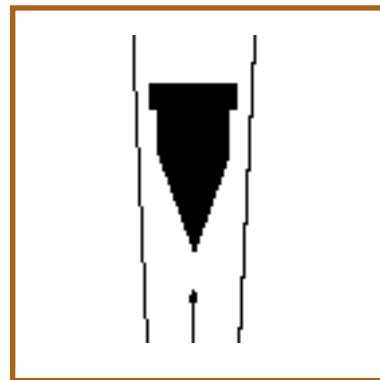


ROTAMETER® SERIES 2000 Variable-area Flowmeters



FEATURES

- ▶ Tubes and/or floats simply replaced without loss of calibration
- ▶ Quick-release tubes
- ▶ Wide range of liquids or gases
- ▶ Custom-made flow scales
- ▶ Individual calibration available to accuracy Class 1.6 (VDI/VDE 3513)



Series 2000 VA (variable-area) flowmeters are general purpose glass tube instruments for non-corrosive applications.

Description of operation

Glass tube VA meters have an internal taper over the full working length of the tube with the wider end at the top. The working fluid, flowing up the tube, causes a float within the tube to settle at a point where its mass is just balanced by the upward forces due to flow through the annulus between float and tube. The greater the flow the higher the float must rise to create a larger annulus. Float position is read off against a scale calibrated in flow rate units.

Introduction

Series 2000 units incorporate standard, interchangeable tubes and floats. Either or both components can be replaced without loss of calibration accuracy beyond the limits set out in the table on page 3.

Tubes can be removed easily for cleaning or replacement without disconnecting the instrument from the pipeline. Uncalibrated instruments are supplied with calibration charts for air or water flows at standard pressure and temperatures.

Flow scales are custom made and predicted from experimental data. They can be individually calibrated to an accuracy of Class 1.6 (VDI/VDE 3513) i.e. $\pm 1.2\%$ of indicated flow $\pm 0.4\%$ full scale reading.

Construction

The chassis is a mild steel channel with welded end plates, through which the connections are secured. The metering tube is held in a simple, quick release fixing and sealed with internal 'O' rings in Viton 'A' or nitrile rubber. The flow scales are pivoted to allow access to the metering tube and accessories. The front of the instrument is protected by a perspex dust cover.

For flush panel mounting, the chassis is designed to allow access to the tube through the panel cut-out and the instrument is supplied with a black bezel with quick release fasteners.

Tubes

Metering tubes are made from borosilicate glass and are fully annealed and stress relieved. There are eight basic sizes of tube, supplemented by the eight 'X' series, which use the same sizes of float as the basic series but give intermediate capacities.

The tubes have both ends expanded to a common and precise internal diameter to suit British Standard 'O' rings. Each tube is identified by the size number and the suffix 'E' e.g. 18E or 18XE.

A millimetre scale is fired on to each tube and the separate scale plate may be related to this.

Temperature rating The maximum working temperature is 100°C

Pressure rating The maximum working pressure for liquid service is given in the table below.

N.B. For gas flows, these ratings must be reduced by a factor of 4.

If polycarbonate safety cover is fitted in place of the perspex cover a factor of 2 may be used.

Connections

The standard end connections are internally screwed B.S.P. taper in gunmetal but stainless steel is available to special order. The thread sizes are given in the table below.

Tube size	7X-14	18X-24	35X-47	65X, 65
B.S.P. taper	1/2 in.	1 in.	1 1/2 in.	2 in.

Screwed union connections in brass can also be supplied. The instrument then becomes Type 2025. Thread sizes are given in the table below.

Tube size	7X-14	18X-24	35X-47	65X, 65
B.S.P. taper	1/2 in.	3/4 in.	1 in.	1 1/2 in.

Alternative threads can be supplied to special order.

Floats

All sizes of float are available in the following materials:

Type S

Stainless Steel 316.S16 for use with most liquids.

Type A

Anodised Aluminium alloy, for non-corrosive gases.

Type K

Korannite, a low density ceramic material for corrosive liquids and gases.

Flow Scales

Separate, printed scale plates are related to the millimetre reference scale and are easily interchanged, enabling the instrument to be converted for use on other fluids.

Tube sizes	7X, 7	10X, 10	14X, 14	18X, 18	24X, 24	35X, 35	47X, 47	65X, 65
Max. working pressure bar.	11.2	10.0	10.0	10.0	8.5	7.0	6.0	4.5

Flow Capacities

The nominal flow capacity of each tube and float combination is shown in the table below. The flows are given in litres per minute, with liquids at 20°C and gases at 15°C/1013 mbar abs.

NOTE: Printed scale plates closely follow BS. 3693: 1964, "The design of scales and indexes". The maximum scale value will be taken to the nearest convenient and rational flow rate within the capacity of each instrument and

this may not exactly correspond with the nominal values quoted in the table. The minimum scale value is normally approximately 10% of the maximum.

Tube Sizes	7X	7	10X	10	14X	14	18X	18	24X	24	35X	35	47X	47	65X	65
Float Type 'S'																
Water	0.8	1.0	1.5	2.0	3.0	5.0	8.0	10	15	20	30	50	80	100	150	200
Paraffin	0.98	1.2	1.75	2.6	3.6	6.0	9.4	12.5	18	24	34	58	90	120	190	250
Petrol	1.1	1.3	1.95	2.7	4.0	6.4	9.8	13	19	25	36	60	94	125	195	260
Ammonia 30%	0.92	1.1	1.65	2.4	3.4	5.6	8.8	11.5	16.5	22	31	54	84	110	175	230
Caustic Soda 25%	0.45	0.58	0.92	1.45	2.1	3.8	6.2	8.4	12.5	17.5	24	43	66	90	140	185
Float Type 'A'																
Air	8	10	15	20	30	50	80	100	150	200	300	500	760	1000	1500	2000
Hydrogen	21	36	56	82	110	190	290	390	580	800	1100	2000	2900	3900	6200	8200
Helium	17	22	33	46	70	123	200	250	382	516	776	1320	2020	2600	4000	5400
Town's Gas (S.G. 0.5)	12	15	23	33	44	74	110	150	220	280	430	740	1100	1450	2300	3100
Methane	11.5	14.5	22	31	42	70	105	140	210	270	410	700	1000	1350	2200	2900
Ammonia	11.5	14	22	30	41	68	105	135	200	260	390	680	1000	1300	2100	2800
Carbon Monoxide	8	10	15	20	30	50	80	100	150	200	300	500	760	1000	1500	2000
Oxygen	8.0	10	15.5	22	29	49	76	100	145	190	290	500	740	960	1550	2000
Argon	7.2	8.8	13.5	20	26	44	68	90	130	170	250	440	660	860	1400	1850
Carbon Dioxide	7.0	8.8	13.5	19	25	42	64	86	125	165	240	420	620	820	1350	1750
Propane	7.4	9.0	13.5	19	26	42	64	84	125	160	240	420	620	820	1300	1750
Butane	6.4	7.8	12	16.5	22	36	56	74	105	140	210	330	540	700	1150	1500
Float Type 'K'																
Air	15	18	26	38	56	90	140	175	280	370	520	900	1300	1750	2800	3800
Water	0.35	0.4	0.66	0.9	1.35	2.25	3.5	4.5	7	9.6	14	22.5	35	47	76	100

Accuracy

The accuracies shown in the adjoining table are expressed as a percentage of full scale reading. When higher accuracies are required, the instruments can be flow calibrated to Class 1.6 (VDI/VDE 3513) accuracy.

Tube size	7X, 7	10X, 10	14X, 14	18X, 18	24X, 24	35X, 35	47X, 47	65X, 65
% F.S.R.	5	5	5	2.5	2.5	2.5	2.5	2.5

Pressure Loss

The pressure loss due to the weight of the float is given in the adjoining table. The figures are expressed in mbar.

	7X, 7	10X, 10	14X, 14	18X, 18	24X, 24	35X, 35	47X, 47	65X, 65
Float Type S in water	4.8	6.4	9.1	11.8	15.5	23	30	36
Float Type A in air	0.6	0.9	1.1	1.4	1.5	2.8	3.6	4.3
Float Type K in water	1.0	1.4	2.0	2.5	3.4	4.9	6.6	7.8
Float Type K in air	1.7	2.3	3.3	4.2	5.6	8.2	11	13

Installation

The Series 2000 are suitable for in-line, projection or flush panel mounting but they must be installed vertically with the fluid flowing upwards. Sudden changes of pipe section at the inlet or fittings which cause violent flow disturbances should be avoided.

Accessories

An adjustable photo-electric alarm or reed switch alarm can be supplied to detect high or low alarm conditions. The composite illustration shows how the alarms are mounted inside the chassis.

Other accessories available include a fluorescent illuminator, black bezel for flush panel mounted instruments and a polycarbonate safety cover for higher pressure gases.

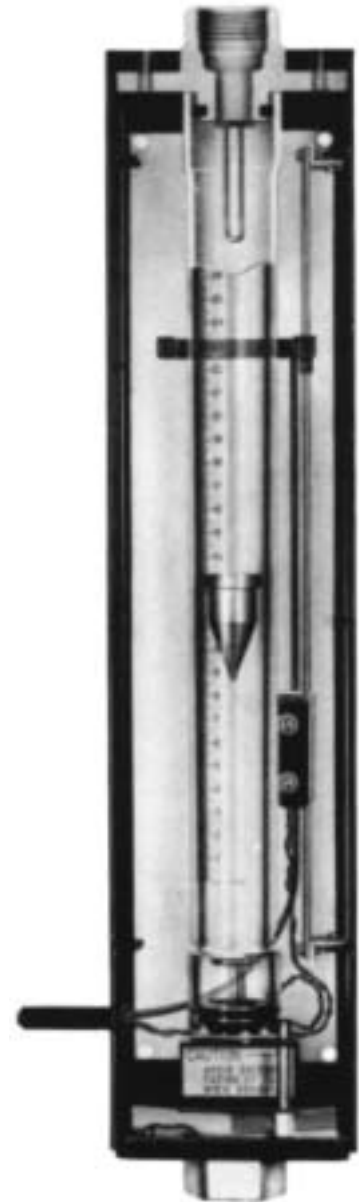
Photo-electric alarm The alarm is fully adjustable but, when used to detect minimum flow, it will operate when the bottom of the float obscures the light beam. With the larger tubes it may not be possible to set the alarm to correspond with the minimum capacity of the instrument.

The standard alarm requires 200/250 volts, 50 cycles supply but alarms for other voltages are available to special order.

Reed switch alarm Stainless steel floats, sizes 18 to 65 inclusive, may be fitted with a permanent magnet which will operate a reed switch mounted alongside the glass tube. The reed switch is adjustable and may be set in any scale position. The maximum power that can be switched is 10 watts, operating at a maximum voltage of 500V d.c. or a maximum current of 0.5 amps.

Illuminator A fluorescent illuminator which uses an 8 watt tube can be fitted inside the chassis. The illuminator can be supplied for use on either 110 or 240 volts supply.

The below illustration is a composite showing both reed and photo-electric alarms.



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