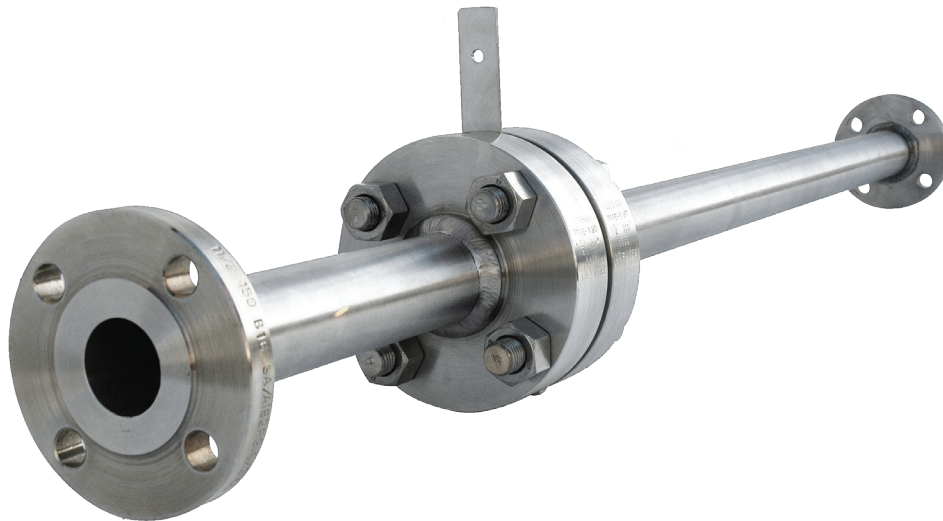


AVCO

FLOW MEASUREMENT ACCESSORIES

Alloy Valves and Control



Orifice Plates

Paddle & Universal Types
Standard Concentric
Counterbored
Eccentric
Quadrant
Segmental
Restriction

Orifice Flange Sets

Raised Face Weld Neck
RTJ Weld Neck
ANSI Class 150 thru 1500
Sizes 1/2" thru 24"

RTJ Holders

Integral Type
Screw Type
Snap Ring Type

Paddle Blinds & Spacers

Standard Individual
Figure 8 (Spectacle) Type

Restriction Unions

NPT & Socket Weld
Male NPT Flow Restrictor
Female NPT Flow Restrictor
Tube Fitting Restrictors

Flow Straighteners

Line Fit Tube Bundle
Flange Fit Tube Bundle

Flow Nozzles

ASME Long Radius
Flange Fit
Integral Spool Piece

Venturis

Welded Style
Machined Style
15° Exit Cone
7° Exit Cone

Complete Meter Runs

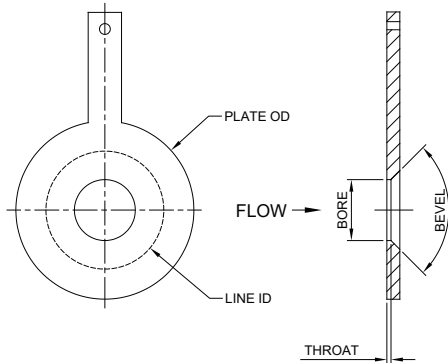
Orifice Plate with Flanges
Upstream/Downstream Pipe
Valve Manifold
dP Transmitter
Flow Computer
Honed Pipe (up to 2")
Sizes up to 12"
ANSI Class 150 thru 1500

Industry Standards

AGA 3
ASME MFC-3M
ASME MFC-14M
ISO 5167

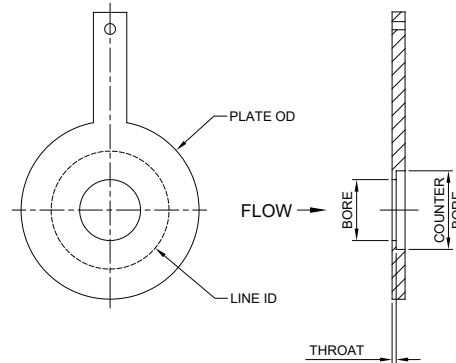
Alloy Valves and Control

Orifice Plate Styles



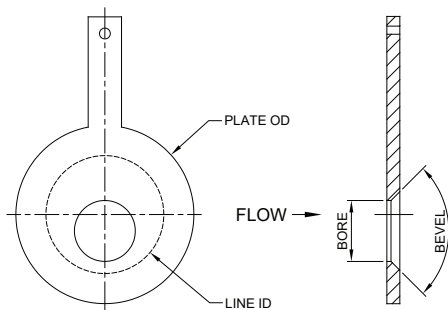
Standard Concentric Orifice Plates

The AVCO standard concentric orifice plate or flow element 'FE' is manufactured in accordance with ASME MFC-3M, ISO 5167 or AGA 3. It is designed to fit between two flanges and has a bevelled bore of exacting size and thickness to produce a known, albeit relatively small pressure drop with minimal loss.



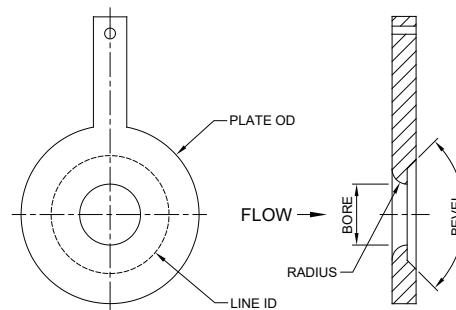
Counterbore Orifice Plates

The AVCO counterbore orifice plate is similar to the standard version except that the throat thickness and pressure recovery is achieved via the counterbore.



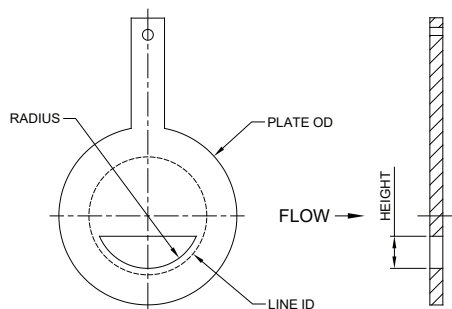
Eccentric Orifice Plates

The AVCO eccentric orifice plate is identical to the standard concentric version except that the bore is toward the bottom or top of the line ID. This is ideal for liquids containing sediment and gases entrained within liquids.



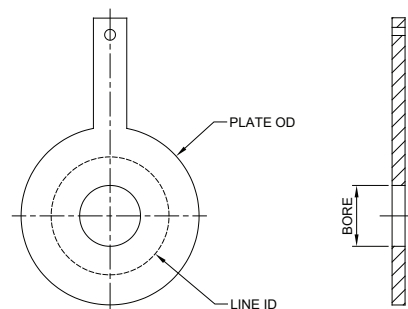
Quadrant Bored Orifice Plates

The AVCO quadrant bored orifice plate is relatively immune to the effects of erosion, corrosion and the deposit of solids on the orifice surface. This lends itself to high viscosity liquids or slurries.



Segmental Orifice Plates

The AVCO segmental orifice plate is essentially identical to the eccentric version, except it eliminates damming of foreign material at the pipe sides and gives better drainage. The accuracy, however, is not quite as high, but sustained over a longer period.



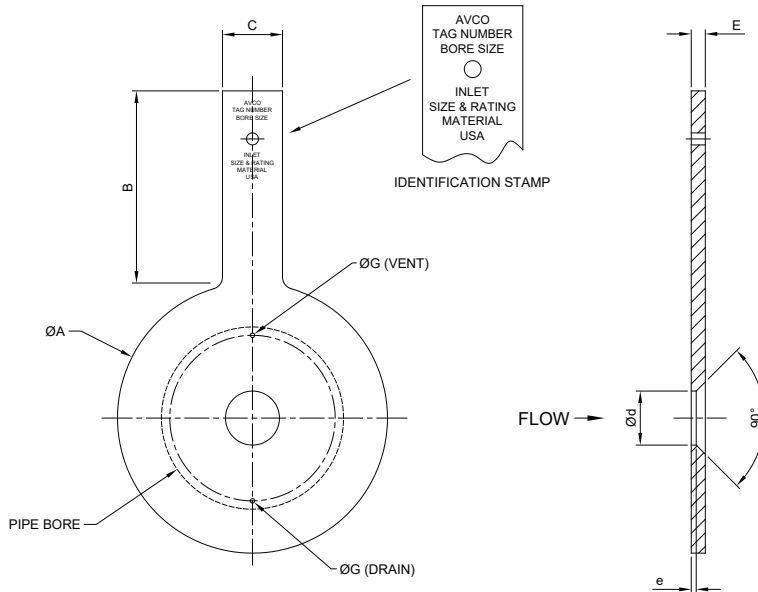
Restriction Orifice Plates

The AVCO restriction orifice plates are used to introduce a pressure drop or give choked (critical) flow in a piping system. They are suitable for both liquids and gases and are commonly used for pump back pressure and blow-down systems.

Alloy Valves and Control

Paddle Type Orifice Plates

The AVCO paddle type orifice plates are available in any of the styles on the previous page and are designed to be sandwiched between ANSI rated flanges. These flanges can be standard ANSI flanges where Vena Contracta taps are used or ANSI orifice flanges where flange taps are used. The mating surfaces can be specifically machined with a surface finish to suit gasket requirements and AVCO holds many blanks in stock awaiting machining of the bore for a quick turn around.



The sketch to the left shows a concentric paddle type orifice plate and an associated dimension table. The outside profile is the same for all paddle type orifice styles with only the bore and plate thickness subject to variations. Paddle type orifice plates can be adapted to suit many other flange standards not shown here. Please contact AVCO for further information.

Vent or Drain Selection

A Vent is required in horizontal pipe runs when a liquid is likely to contain entrained gases. A drain is required in horizontal pipe runs when condensate is likely in a gas or vapor stream. The size of the vent or drain is based upon the orifice bore as shown below. If a possibility that the vent or drain can become plugged with dirt or scale exists, then a vertical pipe run should be considered instead using upward flow for liquids with entrained gases and downward flow for gases or vapor with condensate.

Dimensions for Concentric Paddle Type Orifice Plates

LINE SIZE (in.)	A (in.) For ASME/ANSI B16.5 Class					B (in.)	C (in.)	E (in.)	e (in.)
	150	300	600	900	1500				
1/2	1 7/8	2 1/8	2 1/8	2 1/2	2 1/2	4	1	1/8	1/32
3/4	2 1/4	2 5/8	2 5/8	2 3/4	2 3/4	4	1	1/8	1/32
1	2 5/8	2 7/8	2 7/8	3 1/8	3 1/8	4	1	1/8	1/32
1 1/2	3 3/8	3 3/4	3 3/4	3 7/8	3 7/8	4	1	1/8	1/32
2	4 1/8	4 3/8	4 3/8	5 5/8	5 5/8	4	1 1/4	1/8	1/32
3	5 3/8	5 7/8	5 7/8	6 5/8	6 7/8	4	1 1/4	1/8	1/32
4	6 7/8	7 1/8	7 5/8	8 1/8	8 1/4	4	1 1/4	1/8	1/16
6	8 3/4	9 7/8	10 1/2	11 3/8	11 1/8	5	1 1/4	1/8	3/32
8	11	12 1/8	12 5/8	14 1/8	13 7/8	5	1 1/4	1/4	1/8
10	13 3/8	14 1/4	15 3/4	17 1/8	17 1/8	6	1 1/4	1/4	1/8
12	16 1/8	16 5/8	18	19 5/8	20 1/2	6	1 1/4	1/4	1/8
14	17 3/4	19 1/8	19 3/8	20 1/2	22 3/4	6	1 1/4	1/4	1/8
16	20 1/4	21 1/4	22 1/4	22 5/8	25 1/4	6	1 1/4	3/8	1/4
18	21 1/2	23 3/8	24	25	27 5/8	6	1 1/4	3/8	1/4
20	23 3/4	25 5/8	26 3/4	27 3/8	29 5/8	6	1 1/4	3/8	1/4
24	28 1/8	30 3/8	31	32 7/8	35 1/2	6	1 1/4	1/2	1/4

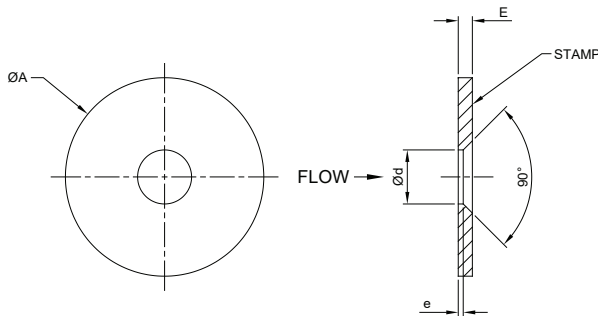
Vent & Drain Dimensions

d (in.) Orifice Bore	G (in.) Maximum Diameter
Less than 1.000	Not recommended
1.000 to 3.500	3/32
3.501 to 4.125	1/8
4.126 to 5.000	5/32
5.001 to 6.000	3/16
6.001 to 6.750	7/32
6.751 to 7.500	1/4
7.501 to 8.375	9/32
8.376 to 9.250	5/16
9.251 to 10.000	11/32
10.001 to 10.875	3/8
10.876 to 11.625	13/32
11.626 to 12.500	7/16
12.501 to 13.250	15/32
13.251 and above	1/2

Alloy Valves and Control

Universal Type Orifice Plates

The AVCO universal type orifice plates are available in any of the styles shown on the second page (although segmental is not recommended) and are designed to be used in orifice fittings such as the AVCO Dual Chamber Orifice Fitting. The bore geometry is identical to that of the paddle type orifice plates, but great care has to be taken when eccentric bores or vent/drain holes are included to ensure correct orientation when placed in the fitting.



Dimensions for Universal Type Orifice Plates

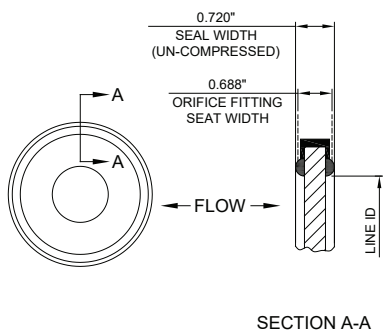
LINE SIZE (in.)	A (in.)	E (in.)	Blank Weight (lbs)
2	2.437	1/8	0.17
3	3.437	1/8	0.34
4	4.406	1/8	0.55
6	6.437	1/8	1.18
8	8.437	1/8	2.03
10	10.687	1/8	3.25
12	13.079	1/4	9.02
14	14.563	1/4	11.16
16	16.563	1/4	14.58
18	18.563	1/4	18.45
20	20.563	3/8	22.78
24	24.500	3/8	32.80
26	26.750	3/8	62.00
30	30.750	1/2	112.00
34	35.228	1/2	134.00
36	38.000	1/2	156.00

NOTE: Dimension 'A' for sizes 12" and above includes a vulcanized seal as standard. Please inform AVCO if it is not required.

Sealing Units for Universal Type Orifice Plates

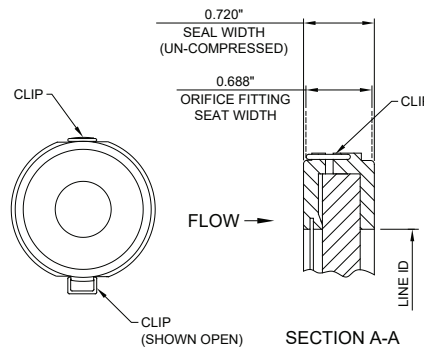
AVCO supplies the following sealing units for universal type orifice plates.

Elastomer Seal



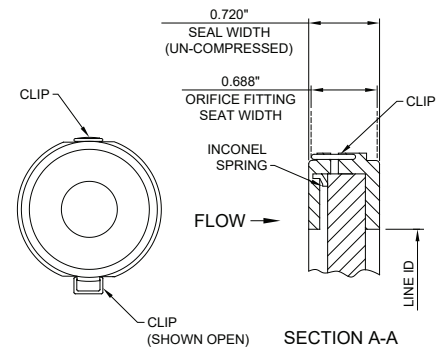
The elastomer seals are removable on line sizes up to 10". Line sizes 12" and above require the seal to be vulcanized to the plate. The seal materials available are: Nitrile, Viton, EPDM, Silicon & PTFE.

Teflon Seal



Teflon seals are suitable for temperatures of -65°F to 500°F. They are primarily used for acidic services and recommended for high pressure orifice fittings above ANSI class 900.

Metal Seal



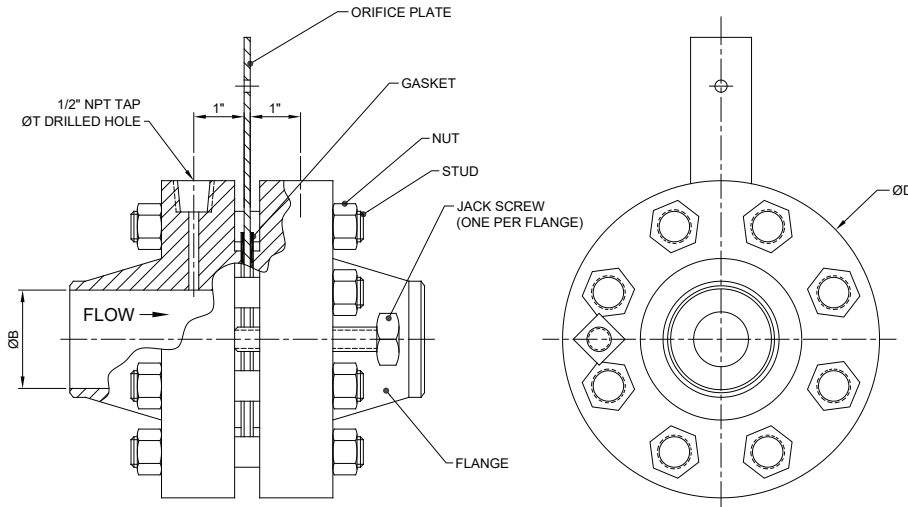
Metal seals are best suited to high temperature service between 500°F & 1200°F and are manufactured from SS 316 with inconel springs. We also have a patented integral orifice seal for special service.

Alloy Valves and Control

Orifice Flange Sets

AVCO supplies complete orifice flange sets with all components required to install a paddle type orifice plate in the pipeline. We supply many styles including weld neck, NPT & socket weld in raised face and RTJ types.

Due to the vast range we have only shown the popular ANSI class 300 weld neck raised face flange set as a typical example of what is supplied in a set. Please contact AVCO for other flange types and styles.



Flange Set Data for Class 300 Raised Face Weld Neck Flanges

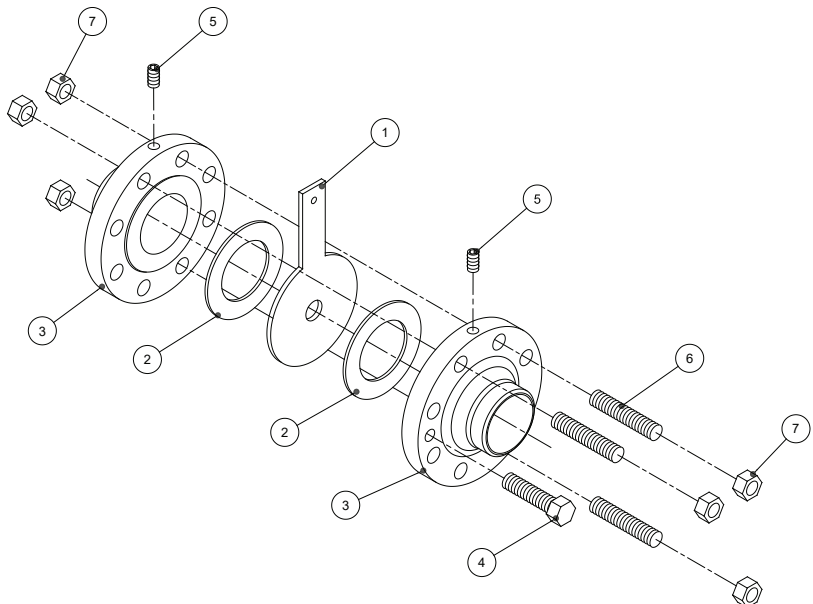
LINE SIZE (in.)	B	Bore Tolerance	T (in.)	Approx. Weight (lbs)
1/2	Sized to suit pipe schedule bore as standard, undersize or job specific per actual mean measurement (Dm) as specified in relevant standards	Customer to specify +/- 0.5% as standard, +/- 0.3% or +/- 0.25% depending upon relevant standards and requirements	1/4	10
3/4			1/4	10
1			1/4	18
1 1/2			1/4	25
2			3/8	27
3			3/8	43
4			1/2	66
6			1/2	106
8			1/2	152
10			1/2	216
12			1/2	327
14			1/2	448
16			1/2	596
18			1/2	741
20			1/2	887
24			1/2	1311

Important Note about Orifice Flange Bore

AVCO supplies flanges conforming to ASME B16.36, which states the orifice bore tolerance shall be +/-0.5% and we can supply these in standard pipe schedule bores. However, ASME MFC-3M, AGA 3 and ISO 5167 require the bore immediately upstream of the orifice plate to be within +/- 0.3% or +/- 0.25% of the mean measured bore (Dm). To achieve this it is important to select an undersize bore and machine it or specify the actual required bore and we will supply it machined within +/- 0.25% for which additional charges will apply.

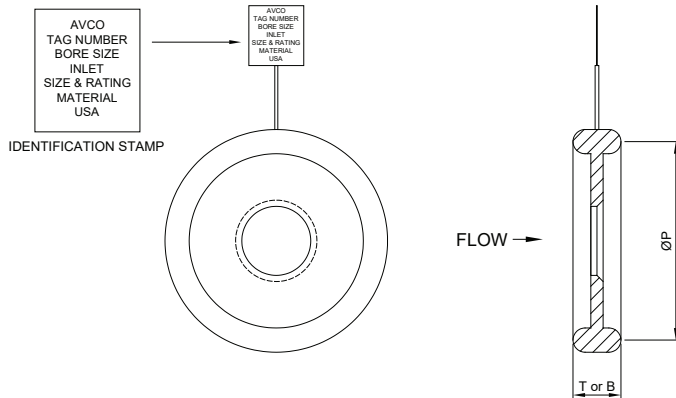
Material Choices

Item	Description	Materials
1	Orifice Plate	SS 316 Alloy 20 Monel Hastelloy C
2	Gaskets	Non Asbestos Flexitallic PTFE
3	Flanges	Carbon Steel SS 316 Alloy 20 Monel Hastelloy C
4	Jack Screws	Carbon Steel Stainless Steel
5	Pipe Plugs	Carbon Steel Stainless Steel
6	Studs	ASTM A193 Grade B7 ASTM A320 Grade B8M
7	Nuts	ASTM A194 Grade 2H ASTM A194 Grade 8M



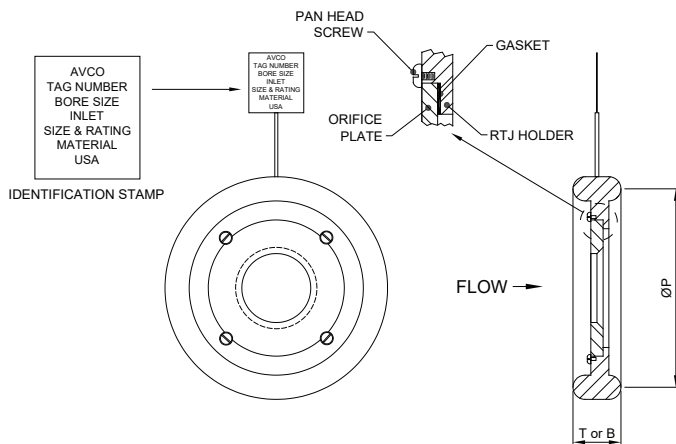
Alloy Valves and Control

Ring Type Joint Holders



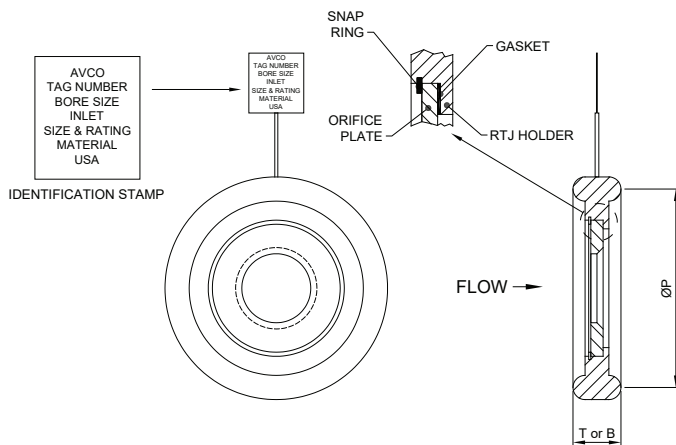
Integral Type

The integral type RTJ orifice is produced in either oval or octagonal designs and is the most common and effective style. It is a one piece design giving rise to a reliable installation. Replacement costs are higher when compared with removable types as the entire ring requires changing.



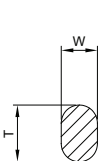
Screw Type

The screw type RTJ orifice holder is produced in either oval or octagonal designs with a removable universal style orifice plate. This plate is held in place with screws and uses a gasket seal, which can possibly give differential leakage. It is important that the unit be installed correctly as it is possible for the plate to become dislodged downstream if installed backwards.

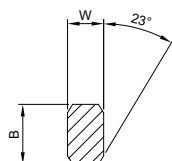


Snap Ring Type

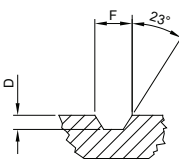
The snap ring type RTJ orifice holder is produced in either oval or octagonal designs with a removable universal type orifice plate. This plate is held in place with a snap ring and gives a greater risk of differential leakage than that of the screw type, but is more forgiving if installed backwards as it is unlikely the plate can be dislodged. This style is the least popular.



Oval



Octagonal



Groove

Standard Ring & Groove Geometry

The RTJ ring geometry and tolerances used in the AVCO RTJ holders follow all industry practices and are fully interchangeable.

Dimensions for Class 300 & 600 RTJ Holders

Line Size (in.)	Ring No.	Ring Dimensions					Groove Dimensions		Distance Between Flanges (in.)
		T (in.)	B (in.)	W (in.)	C (in.)	P (in.)	F (in.)	D (in.)	
1/2	R11	29/32	31/32	1/4	0.170	1 11/32	9/32	7/32	19/32
3/4	R13	1	1 1/16	5/16	0.206	1 11/16	11/32	1/4	19/32
1	R16	1	1 1/16	5/16	0.206	2	11/32	1/4	19/32
1 1/2	R20	1	1 1/16	5/16	0.206	2 11/16	11/32	1/4	19/32
2	R23	1 1/16	1 1/8	7/16	0.305	3 1/4	15/32	5/16	5/8
3	R31	1 1/16	1 1/8	7/16	0.305	4 7/8	15/32	5/16	5/8
4	R37	1 1/16	1 1/8	7/16	0.305	5 7/8	15/32	5/16	5/8
6	R45	1 1/16	1 1/8	7/16	0.305	8 5/16	15/32	5/16	5/8
8	R49	1 1/16	1 1/8	7/16	0.305	10 5/8	15/32	5/16	5/8
10	R53	1 1/16	1 1/8	7/16	0.305	12 3/4	15/32	5/16	5/8
12	R57	1 1/16	1 1/8	7/16	0.305	15	15/32	5/16	5/8
14	R61	1 1/16	1 1/8	7/16	0.305	16 1/2	15/32	5/16	5/8
16	R65	1 3/16	1 1/4	7/16	0.305	18 1/2	15/32	5/16	3/4
18	R69	1 3/16	1 1/4	7/16	0.305	21	15/32	5/16	3/4
20	R73	1 1/4	1 5/16	1/2	0.341	23	17/32	3/8	3/4
24	R77	1 7/16	1 1/2	5/8	0.413	27 1/4	21/32	7/16	13/16

NOTE: Screw & snap ring type RTJ holders are not available for sizes 1 1/2" & below - these can only be supplied as integral.

Dimensions for Class 900 RTJ Holders

Line Size (in.)	Ring No.	Ring Dimensions					Groove Dimensions		Distance Between Flanges (in.)
		T (in.)	B (in.)	W (in.)	C (in.)	P (in.)	F (in.)	D (in.)	
1/2	R12	1	1 1/16	5/16	0.206	1 9/16	11/32	1/4	19/32
3/4	R14	1	1 1/16	5/16	0.206	1 3/4	11/32	1/4	19/32
1	R16	1	1 1/16	5/16	0.206	2	11/32	1/4	19/32
1 1/2	R20	1	1 1/16	5/16	0.206	2 11/16	11/32	1/4	19/32
2	R24	1 1/16	1 1/8	7/16	0.305	3 3/4	15/32	5/16	5/8
3	R31	1 1/16	1 1/8	7/16	0.305	4 7/8	15/32	5/16	5/8
4	R37	1 1/16	1 1/8	7/16	0.305	5 7/8	15/32	5/16	5/8
6	R45	1 1/16	1 1/8	7/16	0.305	8 5/16	17/32	3/8	5/8
8	R49	1 1/16	1 1/8	7/16	0.305	10 5/8	21/32	7/16	5/8
10	R53	1 1/16	1 1/8	7/16	0.305	12 3/4	21/32	7/16	5/8
12	R57	1 1/16	1 1/8	7/16	0.305	15	29/32	9/16	5/8
14	R62	1 5/16	1 3/8	5/8	0.413	16 1/2	1 1/16	5/8	11/16
16	R66	1 7/16	1 1/2	5/8	0.413	18 1/2	1 3/16	11/16	13/16
18	R70	1 9/16	1 5/8	3/4	0.485	21	1 3/16	11/16	15/16
20	R74	1 9/16	1 5/8	3/4	0.485	23	1 5/16	11/16	15/16
24	R78	1 7/8	1 15/16	1	0.681	27 1/4	1 7/16	13/16	15/16

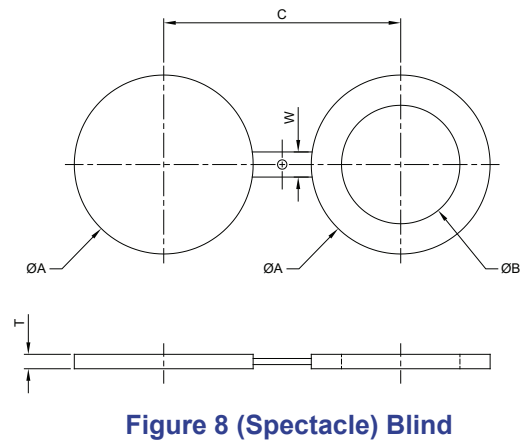
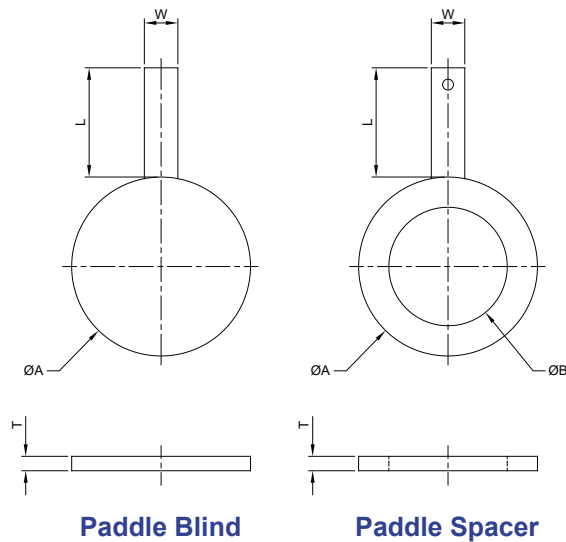
NOTE: Screw & snap ring type RTJ holders are not available for sizes 1 1/2" & below - these can only be supplied as integral.

Alloy Valves and Control

Paddle Blinds & Spacers

AVCO manufactures paddle blinds, spacers & figure 8 (spectacle blinds) per API standard 590 in carbon steel ASTM A516 grade 70 and ASTM A515 grade 70 materials.

A paddle blind is most commonly used between two flanges as a means of isolating flow when piping downstream is being constructed or maintained. A spacer is inserted upon completion of the works to allow flow to resume. The figure 8 (spectacle) blind is essentially the same except that it is single piece and rotated from blind to spacer as required. This ensures that equipment is securely blanked off to protect those working on piping systems and are often included as permanent fixtures. This allows for other sections of the upstream piping network to be brought online during construction or maintenance, whilst ensuring absolute safety.



ANSI Class 150 Blinds

Line Size (in.)	A (in.)	B (in.)	C (in.)	T (in.)	L (in.)	W (in.)
1	2 1/2	1 1/8	3 1/8	1/4	4	1
1 1/2	3 1/4	1 5/8	3 7/8	1/4	4	1
2	4	2 1/8	4 3/4	1/4	4	1
2 1/2	4 3/4	2 1/2	5 1/2	1/4	4	1
3	5 1/4	3 1/8	6	1/4	4	1
4	6 3/4	4 1/8	7 1/2	3/8	4	1
6	8 5/8	6 1/8	9 1/2	1/2	4	1
8	10 7/8	8	11 3/4	1/2	4	1
10	13 1/4	10 1/8	14 1/4	5/8	5	1
12	16	12	17	3/4	5	1
14	17 1/2	13 1/4	18 3/4	3/4	5	1
16	20 1/8	15 1/4	21 1/4	7/8	5	1 1/2
18	21 1/2	17 1/4	22 3/4	1	5	1 1/2
20	23 3/4	19 1/4	25	1 1/8	5	1 1/2
24	28 1/8	23 1/4	29 1/2	1 1/4	5	1 1/2

ANSI Class 300 Blinds

Line Size (in.)	A (in.)	B (in.)	C (in.)	T (in.)	L (in.)	W (in.)
1	2 3/4	1 1/8	3 1/2	1/4	4	1
1 1/2	3 5/8	1 5/8	4 1/2	1/4	4	1
2	4 1/4	2 1/8	5	3/8	4	1
2 1/2	5	2 1/2	5 7/8	3/8	4	1
3	5 3/4	3 1/8	6 5/8	3/8	4	1
4	7	4 1/8	7 7/8	1/2	4	1
6	9 3/4	6 1/8	10 5/8	5/8	4	1
8	12	8	13	7/8	4	1
10	14 1/8	10 1/8	15 1/4	1	5	1
12	16 1/2	12	17 3/4	1 1/8	5	1 1/2
14	19	13 1/4	20 1/4	1 1/4	5	1 1/2
16	21 1/8	15 1/4	22 1/2	1 1/2	5	1 1/2
18	23 3/8	17 1/4	24 3/4	1 5/8	5	1 1/2
20	25 5/8	19 1/4	27	1 3/4	5	1 1/2
24	30 3/8	23 1/4	32	2	5	1 1/2

Alloy Valves and Control

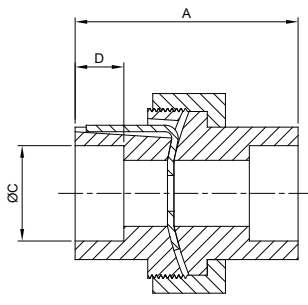
Restriction Unions & Flow Restrictors

AVCO manufactures a number of different restriction unions and flow restrictors in various styles. These are used in piping systems typically less than 2" where the use of flanges is prohibitive or not available. We carry a large range covering female NPT/socket weld, male NPT, compression fittings & AN fittings.

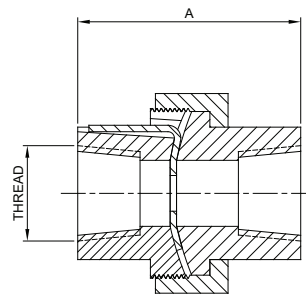
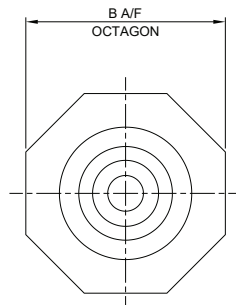
For choked flow it is often overlooked that standard restriction unions are not sufficient. AVCO has in depth knowledge of flow restriction and has developed a number of different styles to ensure flow is properly restricted. For gases the throat length must be between 1 and 6 times the orifice bore for choking to occur. In liquids choking will occur across a standard plate, but cavitation due to the high pressure drop will cause noise and possible damage to upstream piping. To alleviate this the throat length should be somewhere around 6 times the orifice bore thus containing the cavitation zone and eliminating the requirement for frequent replacement.

Female Pressure Restriction Unions

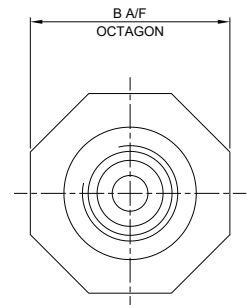
These unions are primarily used in small bore piping under 2" for pressure restriction. They comprise of 4 pieces; an upstream end, a downstream end, an assembly nut and an orifice plate with integral identification tab. These unions are bidirectional and easily installed.



Socket Weld Restriction Union



Threaded NPT Restriction Union



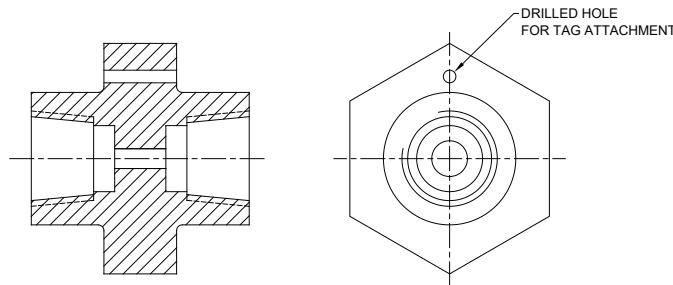
3000# Union Dimensions

Line Size (in.)	A (in.)	B (in.)	C (in.)	D (in.)	Thread
1/4	1.75	1.37	0.560	0.44	1/4 NPT
3/8	1.91	1.56	0.695	0.44	3/8 NPT
1/2	2.06	1.79	0.860	0.44	1/2 NPT
3/4	2.38	2.19	1.070	0.56	3/4 NPT
1	2.50	2.57	1.335	0.56	1 NPT
1 1/4	2.94	3.10	1.680	0.56	1 1/4 NPT
1 1/2	3.06	3.44	1.920	0.56	1 1/2 NPT
2	3.56	4.08	2.410	0.69	2 NPT

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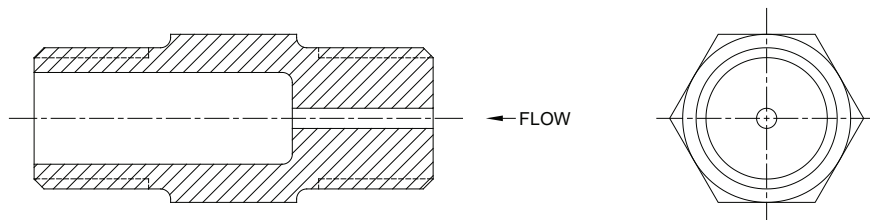
Female Flow Restriction Hex Pipe Coupling

The AVCO female flow restriction hex pipe coupling is better suited to gases for choked flow as the longer throat length required for liquids is prohibitive in this design style. The one piece construction is easily installed in the same way as any other coupling and can be readily replaced if so needed and it is also bidirectional thus preventing incorrect installation. This style is only supplied as NPT due to the one piece nature and the need for possible replacement. The available size range is 1/4" thru 2".



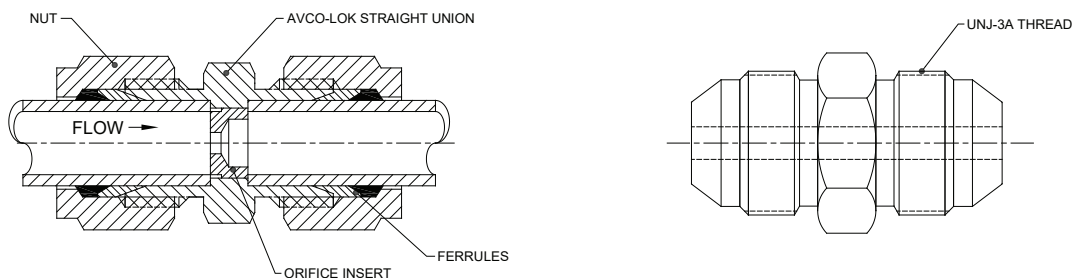
Male Flow Restriction Hex Pipe Nipple

The AVCO male flow restriction hex pipe nipple is suited to both gases and liquids as the throat length can easily exceed the 6 times orifice bore diameter required to contain the cavitation zone. The one piece construction is simple to install, but only available in NPT threaded versions to allow for replacement if necessary. The available sizes are 1/4" thru 2".



Restriction Union Tube Fittings

AVCO also manufactures restriction unions in AVCO-LOK (compression fitting) and AN flared type fittings for the aerospace and military sectors. These fittings are manufactured to the highest standards such as SAE J514 with the AN fittings having the added feature of a UNJ-3A style thread form. They can be used for flow or pressure restriction and are installed just like any other tube fitting making them highly versatile.



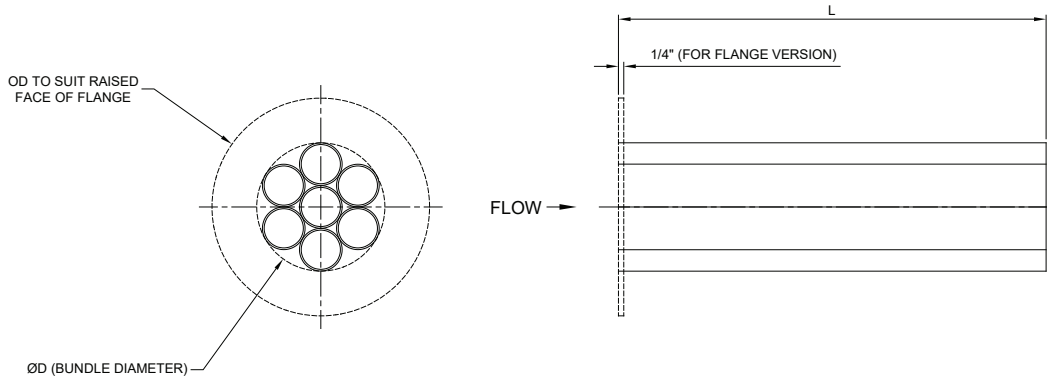
AVCO-LOK Compression Style

AN Flared Fitting Style

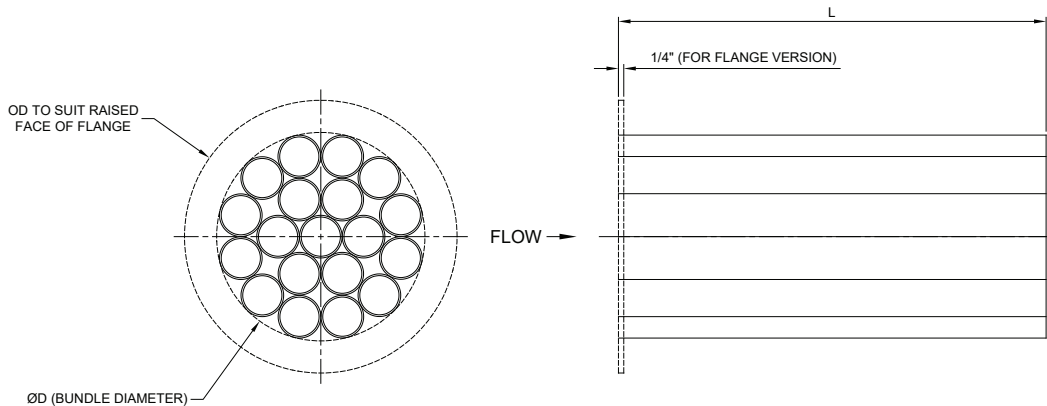
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Flow Straightener

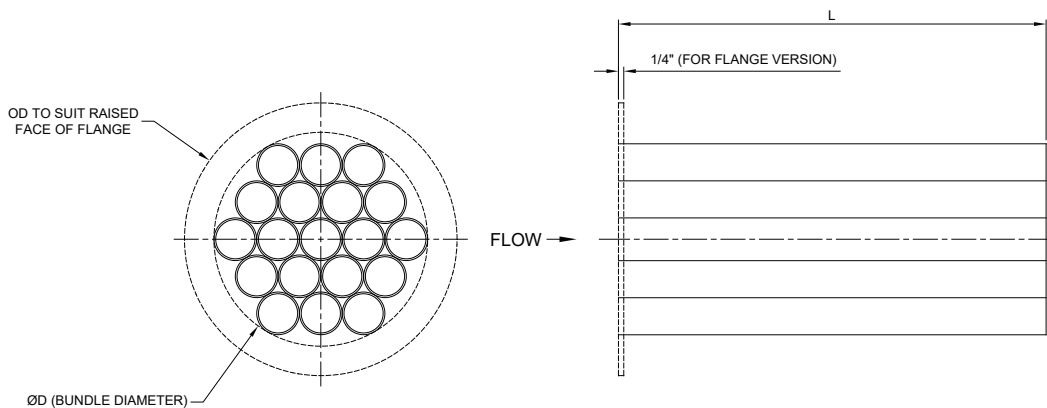
One of the most important criteria for accurate flow measurement is a long length of straight pipe run upstream of the orifice plate. This is required to remove swirl and create an acceptable flow profile, but with lengths required as much as 75 times the pipe diameter per ASME MFC-3M, it is often impractical and prohibitive to achieve such long lengths. A flow straightener provides a simple solution by allowing the lengths to be almost halved, whilst achieving the same results. These can be supplied as flange mounted or line mounted via set screws and installation locations are described in AGA 3, ASME MFC-3M and ISO 5167.



Tube Bundle Type I



Tube Bundle Type II



Tube Bundle Type III

Dimensions for Flow Straightener Tube Bundles

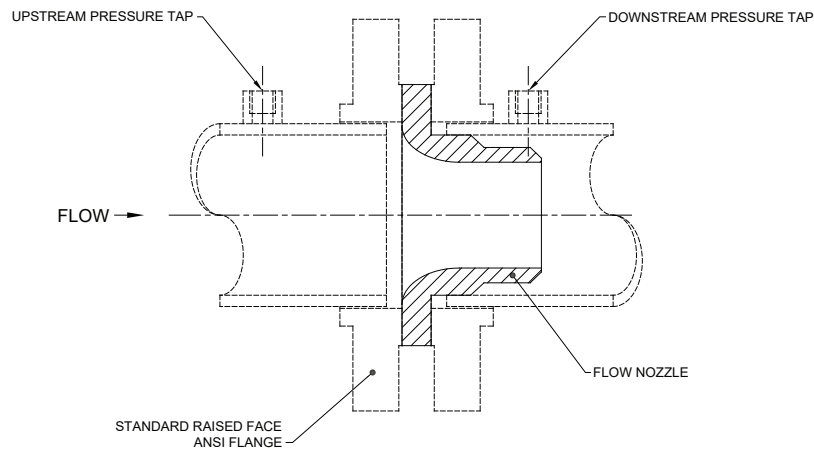
LINE SIZE (in.)	Bundle Type	L (in.)	D (in.)	To Fit Pipe Sch	OD of Tubes (in.)	Tube Wall (in.)	No. of Tubes	Line Model				Flange Model	
								No. of Screws	Screw Thread	Screw Length (in.)	Weight (lbs)	Weight (lbs)	
2	I	6	1 31/32	sch 40	21/32	0.095	7	1	3/8-16 UNC	1	2	2.5	
	I	6	1 7/8	sch 80	21/32	0.095	7	1	3/8-16 UNC	1	2	2.5	
3	II	8	2 7/8	sch 40	19/32	0.049	19	1	3/8-16 UNC	1	3	4	
	II	8	2 3/4	sch 80	9/16	0.049	19	1	3/8-16 UNC	1	3	4	
4	II	10	3 31/32	sch 40	13/16	0.049	19	1	3/8-16 UNC	1	6.5	7.5	
	III	10	3 3/4	sch 80	3/4	0.049	19	1	3/8-16 UNC	1 1/4	6.5	7.5	
6	II	12	5 15/16	sch 40	1 7/32	0.049	19	1	1/2-13 UNC	1 1/4	18.5	20.5	
	II	12	5 5/8	sch 80	1 5/32	0.049	19	1	1/2-13 UNC	1 1/4	18.5	20.5	
8	II	16	7 29/32	sch 30	1 5/8	0.065	19	1	1/2-13 UNC	1 1/4	34.5	37	
	II	16	7 29/32	sch 40	1 5/8	0.065	19	1	1/2-13 UNC	1 1/4	34.5	37	
10	III	20	10	sch 30	2	0.083	19	1	1/2-13 UNC	1 1/4	53.5	57	
	II	20	9 3/4	sch 40	2	0.083	19	1	1/2-13 UNC	1 1/4	53.5	57	
12	III	24	11 7/8	sch 30	2 3/8	0.083	19	2	1/2-13 UNC	1 1/2	77	81	
	III	24	11 7/8	STD	2 3/8	0.083	19	2	1/2-13 UNC	1 1/2	77	81	
	II	24	11 5/8	sch 40	2 3/8	0.083	19	2	1/2-13 UNC	1 1/2	77	81	
14	III	28	13 1/8	STD	2 5/8	0.083	19	2	1/2-13 UNC	1 1/2	100	105	
	II	28	12 3/4	XS	2 5/8	0.083	19	2	1/2-13 UNC	1 1/2	100	105	
16	III	32	15	STD	3	0.188	19	2	1/2-13 UNC	1 3/4	268	274	
	II	32	14 19/32	XS	3	0.188	19	2	1/2-13 UNC	1 1/2	268	274	
18	II	36	17 1/32	STD	3 1/2	0.188	19	2	1/2-13 UNC	1 1/4	378	386	
20	II	40	18 27/32	STD	3 7/8	0.188	19	2	1/2-13 UNC	1 1/4	468	477	
24	II	48	23 1/8	STD	4 3/4	0.188	19	2	1/2-13 UNC	1 1/4	693	704	
26	III	52	25	STD	5	0.188	19	2	1/2-13 UNC	1 1/2	796	814	
30	III	60	28 3/4	STD	5 3/4	0.188	19	2	1/2-13 UNC	1 1/2	1273	1295	
34	II	68	32 13/16	STD	6 3/4	0.250	19	2	1/2-13 UNC	1 1/2	1860	1880	
36	III	72	35	STD	7	0.188	19	2	1/2-13 UNC	1 1/2	1559	1582	

AVCO can also supply other styles of flow conditioners - please contact sales@avcovalve.com for more information.

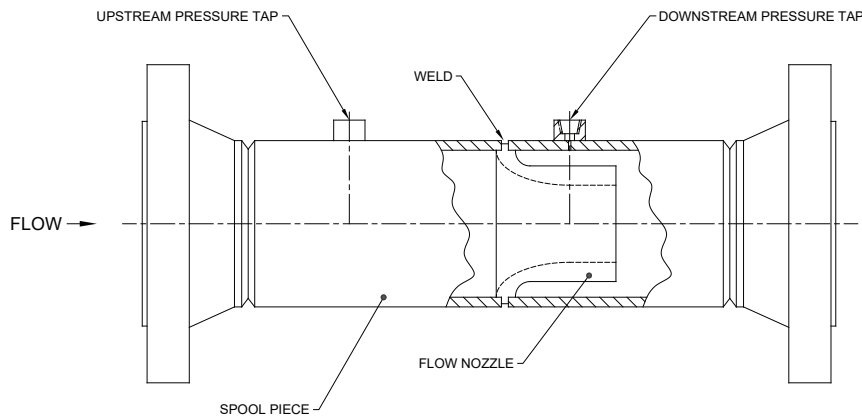
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Flow Nozzles

Flow nozzles are particularly suited to high velocities and temperatures often encountered in steam flow. They are inherently more expensive to manufacture than a standard orifice plate, but are dimensionally more stable and give longer life at the higher velocities. There are 3 main styles of flow nozzle; ASME long radius nozzle, ISA 1932 nozzle and the venturi nozzle. AVCO supplies the nozzles as a single item, normally flanged, or pre-installed in a flanged spool piece with pressure taps added in the correct locations. The flow nozzles meet all relevant industry standards such as ASME MFC-3M.



**Flanged Flow Nozzle
(Shown installed between flanges)**

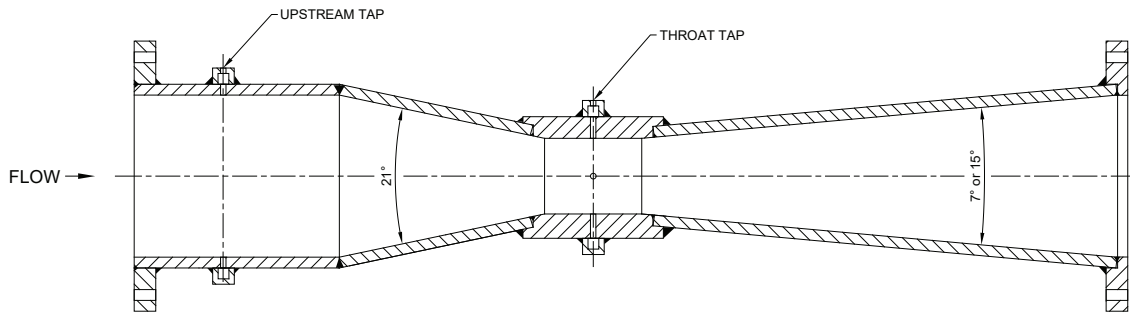


**Flanged Spool Piece with Integral
Flow Nozzle & Pressure Taps**

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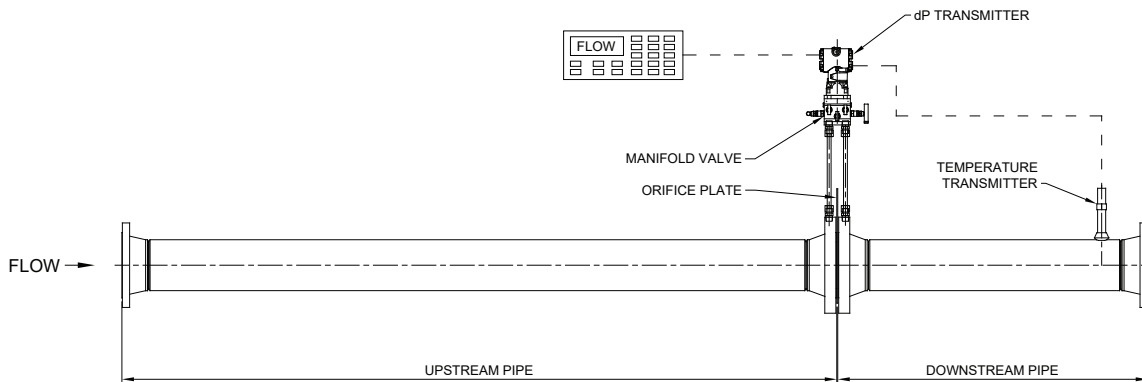
ASME Venturi Tubes

Venturi tubes are particularly suited to applications where pressure loss needs to be kept to a minimum when flow measurement is required due to the high degree of pressure recovery. They also have the added advantage of a flow nozzle with low susceptibility to erosion. Typical accuracy ranges between $\pm 0.25\%$ and $\pm 1\%$ for full scale flow measurement. There are three styles of ASME venturi tube; 'as-cast' convergent section, machined convergent section and rough welded convergent section. AVCO supplies the machined and rough welded versions.



AVCO Meter Runs

AVCO fabricates complete meter runs per AGA 3, ASME MFC-3M or ISO 5167 standards as a total solution to your flow measurement needs and they are supplied fully assembled, tested and calibrated. The upstream and downstream pipe lengths are sized to suit the particular application, including flow straighteners if necessary and we only select the best quality pipe for roundness and straightness. Because AVCO believes in flexibility, we also supply the meter runs without the valve manifold, dP transmitter, temperature transmitter or flow computer to enable the customer to use their own preferred brands or even have us use their preferred brands.



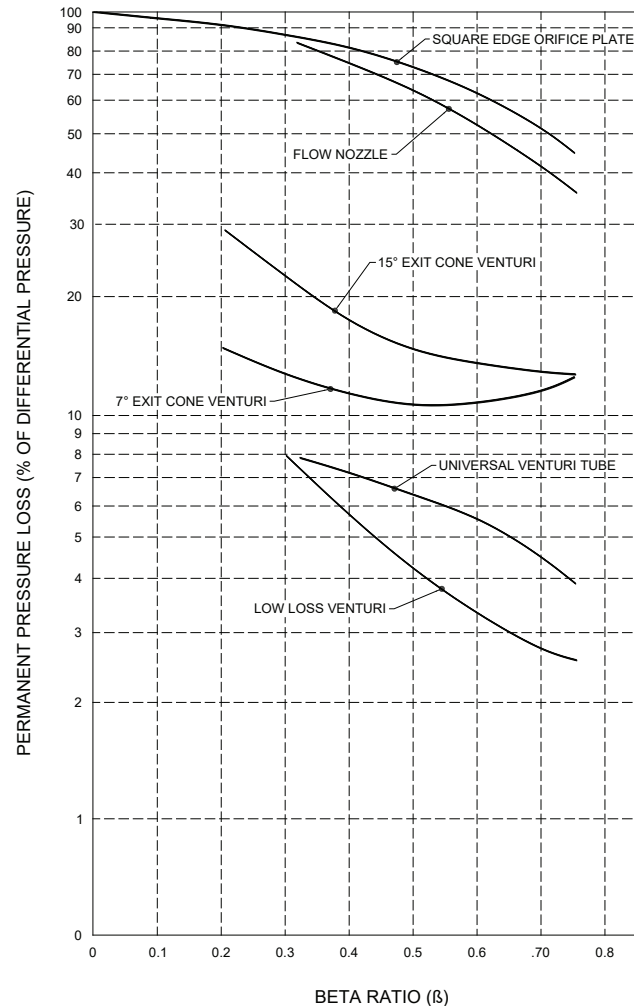
Honed Flow Meter Runs

For relatively small bore meter runs up to 2" in size, accuracy is affected quite dramatically by imperfections in standard pipe bores due to irregularities in surface finish, roughness, straightness and roundness. To overcome these problems, AVCO uses honed pipes with a surface finish of 5 to 10 RMS and a tolerance of $\pm 0.001"$. This gives accuracies of $\pm 0.75\%$ or even $\pm 0.25\%$ with flow calibration. All other elements are similar to that of a standard meter run. These honed flow meter runs meet the requirements of ASME MFC-14M.

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Pressure Loss

Due to the nature of the differential pressure method of calculating flow, there is an inherent permanent pressure loss in the system. Common applications use a differential pressure scale of around 100" water column with an actual pressure loss of around 70" water column and can normally be absorbed by the system. This is not always feasible, especially in low pressure systems and the permanent pressure loss becomes an important factor. The graph below shows how the different types of differential pressure device affect the permanent pressure loss in the system and acts as an aid to selecting the correct device for the application.



Engineering Services

AVCO has many years experience in flow control and our design team can size the required orifice bore for flow measurement, pressure restriction or flow restriction. We use modern orifice sizing programs for all calculations and are fully conversant with the requirements of AGA 3, ASME MFC-3M and ISO 5167. We have worked closely with recognized experts in the field of flow measurement and often become involved in flow measurement software improvement and testing. We can also determine best practice for installation requirements to ensure recommended straight pipe runs are adequate for the flow accuracy required which is affected by upstream conditions.

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FLOW MEASUREMENT DATA SHEET

Company		Date	
Address		Phone Number	
PO Number		Email	

Tag Number							
Element Type (select all that apply)							
Orifice	Choked Flow		Flange Taps		Vena Contracta Taps		
	Restriction (Pipe Taps)		Quadrant		Conic		
	Segmental		Eccentric		Honed Run		
Venturi	Machined Inlet		Rough Welded Inlet				
	7 Degree Exit		15 Degree Exit				
Nozzle	ASME Long Radius		ASME Throat Tap		with Diffuser		
	ISO (ISA 1932)		Venturi Nozzle				
Required Standards							
Element Material							
Pipe Material							
Pipe Data		Nominal Size or OD		Pipe Schedule or ID			
Media State							
Media Name or Description							
Flowing Upstream Pressure							
Atmospheric Pressure							
Flowing Temperature							
Flow conditions (enter at least two)	Flow	Maximum		Normal			
	Pressure Drop	Maximum Differential for Meter or Required Pressure Drop					
	Orifice Bore						
Media Properties (if non-standard) Enter as many properties as possible	Flow Density		Base Density				
	Viscosity		Vapor Press.				
	Base S.G		Flowing S.G		Cp/Cv (gas)		
	Compressibility Factor (gas only)	Base			Flowing		
	Liquid Compressibility			Molecular Weight (gas only)			
Vent or Drain Required							
Notes							