

# ARMORED FLOWRATOR METER

## MODEL 10A1152

The Model 10A1152 Armored Flowrator Meter is a metal tube variable-area flowmeter for liquid or gas applications where process or operating conditions make all-metal construction desirable. The meter is manufactured of various materials of construction, and with 150 or 300 lb. flange connections. An extension with indicating scale is bolted to the meter to indicate the float position; for description refer to Specification 55EM1000. Standard extensions are also available for transmitting, recording, and controlling functions.



10A1152-55EM1010

### MATERIALS OF CONSTRUCTION (✓ = optional)

#### TUBES

- Stainless steel
- ✓ Nickel
- ✓ Steel
- ✓ Monel
- ✓ Everdur
- ✓ Alloy 20
- ✓ Hastelloy<sup>a</sup>

#### FLOATS

- Stainless steel
- ✓ Brass
- ✓ Nickel
- ✓ Monel
- ✓ Alloy 20
- ✓ Hastelloy

#### FITTINGS

- Steel
- Stainless steel
- ✓ Everdur
- ✓ Nickel
- ✓ Monel
- ✓ Alloy 20
- ✓ Hastelloy

### SCALES

Length – 5 inches

Type – Percentage or direct reading on extension or instrument.

### PERFORMANCE

#### ACCURACY

- ±2% of maximum flow rate, standard.
- ±1% of maximum flow rate, optional.

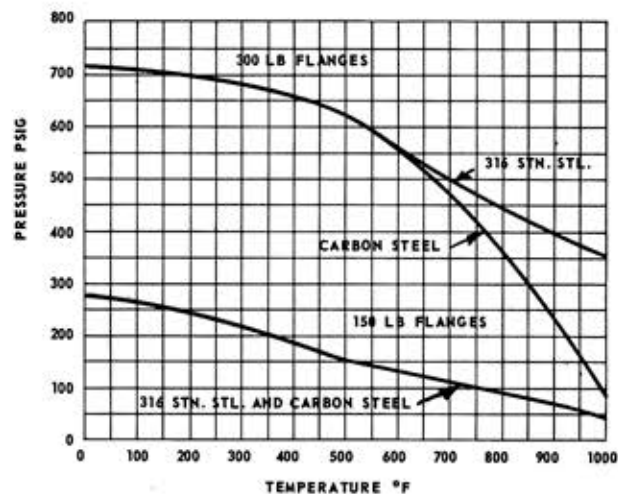
#### RANGEABILITY

12-1/2 to 1

### MOUNTING

Pipe mounted in line

### OPERATIONAL LIMITS



### CONNECTIONS

METER SIZE	CONNECTION SIZE (Inches)	
	Standard & Thermonized	Steam Jacketed
4 to 6	1	2
8	1-1/2	3
9	2	3
11	3	4



## CAPACITIES

Magnabond Coupled Pneumatic Transmitting Meters (OK), Model 10A1151-10A1152 - 1401KA41 and Indicator/Recorders, Model 10A1151-10A1152 - 1100 Series

Meter Size	Metering Tube	Float Shape	MAXIMUM FLOW RATES (1)			Pressure Drop Factor (3)	V. I. C. Factor (4)	Min. psia Factor (5)
			GPM H <sub>2</sub> O	SCFM Air @ 14.7 psia x 70 F	SCFM Air @ 14.7 psia x 70 F (2)			
4	M4-13-5	SV	1.70 - 2.21	6.99 - 9.02	5.20 - 6.74	1170	12.2	450
	M4-20-5	SV	2.55 - 3.32	10.50 - 13.70	7.83 - 10.5	622	8.75	282
		NSV	3.50 - 3.81	14.40 - 15.70	10.7 - 14.4	361	0.95	146
	M4-26-5	SV	3.81 - 4.95	15.70 - 20.40	11.7 - 15.7	313	5.82	66
		NSV	5.15 - 5.70	21.20 - 23.50	16.0 - 21.5	195	0.64	36
	M4-35-5	SV	5.70 - 7.42	23.50 - 30.60	17.5 - 23.6	172	3.88	17.0
NSV		7.88 - 10.20	32.40 - 42.00	24.2 - 32.6	119	0.42	8.8	
5	M5-25-5	SV	6.34 - 8.45	26.10 - 34.80	21.0 - 26.0	66.9	3.98	11.2
		NSV	8.65 - 10.20	35.60 - 42.00	28.7 - 32.6	44.6	0.44	6.0
	M5-35-5	SV	10.20 - 13.60	42.00 - 56.00	32.6 - 40.4	38.2	2.56	4.0
		NSV	14.50 - 18.20	59.70 - 75.00	45.1 - 55.8	29.0	0.26	2.1
6	M6-35-5	SV	13.60 - 18.40	56.00 - 75.80	47.4 - 55.7	15.0	2.01	1.5
		NSV	18.78 - 25.40	77.50 - 104.8	65.5 - 77.0	11.2	0.21	0.80
8	M8-27-5	SV	18.85 - 27.40	77.70 - 113.0		4.8	1.96	0.49
	M8-35-5	SV	27.40 - 38.30	113.0 - 157.5		3.1	1.38	0.23
		NSV	38.30 - 54.00	157.5 - 222.5		2.3	0.15	0.12
9	M9-35-5	SV	50.1 - 71.4	206.5 - 294.0		0.90	1.03	0.07
		NSV	71.8 - 98.4	294.0 - 405.0		0.66	0.11	0.03
11	M11-24-5	SV	73.8 - 105.0	304.0 - 432.0		0.34	1.12	0.07
		NSV	105.0 - 142.0	432.0 - 585.0		0.22	0.12	0.04
	M11-35-5	SV	120.0 - 195.0	494.0 - 700.0		0.17	0.69	0.01
		NSV	170.0 - 270.0	700.0 - 1100.0		0.11	0.07	0.005

### NOTES:

- Maximum flow rate may be specified for any value between limits shown for each tube-float combination. (The float weight is varied to match the capacity specified.)
- Capacities indicated have K2 magnets and are limited to transmitting functions only. Where controller and/or integrator or transmitting recorders are required, use pneumatic transmitter and pneumatic receiving unit with required functions.
- Total pressure loss across the meter, inches of water, is

$$\left( \frac{\text{gpm H}_2\text{O}}{10} \right)^2 \times \left( \frac{\rho_f - \rho}{7.02} \right) \times (\text{factor}), \text{ where } \rho \text{ is operating density in g/cc.}$$

- 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  $(\text{gpm H}_2\text{O}) \times (\text{V.I.C. factor})$ , the Viscosity Immunity Ceiling. V.I.C. is applicable to liquids only; all gas flows fall below the Viscosity Immunity Ceiling.
- Meters not recommended for gas service where operating pressure in psia is less than  $\left( \frac{\text{scfm}}{10} \right)^2 \times (\text{factor})$ . This minimum pressure is based on close coupling the throttling valve to the meter outlet.

**CAPACITIES**

Indicating Meters (OM), Model 10A1151-10A1152-55EM1000

Electronic Transmitting Meters (OG), Model 10A1151-10A1152-50G1000

Ratolarm Meters (OA), Model 10A1151-10A1152-55AR1000

Electrical Transmitting Meters (OL), Model 10A1151-10A1152-50L1000

Indicating Ratolarm Meters (OM-OA), Model 10A1151-10A1152-55AR1000-55EM1000

Meter Size	Metering Tube	Float Shape	MAXIMUM FLOW RATES (1)							Pressure Drop Factor (3)	V.I.C. Factor (4)	Min. psia Factor (5)
			Indicating (OM)		Electronic Transmitter (OG) & Ratolarm (OA)		Electrical Transmitter (OL)		(OM-OA) Indicator Alarm			
			GPM H <sub>2</sub> O	SCFM Air	GPM H <sub>2</sub> O	SCFM Air	GPM H <sub>2</sub> O	SCFM Air	GPM H <sub>2</sub> O			
4	M4-13-5	SV	1.26 to 1.67	5.08 to 6.86	1.08 to 1.23	4.48 to 5.07	1.78 to 1.92	7.32 to 7.88	1.61 to 1.85	1170.	12.2	450.
	M4-20-5	SV	1.88 to 2.51	7.75 to 10.35	1.63 to 1.86	6.71 to 7.65	2.67 to 2.89	11.00 to 11.90	2.41 to 2.78	622.	8.75	282.
		NSV	2.58 to 2.81	10.62 to 11.59	2.23 to 2.43	9.19 to 10.00	3.66 to 3.96	15.08 to 16.31	3.31 to 3.61	361.	0.95	146.
	M4-26-5	SV	2.81 to 3.75	11.59 to 15.45	2.43 to 2.77	10.00 to 11.40	3.96 to 4.31	16.31 to 17.77	3.61 to 4.16	313.	5.82	66.
		NSV	3.80 to 4.20	15.65 to 17.30	3.34 to 3.64	13.70 to 15.00	5.39 to 5.82	22.20 to 24.00	4.88 to 5.40	195.	0.64	36.
	M4-35-5	SV	4.20 to 5.60	17.30 to 23.05	3.64 to 4.15	15.00 to 17.10	5.91 to 6.46	24.35 to 26.60	5.40 to 6.20	172.	3.88	17.0
NSV		5.81 to 7.51	23.90 to 30.90	5.04 to 5.75	20.80 to 23.70	8.26 to 8.95	34.00 to 36.90	7.45 to 8.34	119.	0.42	8.8	
5	M5-25-5	SV	5.05 to 7.05	20.80 to 29.05	4.64 to 6.04	19.12 to 24.90	6.56 to 7.75	27.00 to 31.90	6.16 to 7.62	66.9	3.98	11.2
		NSV	7.05 to 7.87	29.05 to 32.40	6.35 to 7.21	26.15 to 29.70	8.98 to 10.20	37.00 to 42.00	8.60 to 8.75	44.6	0.44	6.0
	M5-35-5	SV	7.87 to 11.00	32.40 to 45.30	7.21 to 9.39	29.70 to 38.60	10.20 to 12.05	42.00 to 49.70	9.88 to 12.21	38.2	2.56	4.0
		NSV	11.40 to 15.15	47.00 to 62.40	9.95 to 13.00	41.00 to 53.50	14.10 to 16.62	58.10 to 68.40	14.07 to 16.32	29.0	0.26	2.1
6	M6-35-5	SV	11.41 to 16.00	47.00 to 65.90	10.67 to 14.21	44.00 to 58.60	13.98 to 17.12	57.60 to 70.60	13.25 to 17.65	15.0	2.01	1.5
		NSV	16.00 to 22.10	65.90 to 91.00	16.60 to 19.65	60.70 to 81.00	19.30 to 23.7	79.50 to 97.6	19.65 to 23.60	11.2	0.21	0.80
8	M8-27-5	SV	17.50 to 25.60	72.1 to 105.8	16.60 to 24.50	68.40 to 101.0	19.10 to 26.40	78.60 to 108.8	18.90 to 26.60	4.8	1.96	0.49
	M8-35-5	SV	25.60 to 36.20	105.8 to 149.3	23.55 to 34.70	97.20 to 143.5	27.10 to 37.4	111.8 to 154.0	27.70 to 37.60	3.1	1.38	0.23
		NSV	36.20 to 50.20	149.3 to 207.0	34.70 to 48.3	143.5 to 199.0	37.4 to 52.0	154.0 to 214.0	39.10 to 52.20	2.3	0.15	0.12
9	M9-35-5	SV	48.30 to 68.80	199.0 to 283.00	47.00 to 67.10	194.0 to 276.0	50.5 to 70.5	208.0 to 290.0	51.30 to 71.00	.90	1.03	0.07
		NSV	68.80 to 95.50	283.0 to 395.00	67.10 to 93.0	276.0 to 383.0	70.5 to 97.9	290.0 to 403.0	73.10 to 98.60	.66	0.11	0.03
11	M11-24-5	SV	72.5 to 104.0	299.0 to 429.0	72.5 to 104.0	298.5 to 428.0	74.0 to 105.0	305.0 to 432.5	73.80 to 105.0	.34	1.12	0.07
		NSV	104.0 to 145.0	429.0 to 597.0	104.0 to 117.0	428.0 to 482.0	105.0 to 143.0	432.5 to 589.0	105.0 to 142.0	.22	0.12	0.04
	M11-35-5	SV	117.5 to 169.0	485.0 to 697.0	117.0 to 172.0	482.0 to 710.0	120.0 to 171.0	495.0 to 704.0	120.0 to 170.0	.17	0.69	0.01
		NSV	169.0 to 240.0	697.0 to 990.0	172.0 to 237.0	710.0 to 978.0	171.0 to 241.5	704.0 to 995.0	170.0 to 242.0	.11	0.07	0.005

**CAPACITIES**

**LOW PRESSURE DROP METERS**

Magnabond Coupled Pneumatic Transmitting Meters (OK), Model 10A1151-10A1152-1401KA41  
 Magnabond Coupled Recorders (OK), Model 10A1151-10A1152-1102KA02

Meter Size	Metering Tube	Float Shape	MAXIMUM FLOW RATES (1)				Pressure Drop Factor (3)	V. I. C. Factor (4)	Min. psia Factor (5)
			10A1152OK - 1401		10A1152OK - 1102				
			GPM H <sub>2</sub> O	SCFM Air	GPM H <sub>2</sub> O	SCFM Air			
4	M4-13-5	USV	1.16 - 1.70	4.79 - 7.0	1.22 - 1.76	5.04 - 7.26	1264	10.8	491
	M4-20-5	USV	1.72 - 2.44	7.10 - 10.0	1.78 - 2.52	7.35 - 10.4	660	7.77	305
	M4-26-5	USV	2.48 - 3.50	10.2 - 14.4	2.57 - 3.62	10.6 - 14.9	344	5.31	76.0
	M4-35-5	USV	3.56 - 4.25	14.7 - 17.5	3.69 - 4.40	15.2 - 18.1	194	3.71	21.3
5	M5-25-5	USV	4.33 - 6.25	17.8 - 25.8	4.47 - 6.45	18.4 - 26.6	71.7	3.58	12.4
	M5-35-5	USV	6.64 - 8.30	27.3 - 34.2	6.86 - 8.60	28.3 - 35.4	43.9	2.43	5.02
6	M6-35-5	USV	8.83 - 10.9	36.3 - 45.0	9.15 - 11.3	37.7 - 46.6	17.0	1.96	1.91
8	M8-27-5	USV	11.1 - 14.8	45.8 - 61.0	11.5 - 15.3	47.5 - 63.1	5.19	1.77	.557
	M8-35-5	USV	15.1 - 20.8	62.3 - 85.9	15.6 - 21.1	64.4 - 87.0	3.49	1.31	.281
9	M9-35-5	USV	28.6 - 34.4	118.0 - 142.0	29.2 - 34.9	120.0 - 144.0	1.03	.977	.079
11	M11-24-5	USV	42.9 - 46.8	177.0 - 193.0	43.3 - 47.0	178.0 - 194.0	.361	1.01	.073
	M11-35-5	USV	65.8 - 71.7	271.0 - 295.0	66.4 - 72.3	273.0 - 298.0	.190	.658	.013

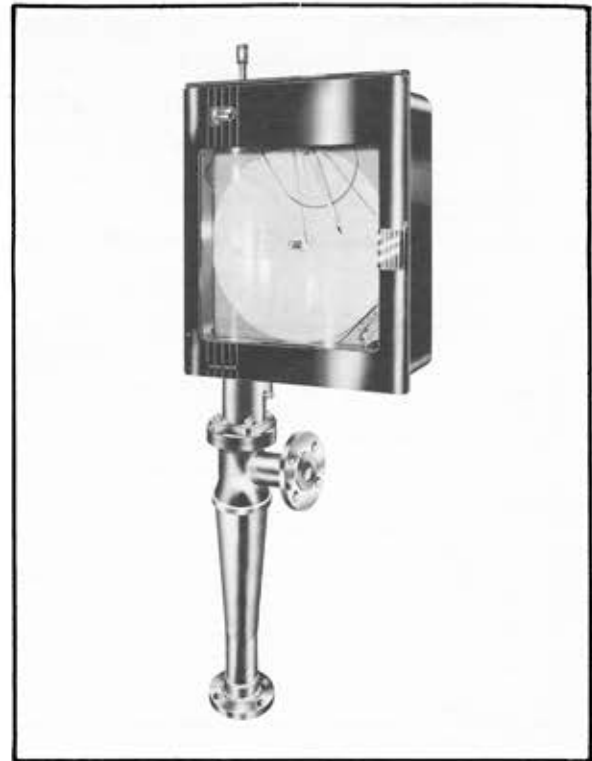
Note: Low Pressure Drop Meters are limited to transmitting and recording functions only.

Indicating Meters (OM) Model 10A1151-10A1152 - 55EM1000

Meter Size	Metering Tube	Float Shape	Maximum Flow GPM H <sub>2</sub> O SP GR 1.0	Maximum Flow SCFM Air 14.7 & 70 F	Pressure Drop Factor (3)	V. I. C. Factor (4)	Min. psia Factor (5)
4	M4-13-5	USV	1.11	4.56	1264	10.8	491
	M4-20-5	USV	1.73	7.13	660	7.77	305
	M4-26-5	USV	2.45	10.1	344	5.31	76.0
	M4-35-5	USV	3.58	14.7	194	3.71	21.3
5	M5-25-5	USV	4.26	17.5	72	3.58	12.4
	M5-35-5	USV	6.30	26.0	43.9	2.43	5.02
6	M6-35-5	USV	8.49	35.0	17.0	1.96	1.91
8	M8-27-5	USV	11.3	46.5	5.19	1.77	.557
	M8-35-5	USV	15.5	63.8	3.49	1.31	.281
9	M9-35-5	USV	29.4	121	1.03	.977	.079
11	M11-24-5	USV	40.4	167	.361	1.01	.073
	M11-35-5	USV	62.9	259	.190	.658	.013



MODEL 10A1152-1401KA41



MODEL 10A1152-1102KA02

### SIZING

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.

The conversion equations shown below permit the capacity tables to be used for other operating conditions.

#### 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

$\rho_f$  = 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

$\rho$  = fluid density, g/cc at operating conditions

gpm H<sub>2</sub>O = equivalent flow rate in gpm H<sub>2</sub>O

#### GAS CONVERSION

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

or

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

where:

scfm = desired maximum flow rate in scfm

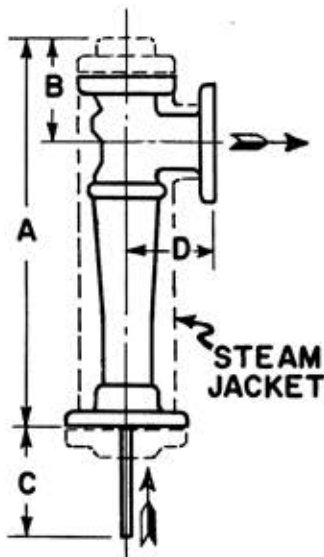
Sp Gr = specific gravity of gas at standard temperature and pressure, referred to air at standard temperature and pressure (14.7 psia and 70 F)

$T_{op}$  = 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

## DIMENSIONS



METER SIZE	DIMENSIONS (inches) common to both types of meters			STANDARD METER		STEAM JACKETED METER*			
				CONN. SIZE (inches)	D (inches)		CONN. SIZE (inches)	D (inches)	
	A	B	C		150#	300#		150#	300#
4 to 6	14-3/4	2-9/16	5-13/16	1	3-1/2	4	2	4-1/2	4-5/8
8	19-1/8	4-7/8	5-3/16	1-1/2	4	4-1/2	3	5-1/2	5-7/8
9	20-5/8	5-1/16	5-1/4	2	4-1/2	5	3	5-1/2	5-7/8
11	28-9/16	10-9/16	5-1/16	3	5-1/2	6	4	6-1/2	6-13/16

\* Steam connections are 1/2" N.P.T. on sizes 4 through 9. Size 11 steam inlet is 1" and outlet is 3/4".

### STANDARD MODELS

- 10A1152A – No accessories
- 10A1152J – Steam jacketing
- 10A1152K – Thermonizing

### UNIT WEIGHT

SIZE	MAXIMUM WEIGHT
4	7 pounds
5	7½ pounds
6	8 pounds
8	13 pounds
9	20 pounds
11	76 pounds

Add model number of extension desired:

- \_55EM1000 (OM) Magnetic Indicator
- \_1401KA41 (OK) Magnabond Indicating Transmitter
- \_1102KA02 (OK) Magnabond Recorder
- \_50L1000 (OL) Electrical Transmitter
- \_50G1000 (OG) Electronic Transmitter
- \_55EM1000-55AR1000 (OM-OA) Indicating Rotolarm

### ACCESSORIES

- Steam jacketing
- Thermonizing
- Companion flanges

### ORDERING INFORMATION

- Model Number
- Materials of construction
- Fluid measured
- Maximum flow rate
- Fluid density
- Fluid viscosity
- Operating temperature and pressure
- Accuracy
- Accessories

### TYPICAL SPECIFICATIONS

The flowmeter shall be of the variable-area type, all metal construction of high pressure, high temperature design. The meter shall have (size and rating) (vertical inlet and horizontal outlet flanged) connections. The float must be removable from the top of the meter body without removing the meter from the line.

The meter shall have (material) end fittings, (material) meter tube, (material) float with (material) float extension and (material) extension well.

The meter shall be sized for a maximum flow rate of (flow rate and units) (liquid) (gas), specific gravity (specify), viscosity (specify) metered at (temperature and pressure). Maximum temperature and pressure is (specify).

See appropriate specification sheet for desired extension, i.e., indicating, transmitting, etc.



# FISCHER & PORTER COMPANY

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

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