

INDICATING FLOWRATOR METER SERIES 10A2700 C



The Model 10A2700C Series Flowrator meters are glass tube variable-area flowmeters providing visual indication of flow rate with linear scales of 12-1/2 to 1 range. A choice of capacity is available from a fraction of a cubic centimeter per minute to 41 gpm or 169 scfm air equivalent. The "snap-in" tube construction¹ allows easy range change. Tubes and floats of the same size can be interchanged without tools or disassembly of meter. Because of its o-ring construction the meter has no packing or stuffing boxes, eliminating the need for operating and maintenance adjustments.

The meter is adaptable to both liquid and gas service, and is available in a variety of materials of construction. Dimensions and nomenclature are in accord with ISA standards.

MATERIALS OF CONSTRUCTION (✓ = optional)

Tube: Standard borosilicate glass sizes 1/16-, 1/8-, and 1/4-inch

Tempered borosilicate glass sizes 1/2-inch and up

✓Plastijacket² tube

Ball Floats: Glass, stainless steel, sapphire, ✓tantalum

USV, SV, NSV Floats: Stainless steel, ✓Hastelloy³ Alloy C, ✓nickel, ✓monel

O-Rings: Buna N, ✓Viton⁴, ✓Kel-F⁵ ✓Butyl

Fittings: Steel, brass (bronze - 1-1/2-inch size), stainless steel, ✓nickel, ✓monel, ✓Hastelloy Alloy C, ✓Alloy 20

Inlet Float Stop: Tube size 1/16-, 1/8-, and 1/4-inch - glass formed in tube

Tube size 1/2-, 3/4-, and 1-inch - stainless steel, ✓Hastelloy Alloy B

Tube size 1-1/2-, and 2-inch - same material as fittings except stainless steel furnished with steel and brass (bronze) fittings

Outlet Float Stop: Tube size 1/16-, 1/8-, and 1/4-inch - stainless steel

Tube size 1/2-, 3/4-, and 1-inch - Nylon⁶, ✓Teflon⁷

Tube size 1-1/2-, and 2-inch - stainless steel, ✓Hastelloy Alloy B

DESIGN FEATURES

Interchangeability of tubes, permitting flow range changes by utilizing the exclusive o-ring "snap-in" construction.

Complete absence of operating and maintenance adjustments.

Bezels of stainless steel.

End fittings rotatable through full 360°.

Unaffected by vacuum, pressure or backflow.

PERFORMANCE

Accuracy: Standard ± 2 per cent maximum flow
Optional ± 1 per cent maximum flow (calibrated)

Rangeability: 12-1/2 to 1

1. Patent pending

2. T.M., Fischer & Porter Company

3. T.M., Union Carbide & Carbon Corp.

4. T.M., E. I. DuPont de Nemours & Company, Inc.

5. T.M., M. W. Kellogg Company

6. T.M., E. I. DuPont de Nemours & Company, Inc.

7. T.M., E. I. DuPont de Nemours & Company, Inc.

FISCHER & PORTER



Complete Process Instrumentation

MOUNTING

Pipe Mounted In Line

Panel Mounting: Flush, surface

WEIGHT

Meter Size	1/16, 1/8 1/4-inch	1/2, 3/4, 1-inch	1-1/2, 2-inch
10A2735C, 10A2775C	3 lb	12 lb	40 lb
10A2736C, 10A2776C	-	20 lb	50 lb

SCALES

Meter Size (Inch)	Scale	
	Length	Type
1/16, 1/8, 1/4	5-inch	Diameter Ratio Direct Reading
1/2, 3/4, 1, 1-1/2, 2	10-inch	Percentage Direct Reading

CONNECTIONS - HORIZONTAL ONLY

Meter Size (Inch)	Connections	
	10A2735C 10A2775C	10A2736C 10A2776C
1/16, 1/8, 1/4	1/4-inch NPT	- -
1/2, 3/4, 1	3/4-inch NPT	1-inch flange
1-1/2, 2	1-1/2-inch NPT	1-1/2-inch flange

Note:

Flange connections match 125-150-pound ASA Standards; 1/16-inch raised face.

For sizing flowmeters with type 316 stainless steel floats, when the required flow is of liquid (density 1.0 g/cc), or of gas (sp gr of air and at 14.7 psia and 70 F) the capacity table may be entered directly.

For meters with Tri-Flat tubes, sizes 1/16-, 1/8-, and 1/4-inch, follow the sizing procedure

LIQUID CONVERSION

$$\text{gpm H}_2\text{O} = \text{gpm} \sqrt{\frac{7.02 \times \rho}{\rho_f - \rho}}$$

or

$$\text{gpm H}_2\text{O} = \frac{\text{lbs/min}}{8.33 \times \rho} \sqrt{\frac{7.02 \times \rho}{\rho_f - \rho}}$$

where:

gpm = desired maximum flow rate in gpm

lbs/min = desired maximum flow rate in pounds per minute

ρ_f = density of the float required for the application and selected from the following list

316 stainless steel = 8.02

Hastelloy C = 8.94

Nickel = 8.91

Monel = 8.84

ρ = fluid density, g/cc at operating conditions

gpm H₂O = equivalent flow rate in gpm H₂O

SIZING

outlined in the Fischer & Porter Tri-Flat Variable-Area Flowmeter Handbook.

The conversion equations shown below permit the capacity tables to be used for other operating conditions, and apply to meters with tube sizes of 1/2-, 3/4-, 1-, 1-1/2-, and 2-inch.

GAS CONVERSION

$$\text{scfm air at 14.7 psia and 70 F} = \text{scfm} \sqrt{\frac{\text{sp gr} \times 14.7 \times T_{op} \times 8.02}{1.0 \times P_{op} \times 530 \times \rho_f}}$$

or

$$\text{scfm air at 14.7 psia and 70 F} = \text{lbs/min} \times 13.34 \sqrt{\frac{1.0 \times 14.7 \times T_{op} \times 8.02}{\text{sp gr} \times P_{op} \times 530 \times \rho_f}}$$

where:

scfm = desired maximum flow rate in scfm

sp gr = specific gravity of gas at standard temperature and pressure, referred to air at standard temperature and pressure (14.7 psia and 70 F)

T_{op} = absolute temperature, (460 + °F) at operating pressure

P_{op} = absolute pressure in psia at operating conditions

scfm air = equivalent flow rate in scfm of air at 14.7 psia and 70 F

OPERATIONAL LIMITS

Glass Tube Pressure Limitations: Under normal conditions the pressures listed have a reasonable factor of safety. Glass tubes are not recommended for either hot or strong alkalis, fluorine, hydrofluoric acid or steam.

Maximum recommended temperature 250 F with Buna N or Butyl o-rings, 350 F with Kel-F o-rings and 400 F with Viton o-rings.

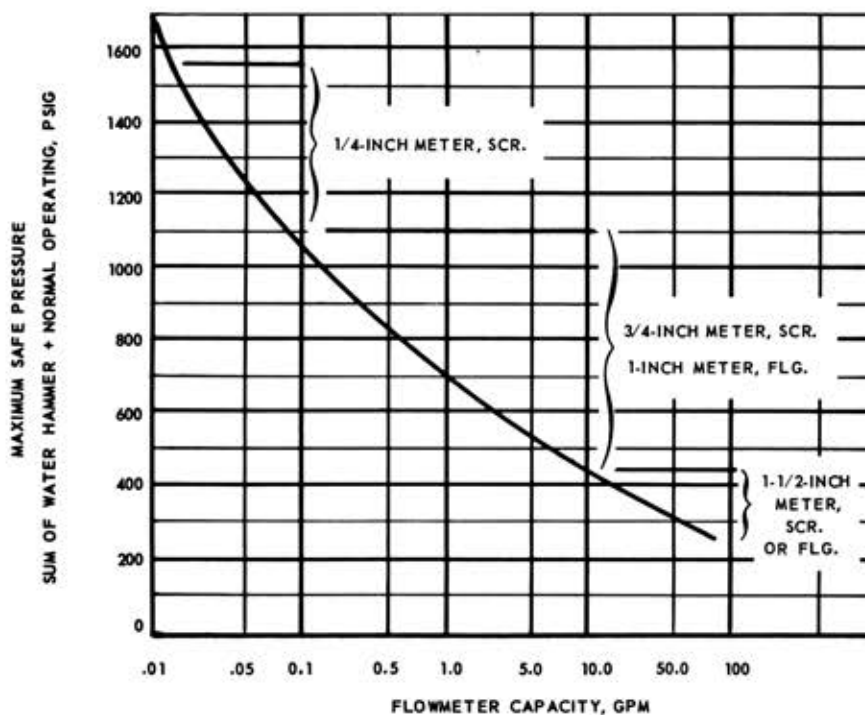
Minimum recommended temperature 32 F.

Tube Size	Max. Safe Static Working Pressure, psig @ 200 F	
1/16	560	Standard Borosilicate Glass
1/8	490	
1/4	430	
1/2	600	Tempered Borosilicate Glass
3/4	440	
1	325	
1-1/2	230	
2	150	

1) Sizes 1/16- to 3/4-inch; maximum pressure rating does not decrease with increasing temperature.

2) Sizes 1- to 2-inch; decrease pressure rating by 1 per cent each 4 F increase in operating temperature above 200 F.

WATER HAMMER



Maximum tube pressure due to water hammer surge is determined by the following formula:

$$P = P_s + 64V$$

where:

P = maximum tube pressure due to water hammer surge, psig

P_s = operating static pressure, psig

V = velocity of fluid prior to valve closure, feet/sec

For schedule 40 steel pipe:

1/4-inch	V = 3.08 x gpm
1/2-inch	V = 1.06 x gpm
3/4-inch	V = 0.60 x gpm
1-inch	V = 0.37 x gpm
1-1/2-inch	V = 0.16 x gpm
2-inch	V = 0.10 x gpm

CAPACITIES

Tube Size (Inches)	Maximum Flow Rate		Tri-Flat Tube	Ball Float	ΔP Float -inch H ₂ O
	cc/min H ₂ O $\rho = 1.0 \text{ g/cc}$ visc = 1 cps	scc/min Air @ 14.7 psia & 70 F			
1/16	1.05	75	FP - 1/16" - 10 - G - 5	1/16" - SA	0.17
	1.37	83.3	FP - 1/16" - 08 - G - 5	1/16" - SS	0.33
	1.81	122	FP - 1/16" - 12 - G - 5	1/16" - SA	0.17
	2.46	136	FP - 1/16" - 10 - G - 5	1/16" - SS	0.33
	3.20	196	FP - 1/16" - 16 - G - 5	1/16" - SA	0.17
	4.82	271	FP - 1/16" - 20 - G - 5	1/16" - SA	0.17
	7.20	315	FP - 1/16" - 16 - G - 5	1/16" - SS	0.33
	8.40	332 *	FP - 1/16" - 12 - G - 5	1/16" - TA	0.68
	10.30	426	FP - 1/16" - 20 - G - 5	1/16" - SS	0.33
	13.50	510 *	FP - 1/16" - 16 - G - 5	1/16" - TA	0.68
18.60	681 *	FP - 1/16" - 20 - G - 5	1/16" - TA	0.68	
1/8	23.0	960	FP - 1/8" - 12 - G - 5	1/8" - SA	0.33
	35.7	1,420	FP - 1/8" - 16 - G - 5	1/8" - SA	0.33
	48.5	1,910	FP - 1/8" - 20 - G - 5	1/8" - SA	0.33
	64.5	2,480	FP - 1/8" - 25 - G - 5	1/8" - SA	0.33
	81.0	2,860	FP - 1/8" - 20 - G - 5	1/8" - SS	0.66
	97.5	3,270 *	FP - 1/8" - 16 - G - 5	1/8" - TA	1.37
	107.0	3,660	FP - 1/8" - 25 - G - 5	1/8" - SS	0.66
	130.0	4,325 *	FP - 1/8" - 20 - G - 5	1/8" - TA	1.37
	171.5	5,580 *	FP - 1/8" - 25 - G - 5	1/8" - TA	1.37
	1/4	151.0	6,950	FP - 1/4" - 16 - G - 5	1/4" - CD
203.0		9,100	FP - 1/4" - 20 - G - 5	1/4" - CD	0.37
268.0		11,750	FP - 1/4" - 25 - G - 5	1/4" - CD	0.37
415.0		14,100	FP - 1/4" - 16 - G - 5	1/4" - SS	1.32
547.0		18,400	FP - 1/4" - 20 - G - 5	1/4" - SS	1.32
703.0		23,400	FP - 1/4" - 25 - G - 5	1/4" - SS	1.32
860.0		27,600 *	FP - 1/4" - 20 - G - 5	1/4" - TA	2.73
1,105.0		35,200 *	FP - 1/4" - 25 - G - 5	1/4" - TA	2.73

Key to ball float nomenclature:

SA = sapphire CD = black glass SS = stainless steel TA = tantalum

*Tantalum floats not recommended for gas service where pressure is below 2 psig.

CAPACITIES (continued)

Tube Size (Inches)	Maximum Flow Rate		Bead Guide (G) or Plain Glass (P) Tube	Float Nomenclature	ΔP -inch H ₂ O (1)	V.I.C. (2)	Min. psia for gas service (3)
	gpm H ₂ O $\rho = 1.0$ g/cc visc = 1 cps	scfm Air @ 14.7 psia & 70 F					
1/2	0.270	1.12	FP - 1/2" - 17 - G - 10	1/2" - GUSVT - 40	0.8	2.9	5.5
	0.315	1.30	FP - 1/2" - 21 - G - 10	1/2" - GUSVT - 40	0.8	2.9	3.5
	0.425	1.74	FP - 1/2" - 27 - G - 10	1/2" - GUSVT - 40	0.8	2.9	2.7
	0.620	2.55	FP - 1/2" - 21 - G - 10	1/2" - GSVT - 45	2.3	5.1	11.5
	0.810	3.35	FP - 1/2" - 27 - G - 10	1/2" - GSVT - 45	2.4	5.1	8.4
	1.12	4.60	FP - 1/2" - 27 - G - 10	1/2" - GSVT - 44	4.6	7.1	16.2
3/4	1.19	4.90	FP - 1/2" - 27 - G - 10	1/2" - GSVT - 48	5.2	7.6	18.6
	1.52	6.25	FP - 1/2" - 27 - G - 10	1/2" - GNSVT - 48	5.8	1.1	18.6
	1.96	8.0	FP - 3/4" - 21 - G - 10	3/4" - GSVT - 54	3.8	10.4	13.9
	2.70	11.0	FP - 3/4" - 27 - G - 10	3/4" - GSVT - 54	4.4	10.4	9.6
	3.55	14.6	FP - 3/4" - 27 - G - 10	3/4" - GNSVT - 54	5.4	1.6	9.6
	3.85	15.8	FP - 3/4" - 27 - G - 10	3/4" - GSVT - 56	9.0	14.9	19.8
1	5.05	20.8	FP - 3/4" - 27 - G - 10	3/4" - GNSVT - 56	10.9	2.2	19.8
	4.70	19.2	FP - 1" - 27 - G - 10	1" - GSVT - 64	7.6	14.8	11.5
	6.30	26.0	FP - 1" - 27 - G - 10	1" - GNSVT - 64	10.4	2.2	11.5
	6.60	27.0	FP - 1" - 35 - G - 10	1" - GSVT - 64	11.1	14.8	6.8
	7.50	31.0	FP - 1" - 35 - G - 10	1" - GSVT - 65	14.3	16.9	8.9
	8.80	36.0	FP - 1" - 35 - G - 10	1" - GNSVT - 64	16.6	2.2	6.8
1-1/2	10.0	41.0	FP - 1" - 35 - G - 10	1" - GNSVT - 65	21.4	2.5	8.9
	11.0	45.1	FP - 1" - 35 - G - 10	1" - GSVT - 66	28.4	8.5	13.4
	12.0	49.4	FP - 1" - 35 - G - 10	1" - GNSVT - 66	31.9	1.5	13.4
	13.4	55.0	FP - 1-1/2" - 27 - G - 10	1-1/2" - GSVT - 84	7.9	27.6	15.4
2	15.4	63.5	FP - 1-1/2" - 27 - G - 10	1-1/2" - GSVT - 85	10.6	33.0	22.0
	17.6	72.0	FP - 1-1/2" - 27 - G - 10	1-1/2" - GNSVT - 84	8.8	4.2	15.4
	20.4	84.0	FP - 1-1/2" - 27 - G - 10	1-1/2" - GNSVT - 85	11.8	5.0	22.0
	26.5	110.0	FP - 2" - 27 - G - 10	2" - GSVT - 94	12.4	26.5	16.4
2	35.0	144.0	FP - 2" - 27 - G - 10	2" - GSVT - 96	19.8	18.5	21.2
	41.0	169.0	FP - 2" - 27 - G - 10	2" - GNSVT - 96	22.2	3.3	21.2

Notes:

- 1) Pressure drop is total pressure loss across the meter.
- 2) Meter is unaffected by viscosity when the value of $\text{cps}/\sqrt{\rho}$ (using operating density in g/cc and viscosity in centipoises) is less than V.I.C. (viscosity immunity ceiling). V.I.C. is applicable to liquids only; all gas flows fall below Viscosity Immunity Ceiling.
- 3) Meters not recommended for gas service where pressure is below minimum shown. For such applications see low pressure drop capacity table. A flow throttling valve close coupled to meter outlet is recommended for all gas applications.

LOW PRESSURE DROP DESIGN

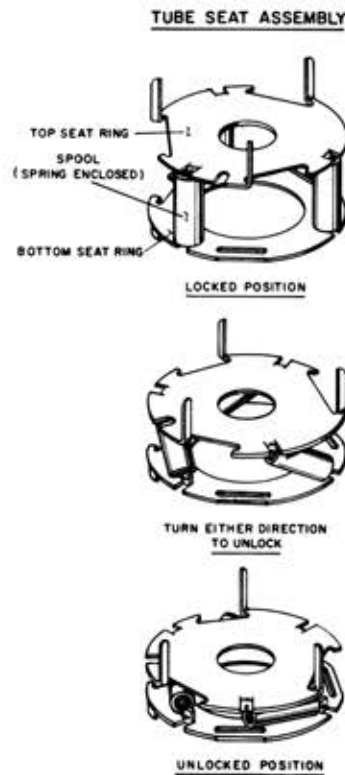
Note: Capacities are not necessarily listed in order of increasing flow rate

Tube Size (Inches)	Maximum Capacities & Pressure Drops				Bead Guide (G)	Float Nomenclature	V.I.C. (1)	Min. psia for gas service (2)
	Maximum gpm H ₂ O	ΔP Across Meter Inch-H ₂ O	Maximum scfm Air	ΔP Across Meter Inch-H ₂ O				
1/2	.198	.53	.80	.45	FP-1/2" - 17-G-10	1/2-GUSVT-410	2.2	3.6
	.238	.53	.98	.45	FP-1/2" - 21-G-10	1/2-GUSVT-410	2.2	3.6
	.324	.58	1.34	.50	FP-1/2" - 27-G-10	1/2-GUSVT-410	2.2	3.6
3/4	.633	.60	2.62	.55	FP-3/4" - 21-G-10	3/4-GUSVT-510	3.3	3.1
	.860	.71	3.54	.67	FP-3/4" - 27-G-10	3/4-GUSVT-510	3.3	1.5
1	1.36	1.28	5.60	1.05	FP-1" - 27-G-10	1-GUSVT-611	4.0	1.0
	1.88	1.83	7.80	1.45	FP-1" - 35-G-10	1-GUSVT-611	4.0	.75
	2.90	5.47	12.1	4.65	FP-1" - 27-G-10	1-GUSVT-610	8.6	4.5
	4.05	7.97	16.8	6.61	FP-1" - 35-G-10	1-GUSVT-610	8.6	3.4
1-1/2	2.60	.92	10.8	.79	FP-1-1/2" - 21-G-10	1-1/2-GUSVT-812	6.5	1.0
	3.50	1.24	14.4	.97	FP-1-1/2" - 27-G-10	1-1/2-GUSVT-812	6.5	1.0
	6.50	5.75	27.0	4.96	FP-1-1/2" - 21-G-10	1-1/2-GUSVT-810	16.2	6.8
	8.70	7.20	36.0	6.00	FP-1-1/2" - 27-G-10	1-1/2-GUSVT-810	16.2	6.8
2	6.20	1.65	25.8	1.31	FP-2" - 27-G-10	2-GUSVT-911	8.9	1.0
	15.40	9.00	63.5	7.34	FP-2" - 27-G-10	2-GUSVT-912	22.0	6.2

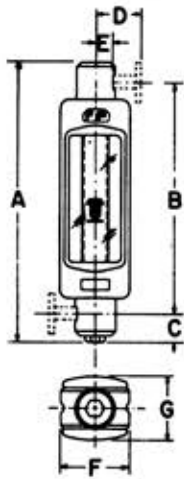
Notes:

- 1) Meter is unaffected by viscosity when the value of $\text{cps}/\sqrt{\rho}$ (using operating density in g/cc and viscosity in centipoises) is less than V.I.C. (viscosity immunity ceiling). V.I.C. is applicable to liquids only; all gas flows fall below Viscosity Immunity Ceiling.
- 2) Meters not recommended for gas service where pressure is below minimum shown.

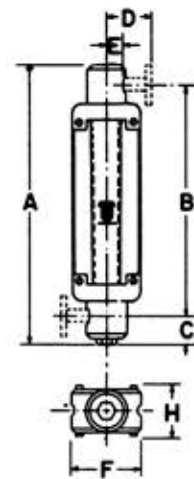
TYPICAL 10A2700C SERIES FLOWRATOR METER



DIMENSIONS



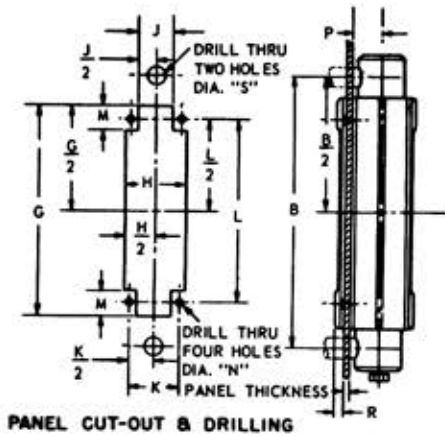
METER SIZE	1/16, 1/8, 1/4	3/4, 1	1-1/2, 2
CONNECTION SIZE & TYPE	1/4-INCH SCREWED	3/4-INCH SCRD 1-INCH FLGD	1-1/2-INCH SCRD 1-1/2-INCH FLGD
SCALE LENGTH	5-INCH	10-INCH	10-INCH
A	13	20	24-5/16
B	11	17-1/2	20-1/2
C	1-1/8	1-9/16	2-1/16
D	-	4	5
E	17/32	1	1-3/4
F	2-3/16	3-1/4	5-1/4
G	2-3/16	3	4-7/8
H	1-3/4	2-5/8	4-1/4



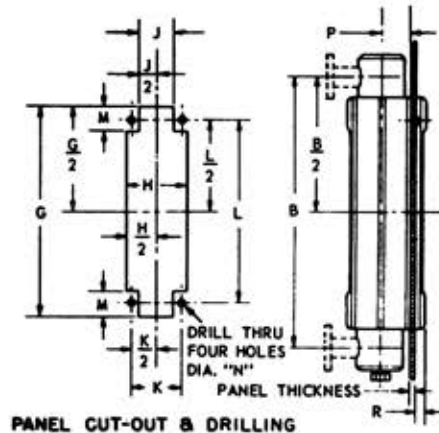
All dimensions in inches

MODEL 10A2735C (Screwed)
MODEL 10A2736C (Flanged)
STANDARD ENCLOSURE

MODEL 10A2775C (Screwed)
MODEL 10A2776C (Flanged)
SIDE PLATE ENCLOSURE



PANEL CUT-OUT & DRILLING



PANEL CUT-OUT & DRILLING

(Meter may be mounted against white background without cutout when supported by piping.)

10A2735C and 10A2775C

SURFACE MOUNTING

10A2735C, 10A2736C,
10A2775C and 10A2776C

FLUSH MOUNTING

METER SIZE (Inch)	CONNECTION SIZE (Inch)	B	G	H	J	K	L	M	N	P	R	S
1/16, 1/8, 1/4	1/4	11	8-7/8	1-15/16	1-3/32	1-15/32	7-7/8	13/16	1/4	7/8	7/16	5/8
3/4, 1	3/4	17-1/2	14	2-15/16	1-31/32	2-13/32	12-3/4	29/32	5/16	1-3/16	9/16	1-1/8
1-1/2, 2	1-1/2	20-1/2	14-5/8	4-11/16	3-13/32	4-1/32	13	1-3/16	7/16	1-15/16	13/16	2

TYPICAL SPECIFICATIONS

The flowmeter shall be of the variable-area type, with borosilicate glass meter tubing and (material) o-ring seals. The tube shall be easily removable from meter without taking meter from the pipe line. The meter end fittings shall be fully rotatable through 360° for ease of installation.

The meter shall have (material) end fittings and (material) metering float. The meter shall be sized for a flow range of (specify flow range and units) of (specify fluid) metered at (specify temperature and pressure). Maximum temperature and pressure shall be (specify).

STANDARD MODELS

Enclosed Design

Model	Connection Type
10A2735C	Horizontal Screwed
10A2736C	Horizontal Flanged

Side Plate Design

Model	Connection Type
10A2775C	Horizontal Screwed
10A2776C	Horizontal Flanged

Lucite Shield Design

Model	Connection Type
10A2765C	Horizontal Screwed
10A2766C	Horizontal Flanged

ACCESSORIES

Illumination (L): non-explosion proof lighting fixture or explosion proof lighting fixture is available for illuminating the metering elements. Fixtures do not mount on meter frames.

Steam Tracing (J): single steam tube available, suitable for 120 psi saturated steam.

Tripod Base (B): available in all sizes for portable bench or table top use.

Hose Connectors (H): available in brass or stainless steel for all sizes. For use where meter is to be used with soft flexible hose and hose clamps. Use (D) when both tripod base and hose connectors are desired.

Panel Mounting (M)

Note: Model number is completed by adding the appropriate letter as determined by the required accessories. When no accessories are required, the letter "A" should be added.

ORDERING INFORMATION

To eliminate any delays in processing orders and to insure prompt delivery, the following items must be specified:

Model number

Meter size

Materials of construction

Fittings

Float

O-rings

Type of scale

Accuracy desired

Accessories (if panel mounted, specify whether flush or surface, and panel thickness)

Operating conditions

Fluid to be metered

Maximum flow rate

Fluid density and viscosity at operating conditions

Allowable pressure drop

Operating and maximum temperature

Operating and maximum pressure



FISCHER & PORTER COMPANY

GENERAL OFFICES: WARMINSTER, PENNSYLVANIA, U.S.A.

A world-wide control instrument company with manufacturing plants in Australia, Canada, England, France, W. Germany, Italy, Mexico, The Netherlands, Spain and the U.S.A.