a different flange for the inlet and outlet. Valve manifolds with a bore size of 137mm and 168mm have identical flanges on the inlet and outlet.

The outlet of a PBA… series valve manifold mates directly to a blower. Sealing between the PBA… valve manifold and the blower is accomplished with either an o-ring or gasket depending on the blower model. Table 2 outlines common blower compatibility and the recommended sealing method.

Table 2: Blower Compatibility

LEGEND:
G = Gasket Sealing
O = O-ring Sealing

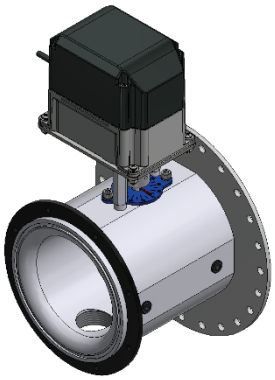
PBA Part Number	Blower Flange				Blowers								
	Bolt Circle		Fastener		Ametek 8.9	EBM RG175	Ametek 12.3	EBM G3G170	EBM G3G200 [1]	EBM G3G250	EBM G3G315	American Fan AF-10	American Fan AF-12 [2]
	in	mm	Thread Size	Qty.									
PBA10.089A-U6140Ax	5.51	140	M8 x 1.25mm	6	O	O		O	O				
PBA10.089A-D6140Ax													
PBA10.089A-U6220Ax	8.66	220	M8 x 1.25mm	6			O		O	O		G	G
PBA10.089A-D6220Ax													
PBA10.111A-U6220Ax	8.66	220	M8 x 1.25mm	6			O		O	O		G	G
PBA10.111A-D6220Ax	8.66	220											
PBA10.137A-R62XXAx	8.66	220	M8 x 1.25mm	6			O		O	O			
	9.50	241	7/16"	8								G	G
PBA10.168A-R6241Ax	9.50	241	7/16"	8									G
PBA10.168A-R6294Ax	11.58	294	M8 x 1.25mm	6							O		

Specific Notes:
[1]The EBM G3G200 has the 8.66” (220mm) bolt circle on every model, one model has the 5.51” (140mm) bolt circle
[2]The American Fans AF-12 has the 9.50” (241mm) bolt circle on every model, one model has the 8.66” (220mm)

General Notes:
PBA assemblies are not supplied with gaskets, O-rings, and fasteners needed to install the PBA assembly to the blower.
Thread locking hardware (locknuts, lock washers, loctite, etc) is recommended for blower flange connection.
The chart above only covers mechanical compatibility of the PBA to a blower.

Accessories

VA… Valve Actuator Assemblies



A PBA… valve manifold, SQM33 actuator, coupling, and bracket are built, tested, and shipped as a VA… assembly. Valve actuator assemblies ensure proper shaft alignment and engagement. For additional information see Document No. VA-9000.

AGA92.5

A manual adjustment kit can be added to any PBA… valve manifold. To order the AGA92.5 premounted on a PBA… valve manifold, add “-925” to the end of the PBA part number. For example, a PBA… valve manifold with a manual kit would be PBA10.111A-U6220AX-925. Please note, a bracket/coupling cannot be used when a manual kit is installed.

Materials

Below is a typical valve manifold cross-section that identifies the materials used in PBA… valve manifolds with a bore size of 89mm or 111mm.

Table 3: PBA… Valve Manifold Materials for Bore Sizes 89mm and 111mm

Item	Description	Material
A	Socket Head Screw	Stainless Steel
B	Lock Washer	Stainless Steel
C	Valve Body	Aluminum-6061
D	O-rings	Buna-N
E	Blower Flange	Aluminum-5052
F	1/4" Pipe Plug	Steel (Black Oxide)
G	Dial	Aluminum-5052 (Anodized)
H	Ball Bearing	Steel
I	Shims	Stainless Steel
J	Shaft	Steel (Electroless Nickel Plated)
K	Button Head Screws	Stainless Steel
L	Disc	Aluminum-5052
M	Bearing (Sleeve)	Acetal
N	Cover	Aluminum-5052
O	Inlet Flange	Steel (Powder Coated)
P	Button Head Screws	Steel (Zinc Plated)

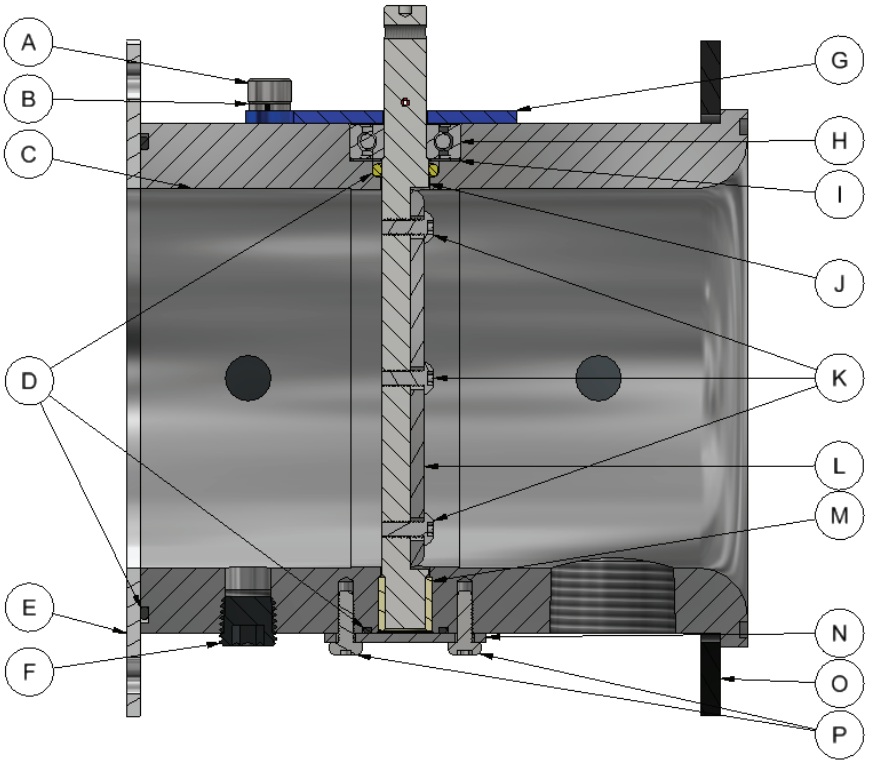


Figure 1: Cross-section of a PBA10.089A-Uxxxxxx

Materials (continued)

Below is a typical valve manifold cross-section that identifies the materials used in PBA… valve manifolds with a bore size of 137mm or 168mm.

Table 4: PBA… Valve Manifold Materials for Bore Sizes 137mm and 168mm

Item	Description	Material
A	Socket Head Screw	Stainless Steel
B	Lock Washer	Stainless Steel
C	Valve Body	Aluminum-356
D	O-rings	Buna-N
E	1/4" Pipe Plug	Steel (Black Oxide)
F	Dial	Aluminum-5052 (Anodized)
G	Ball Bearing	Steel
H	Shims	Stainless Steel
I	Shaft	Steel (Electroless Nickel Plated)
J	Button Head Screws	Stainless Steel
K	Disc	Aluminum-5052
L	Bearing (Sleeve)	Acetal
M	Cover	Aluminum-5052
N	Button Head Screws	Steel (Zinc Plated)

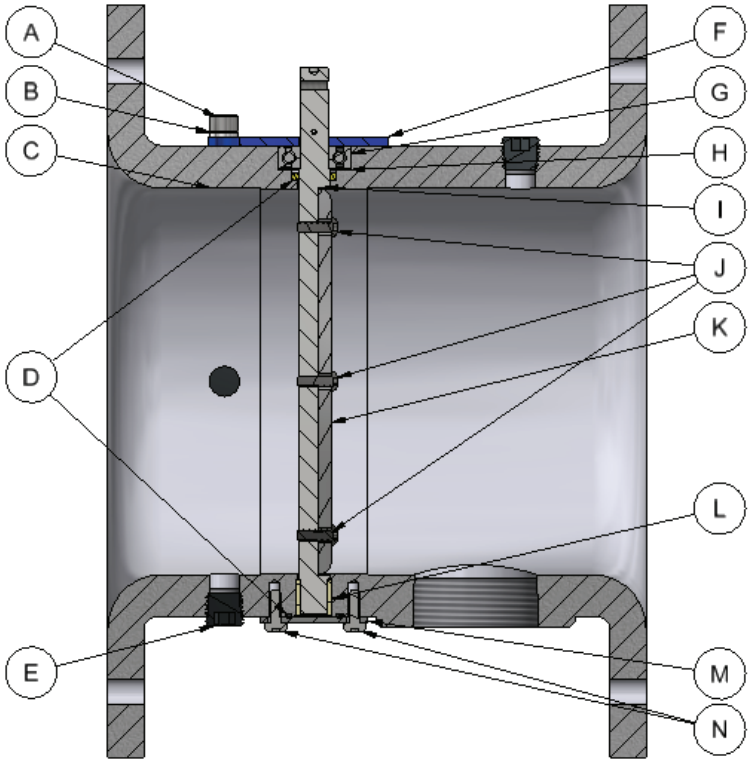


Figure 2: Cross-section of a PBA10.137A-Rxxxxxx

Flow Data

Air flow and C_v values are listed for common differential pressures in Table 5. C_v values can be utilized to calculate flow at any operating conditions.

Flow is calculated with atmospheric inlet pressure at a media temperature of 70°F.

Table 5: Approximate Flow Rates [SCFH] and Maximum Burner Size at Full Open Position (1" - 3" wc Differential Pressure)

Part Number	Bore Size		Gas Inlet		C_v	Capacity					
						1" WC		2" WC		3" WC	
	in	mm	NPT in	Entry Point [4]		SCFH [1]	MBH [2]	SCFH [1]	MBH [2]	SCFH [1]	MBH [2]
PBA10.089A-U6140Ax	3.50	89	1	Upstream	327	14943	974	20865	1359	25123	1637
PBA10.089A-D6140Ax				Downstream							
PBA10.089A-U6220Ax				Upstream							
PBA10.089A-D6220Ax				Downstream							
PBA10.111A-U6220Ax	4.38	111	1.25	Upstream	510	23262	1515	32152	2095	39647	2583
PBA10.111A-D6220Ax				Downstream							
PBA10.137A-R62XXAx	5.38	137	1.50	Reversible	720	33376	2174	46625	3037	55728	3630
PBA10.168A-R6241Ax	6.60	168	2	Reversible	1215	54514	3551	77877	5073	94039	6126
PBA10.168A-R6294Ax											

Specific Notes:

1. Standard cubic feet per hour mixed (air/gas) flow. Gas flow through PBA body is taken into account assuming a SG of 0.66 for natural gas.
2. Burner output in thousands of BTU / HR calculated using a 14.35 to 1 air / fuel ratio and natural gas that is 1000 BTU/ SCF.
3. Flows are assuming mixed flow over disc. Flow will be 1-2% less if only air across disc.
4. The gas inlet entry point can be upstream of the disc, downstream of the disc, or reversible.

General Notes:

When firing natural gas, an air / fuel ratio of 14.35 to 1 results in approximately 6% O_2 (dry) in the boiler exhaust.
When firing natural gas, 6% O_2 (dry) in the boiler exhaust is approximately equal to 8.6% CO_2 (dry).
A lower air / fuel ratio (richer) will increase the burner output, reduce the % O_2, and increase the % CO_2.
Upstream and reversible PBA models may have fuel gas traveling past the valve disc. In this configuration, high fire air flow can be reduced by approximately 5%. If gas is introduced downstream of the disc, the fuel gas flow has minimal impact on the air flow (less than 2%).

Flow Data (continued)

Flow rate through the valve body at the full open position can be estimated using the equation below and the C_v values from Table 5.

$$Q = 1360 \times C_v \times \left(\sqrt{\frac{P_1 + P_2}{GT_f}}\right) \times \left(\sqrt{\frac{P_1 - P_2}{2}}\right)$$

…where…

C_v = Flow coefficient (see Table 5)
G = Specific gravity of mix (0.978 for a mix with 14.35 air/fuel ratio)
P_1 = Absolute inlet pressure in PSIA (PSIG + 14.7)
P_2 = Absolute outlet pressure in PSIA (PSIG + 14.7)
Q = Flow rate in SCFH (air + gas flow)
T_f = Media temperature in degrees Rankine (°F + 460)

PBA… Sizing Example:
Burner with 2000 SCFH gas flow
Air at 70 degrees Fahrenheit
PBA will have 3" wc (0.1 PSI) pressure drop with the inlet side at atmospheric pressure
14.35 air/fuel ratio

G = 0.978
P_1 = 14.7 PSIA
P_2 = (14.7 - 0.1) = 14.6 PSIA
Q = 14.35 (A/F Ratio) × 2000 (Gas Flow)) + Gas Flow = 28,700 SCFH of air flow + 2,000 SCFH
T_f = (70°F + 460) = 530°R

Re-arrange equation and solve for C_v

$$C_v = \frac{28700 + 2000}{1360 \times \left(\sqrt{\frac{14.7 + 14.6}{0.978 \times 530}}\right) \times \left(\sqrt{\frac{14.7 - 14.6}{2}}\right)}$$

$$C_v = 424.6$$

Using Table 5 and a required C_v of 424.6, choose the smallest valve bore size that has a higher C_v value than the one calculated. In this example the correctly sized valve would be the PBA10.111x.xxxxxxx.

Note: Upstream and Reversible PBA… models may have fuel gas traveling past the valve disc. This calculation assumes the gas is traveling past the disc. The calculation above assumes natural gas to have a SG of 0.66. If using a downstream PBA, do not add the natural gas flow into the Cv equation and use a specific gravity of 1.00.

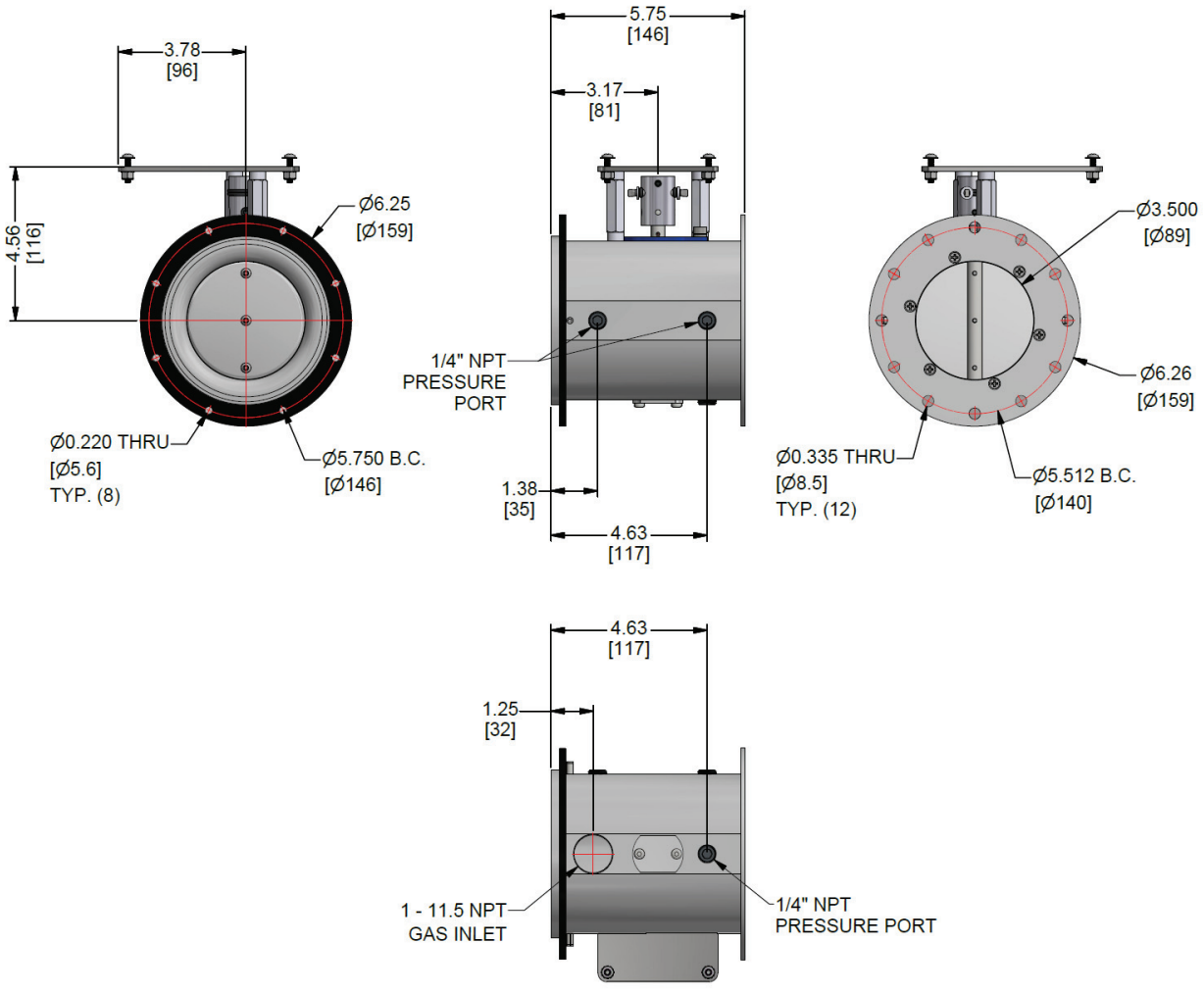
Dimensions

PBA10.089A-U6140A9

Valve manifold with a 3.50” (89mm) bore, 1” NPT gas inlet upstream of the disc, and a blower flange mating to a 5.51” (140mm) bolt circle.

Compatible blowers include: Ametek 8.9, EBM RG175, EBM G3G170

Dimensions in inches [mm]



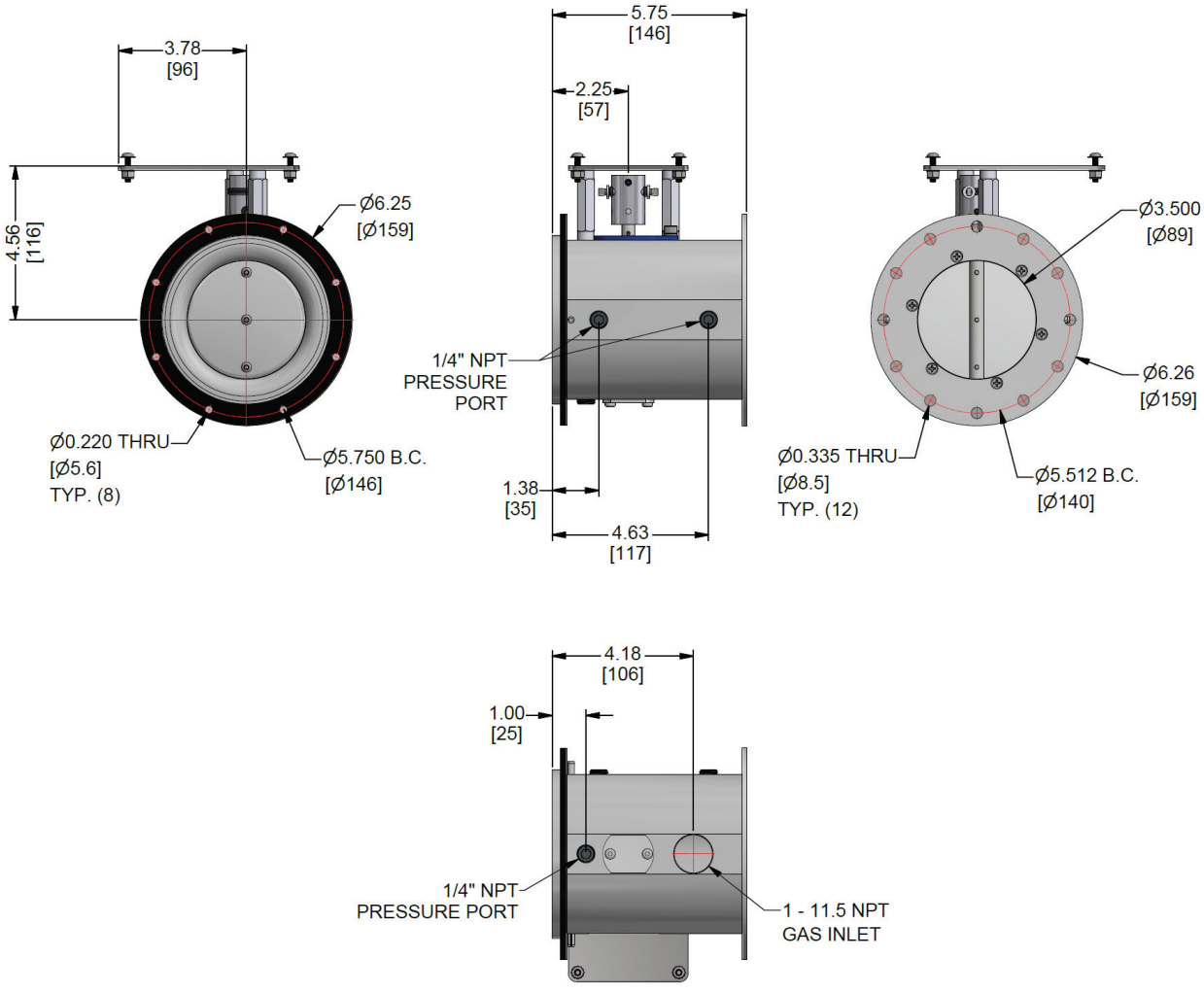
Dimensions (continued)

PBA10.089A-D6140A9

Valve manifold with a 3.50” (89mm) bore, 1” NPT gas inlet downstream of the disc, and a blower flange mating to a 5.51” (140mm) bolt circle.

Compatible blowers include: Ametek 8.9, EBM RG175, EBM G3G170

Dimensions in inches [mm]



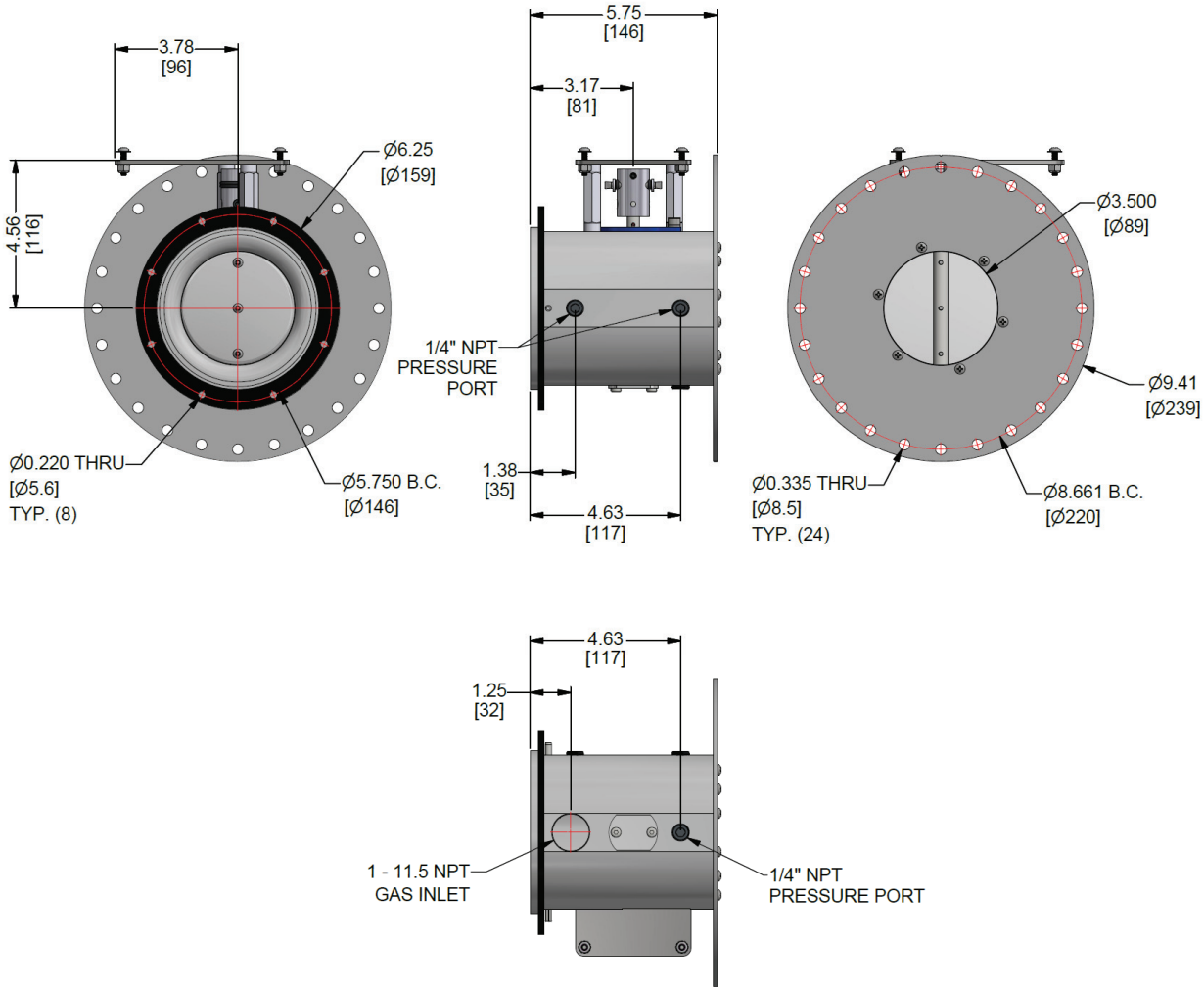
Dimensions (continued)

PBA10.089A-U6220A9

Valve manifold with a 3.50” (89mm) bore, 1” NPT gas inlet upstream of the disc, and a blower flange mating to an 8.66” (220mm) bolt circle.

Compatible blowers include: Ametek 12.3, EBM G3G200, EBM G3G250, and AF-10

Dimensions in inches [mm]



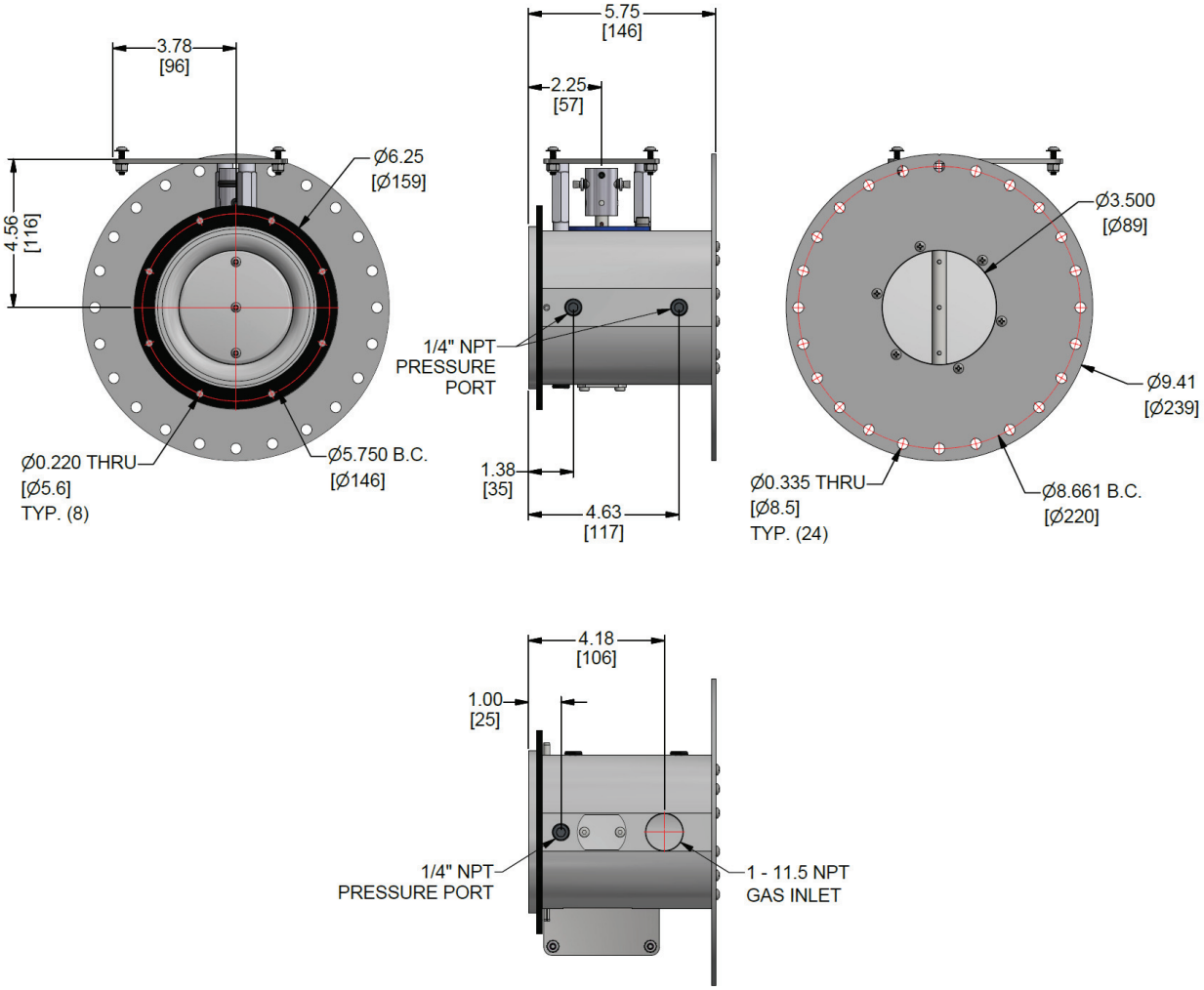
Dimensions (continued)

PBA10.089A-D6220A9

Valve manifold with a 3.50” (89mm) bore, 1” NPT gas inlet downstream of the disc, and a blower flange mating to an 8.66” (220mm) bolt circle.

Compatible blowers include: Ametek 12.3, EBM G3G200, EBM G3G250, and AF-10

Dimensions in inches [mm]



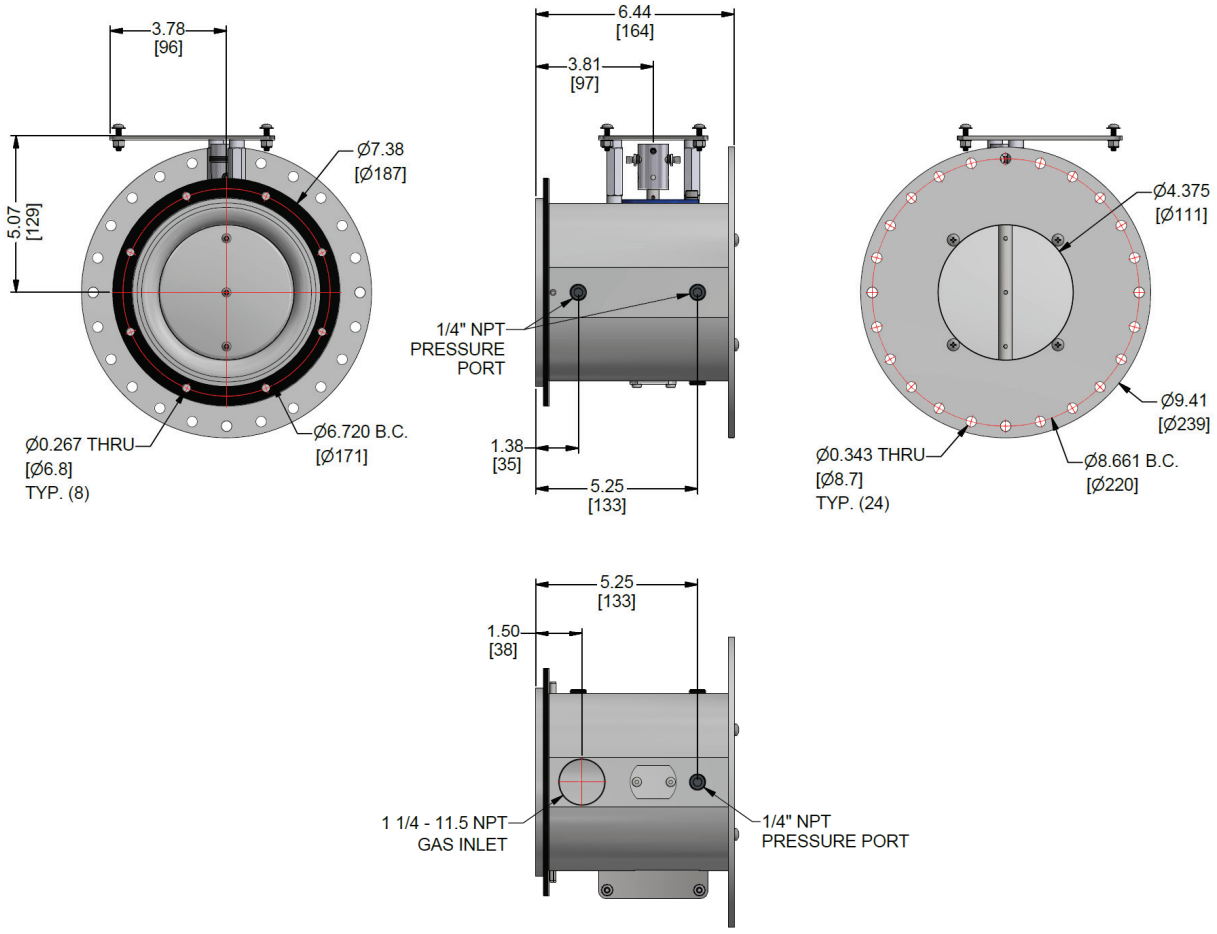
Dimensions (continued)

PBA10.111A-U6220A9

Valve manifold with a 4.38” (111mm) bore, 1-1/4” NPT gas inlet upstream of the disc, and a blower flange mating to an 8.66” (220mm) bolt circle.

Compatible blowers include: Ametek 12.3, EBM G3G200, EBM G3G250, and AF-10

Dimensions in inches [mm]



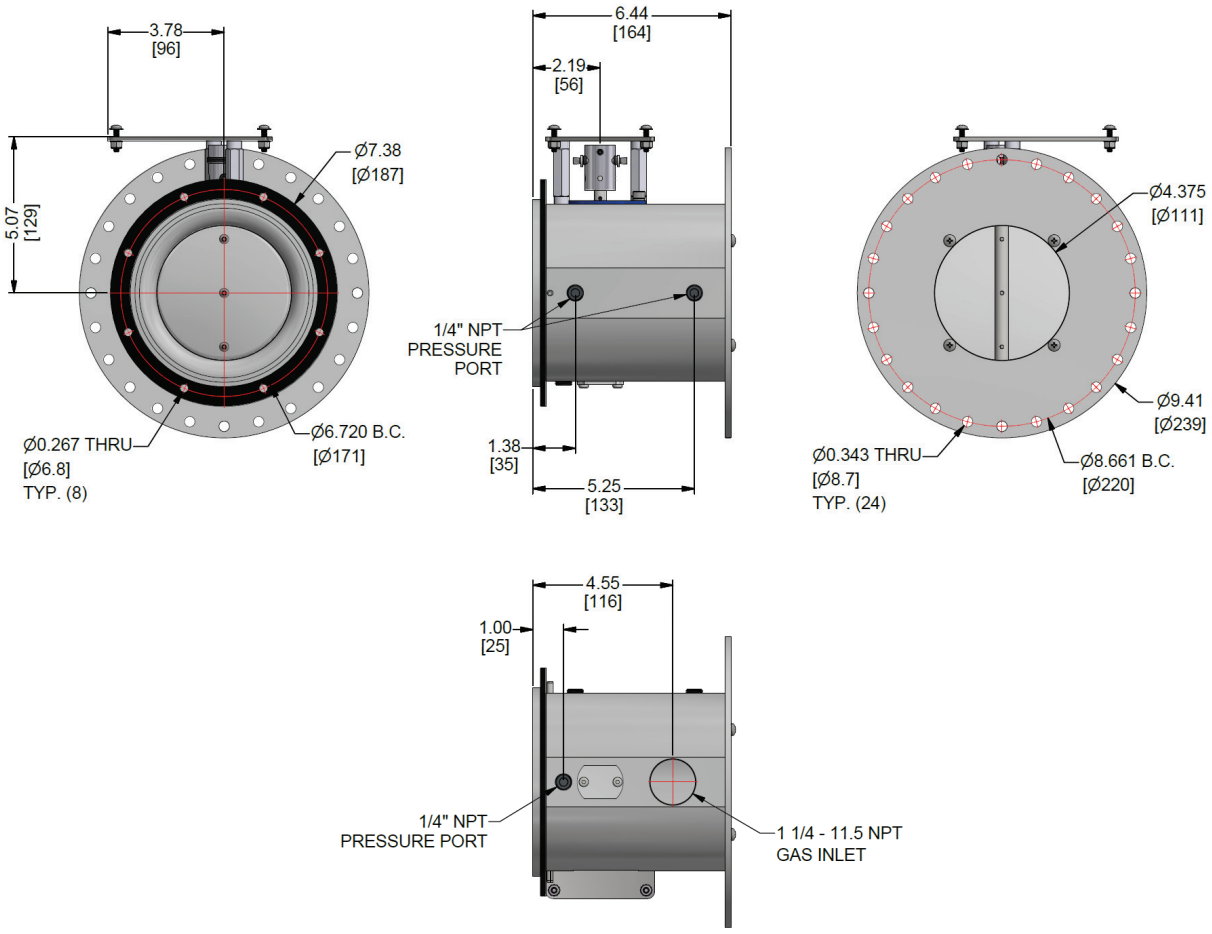
Dimensions (continued)

PBA10.111A-D6220A9

Valve manifold with a 4.38” (111mm) bore, 1-1/4” NPT gas inlet downstream of the disc, and a blower flange mating to an 8.66” (220mm) bolt circle.

Compatible blowers include: Ametek 12.3, EBM G3G200, EBM G3G250, and AF-10

Dimensions in inches [mm]



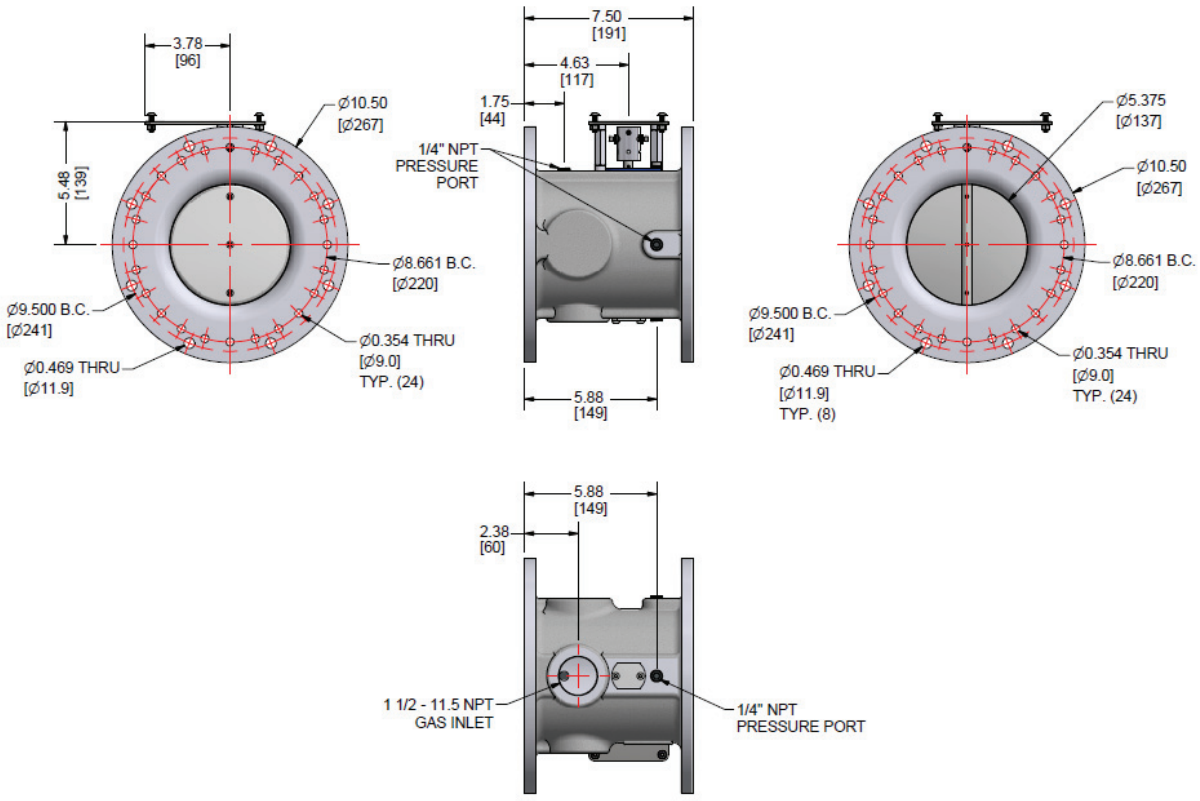
Dimensions (continued)

PBA10.137A-R62XXA9

Reversible valve manifold with a 5.38” (137mm) bore, 1-1/2” NPT gas inlet, and flanges with two bolt circles: 8.66” (220mm) and 9.50” (241mm).

Compatible blowers include: Ametek 12.3, EBM G3G200, EBM G3G250, AF-10, and AF-12

Dimensions in inches [mm]



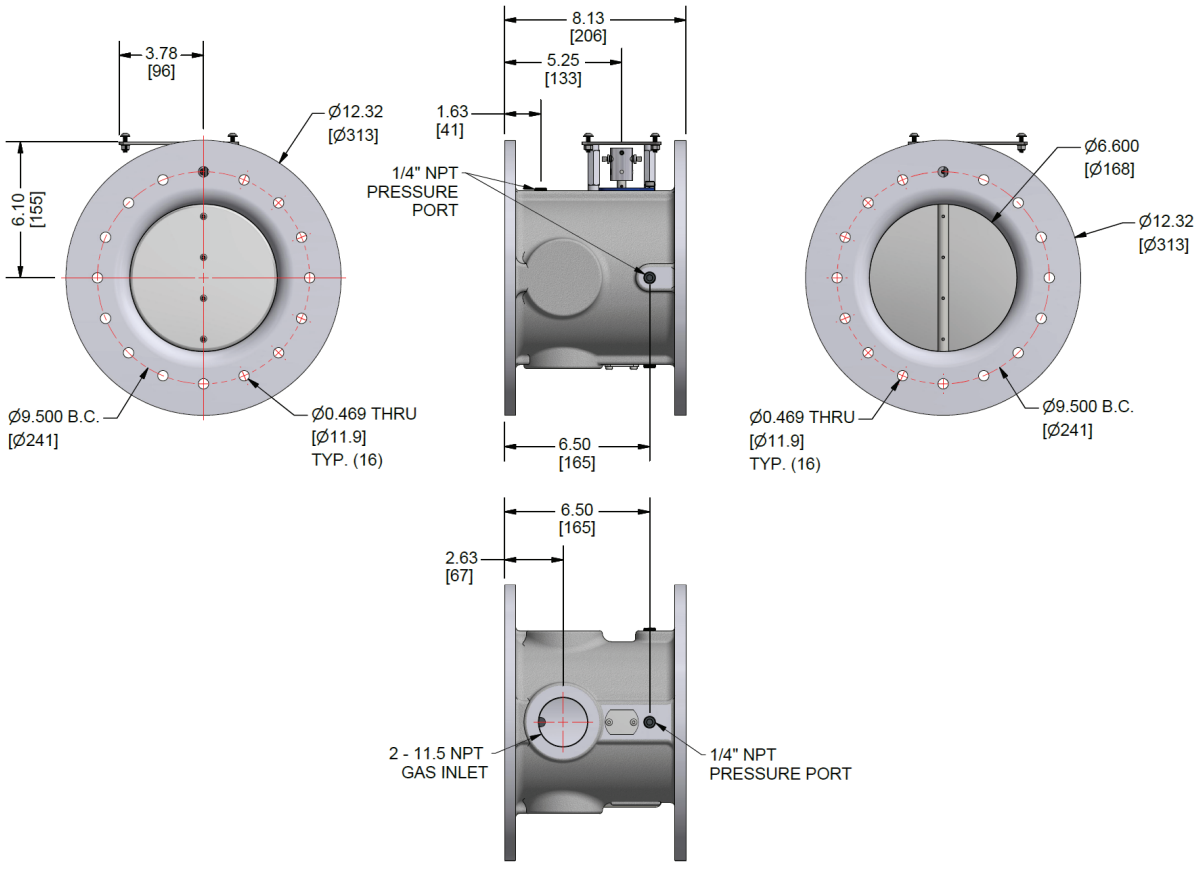
Dimensions (continued)

PBA10.168A-R6241A9

Reversible valve manifold with a 6.60” (168mm) bore, 2” NPT gas inlet, and flanges with a bolt circle of 9.5” (241mm).

Compatible blower: AF-12

Dimensions in inches [mm]



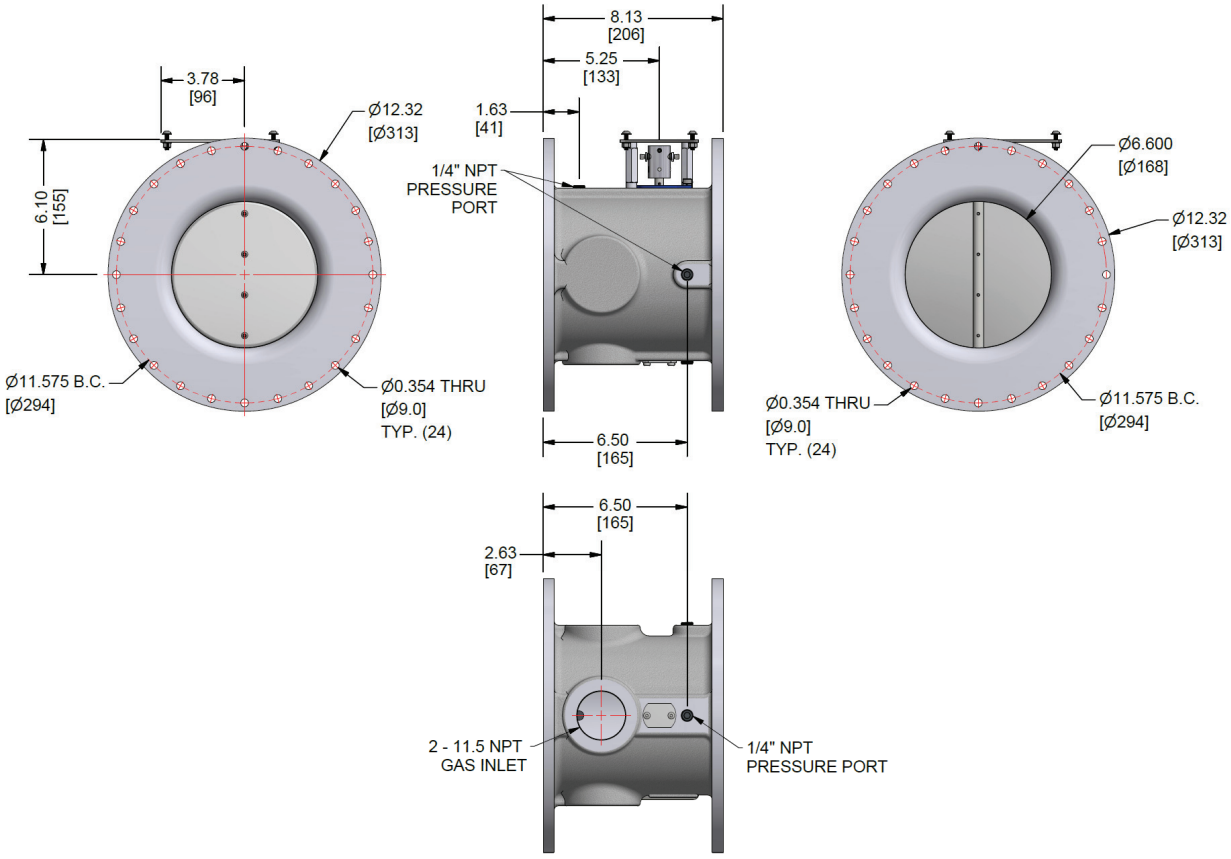
Dimensions (continued)

PBA10.168A-R6294A9

Reversible valve manifold with a 6.60” (168mm) bore, 2” NPT gas inlet, and flanges with a bolt circle of 11.58” (294mm).

Compatible blower: EBM G3G315

Dimensions in inches [mm]



Dimensions (continued)

PBA…-925

PBA assembly with AGA92.5 manual kit attached.

Dimensions in inches [mm]