

FL-1600 SERIES ROTAMETERS

CAUTION

It is recommended that this publication be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The OMEGA® Series FL-1600 Rotameters are variable area flowmeters designed for general in-line and by-pass metering applications where operating conditions are within the limitations of glass metering tubes.

A float is free to travel up and down within a tapered borosilicate glass tube. As the float rises a greater flow area exists; as it descends, flow area decreases. Fluid flowing through the flowmeter (from bottom to top) causes the float to rise to a point of dynamic balance, which is a true indication of the flow.

1.2 SPECIFICATIONS

CAUTION

Do not operate this instrument in excess of specifications listed below.

PRESSURE RATINGS:

Model	Max. Pressure* (psig) at 200°F	Max. Temp. Degrees F	Pressure above 200°F psi/Degrees F
FL-1601 FL-1602	300	400	0.75
FL-1603	175	400	0.60
FL-1604 FL-1605	100	400	0.45
FL-1606	75	400	0.33
FL-1607	100	400	0.25

NOTES:

1. Pressure ratings are based on static pressure applicable at 200 degrees F.
2. Above pressure ratings apply to rib or plain tapered tubes.
3. Maximum safe working pressures for glass tubes above 200 degrees F can be calculated by using the pressure reduction given in the table above.
Caution: Do not use meters in excess of these pressures.
* All plastic or non-metallic meters have a maximum safe pressure rating of 100 psig at 75 degrees F.

CONNECTIONS:

Model	Inlet & Outlet Horiz. (NPT)	Inlet & Outlet Vertical (NPT)
FL-1601 FL-1602	½"	½"
FL-1603	¾"	¾"
FL-1604 FL-1605	¾"	1"
FL-1606	1½"	1½"
FL-1607	1½"	2"

ACCURACY

INDUSTRIAL: ±2% of full scale from 100% to 10% of scale reading.

CALIBRATED: ±1% of full scale from 100% to 10% of scale reading.

REPEATABILITY: Within ± ½ % full scale.

MATERIALS OF CONSTRUCTION

METERING TUBE: Borosilicate glass

FLOATS: 316SS

END FITTINGS: Brass or 316SS

PACKING MATERIAL: Neoprene (brass meters); Teflon (316SS meters)

O-RINGS: Buna-N

SIDE PLATES: Aluminum

GLAND RINGS: Steel

GUIDE RODS, CARTRIDGES: 316SS

SAFETY GLASS WINDOWS: Aluminum Frames

GLAND FOLLOWERS: Aluminum

SCALE: 250 mm, detachable metal plate, 10%-100% of FS

SECTION 2 INSTALLATION

RECOMMENDED INSTALLATION PRACTICES

Water hammer and surges can be damaging to any flowmeter and must *always* be avoided.

Water hammer occurs when a liquid flow is suddenly stopped as with quick closing and solenoid operated valves. Surges occur when flow is suddenly begun, as when a pump is turned on at full power or a valve is quickly opened.

Liquid surges are particularly damaging to flowmeters if the pipe is originally empty. To avoid damaging surges, fluid lines should remain full (if possible) and pumps should be brought up to power slowly and valves opened slowly. In addition, to avoid both water hammer and surges, a surge chamber should be installed.

2.1 RECEIPT OF EQUIPMENT

When the equipment is received, the outside packing case should be checked for any damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability.

Remove the envelope containing the shipping list. Carefully remove the equipment from the packing case and inspect for damaged or missing parts. Be sure the float is not accidentally discarded with the packing, as some larger meters are shipped with the float removed from the tube to prevent breakage.

2.2 RETURN SHIPMENT.

Do not return any merchandise without an Authorized Return (AR) number. Call OMEGA Customer Service Department at (203) 359-1660.

2.3 INSTALLATION OF FLOAT

Some flowmeters are shipped with the float installed in the metering tube; others are shipped with the float packed separately to prevent possible damage during shipment and handling. In either case, remove the wrappings and/or other protective material. Take great care to avoid damaging the float. The accuracy of the meter depends upon the float remaining dimensionally and gravimetrically stable.

It is advisable to insert the float before the flowmeter is installed in the line. Where the vertical inlet and outlet are used for piping connections this is absolutely necessary.

Use reasonable care in inserting the float. Don't just drop it in the glass metering tube. A sheet of paper slightly coiled, forms a convenient chute so the float can be slid into the metering tube avoiding high impact.

To install free or ribbed tube floats, remove the bottom cleanout plug (or flanged cover) and take out the bottom float stop. Place the float in the tube with a paper chute, as described above, and replace the float stop and cleanout plug.

With rod guided floats, take great care not to bend the guide rod. Should the guide rod become bent, or its polished surface become marred by burrs, scratches or accumulation of foreign matter, it is advisable to replace it with a new one. Never attempt to straighten a bent guide rod.

Rod guided floats are inserted at OMEGA and are shipped with a wooden dowel protector preventing undue movement of the float while the rotameter is in transit. Be sure to remove the wooden dowel before installing the rotameter.

To install rod-guided floats, remove both top and bottom cleanout plugs. Remove the top nuts on the guide rod and remove the guide rod and guide rod cartridge through the bottom opening of the meter. Place the float on the guide rod and put it back in the tube. Guide rod nuts should be tightened until the guide rod is tensioned. If the guide is not sufficiently tightened, there may be a tendency of the float to whip under flow conditions. Replace the cleanout plugs (or flanged cover).

2.4 LOCATION OF CONTROL VALVE

Location of the control valve depends on many variables. On most applications, the flowmeter will operate properly with the control valve on either the upstream or downstream side.

2.5 INSTALLATION OF FLOWMETER

The flowmeter should always be mounted within 6° of true vertical with the outlet connection (downstream connection) at the top of the meter, and the inlet connection (upstream connection) at the bottom; that is, with highest scale graduation and largest part of the glass tube at the top. Use a plumb-bob or other device to assure perfect vertical positioning. Should the rotameter not be mounted in a vertical position, both accuracy and sensitivity may be affected.

2.6 BY-PASS PIPING

It is strongly recommended to install a by-pass piping arrangement around the meter. By-pass piping permits the meter to be isolated from the flow line for servicing or cleaning.

Where connections are interchangeable (for vertical or horizontal connections), it is recommended that the horizontal connections be used if at all practical in the overall piping arrangement. Horizontal connections permit the plugged vertical openings to serve as convenient cleanout ports. The design permits the end-fitting to be rotated in 90° increments, allowing inlet and outlet connections to be made at right side, left side, at the front or at the back of the rotameter. Refer to Figure 2.1

WARNING

If the inlet and outlet valves adjacent to the flowmeter are to be closed for any reason, the flowmeter must be completely drained. Failure to do so may result in thermal expansion of the liquid which can cause rupture of the meter and possible personal injury.

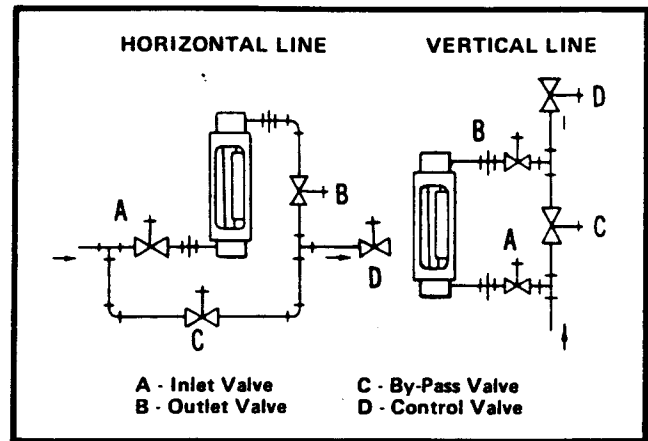


FIGURE 2.1 BY-PASS PIPING

SECTION 3 OPERATION

3.1 PRE-OPERATIONAL CHECK

Prior to initial start-up and each time the flowmeter is re-assembled, the zero alignment should be checked. The zero line on the tube should coincide with the zero line on the indicating scale. If these marks line up, it can be assured that the tube is correctly seated and the flowmeter is ready for accurate flow indication.

3.2 OPERATING PROCEDURE

CAUTION

During operation of this instrument, do not exceed temperature and pressure ratings as listed in Specifications.

It is well to by-pass the original flow surge when the meter is first put in the line. Refer to Figure 2-1. First, open the by-pass valve (C) fully and the control valve (D) slightly. Then, open the meter inlet and outlet valves (A and B respectively). After the inlet line has been purged of air, close the by-pass valve (C) slowly. This method brings the flowmeter on-stream smoothly; allows the float to start indicating the flow without bouncing or shooting up to the very top of the metering tube.

For best results, the meter inlet and outlet valves (A and B) should remain fully opened, permitting the control valve (D) to be used for complete flow control. This arrangement is consistent with good control practice and provides steadiest float operation.

When it is necessary to clean or repair the meter, open the by-pass valve (C) first. Then, close the meter inlet and outlet valves (A and B).

If the by-pass arrangement is not used, the valves should be opened with extreme caution to prevent damage to the float and metering tube.

SECTION 4 MAINTENANCE

4.1 CLEANING

When the recommended horizontal connections are used, the flowmeter may be cleaned in this manner:

1. Remove top and bottom cleanout plugs (or flanges).
2. Remove the float and float stops. Be careful not to damage the float.
3. Swab out the metering tube and end fittings with a suitable solvent.
4. Replace float, float stops, and cleanout plugs (or flanges).

4.2 DISASSEMBLY

1. Remove front and back windows and window frames.
2. Completely unscrew gland bolts from top and bottom end fittings.
3. Remove cap screws from the side plates of the top end fittings.
4. Loosen the cap screws in the bottom end fitting so that the side plates may be spread apart to allow the top and bottom end fittings to be removed.
5. The metering tube may now be removed.

4.3 REASSEMBLY

1. Replace the tube, being careful to see that the outlet (wide) end of the tube fits flush against the tube seat gasket in the outlet (top) end fitting.

NOTE

Because both Teflon hat gaskets are purposely tight fitting, they can be more easily assembled from the inlet (smaller) end of the tube. The smaller (inlet end) gasket is often difficult to place over the glass tube. A suggested method is to place the hat gasket in the gland ring on a horizontal surface and carefully force the end of the tube through the gasket and ring. This will stretch the gasket enough that it can be removed and reassembled on the tube in the proper order. Immersing the gaskets in warm water will further increase their elasticity and help prevent damaging them, particularly in cold weather. If the outlet gasket on the larger tubes seems unable to be moved into position when being driven by the packing ring, a small amount of silicone lubricant may be used.

2. Since the dowel-pin construction assures perfect alignment of the frame assembly, merely tighten the cap screws to attach the side plates to the end fittings.
3. Insert the packing gland bolts. Tighten the gland follower on the "seating end fitting" before tightening the gland follower on the other end fitting. The "seating end fitting" is always the outlet (top) end fitting. If this procedure of tightening the seating end first is not followed, the tube may be pulled away from the seat gasket and the zero line on the tube may not show above the inlet gland follower. In tightening the packing bolts, tighten them diagonally.
4. Check the zero line on the metering tube and on the scale for exact alignment.

5. Replace the windows and window frames. The sealing gaskets on the windows should be placed face down against the meter body. Tighten the shield bolts on the window frame only until they are "snug," then tighten one-quarter additional turn.
6. After the flowmeter has been re-assembled, it is important that it be hydrostatically tested at the liquid pressure rating as shown in the Hydrostatic Test Pressure Table.

CAUTION

Hydrostatic testing should be performed only by trained and qualified personnel or serious damage could result.

TABLE 4-1.
HYDROSTATIC TEST PRESSURES

Model	Max. Working Pressure (PSI) at 200°F	Hydrostatic Test Pressure (PSI)
FL-1601, 1602	300	450
FL-1603	175	260
FL-1604, 1605	100	150
FL-1606	75	110
FL-1607	100	150

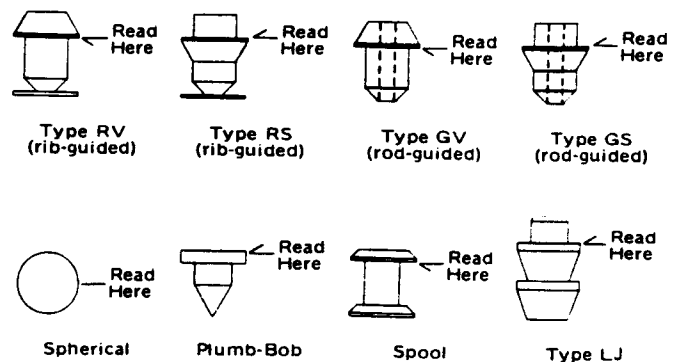


Figure 3-1. Float Types

SECTION 5 PARTS LIST

When ordering replacement parts be sure to specify the following: SERIAL NUMBER, Complete model number, part description and quantity. Refer to Figure 5-2.

WARNING

Glass metering tubes are designed for operation up to the maximum operating pressures and temperatures as specified herein. Due to the inherent brittle characteristic of glass and conditions beyond our control, tube breakage could result below specified operating conditions. Possible glass tube breakage represents a potential hazard to operating personnel; therefore, operator protection should be supplied where operating pressures may exceed 50 psig. A safety shield construction of 1/2 inch acrylic plastic may be used or the glass tube meter may be replaced with an all metal (armored) meter.

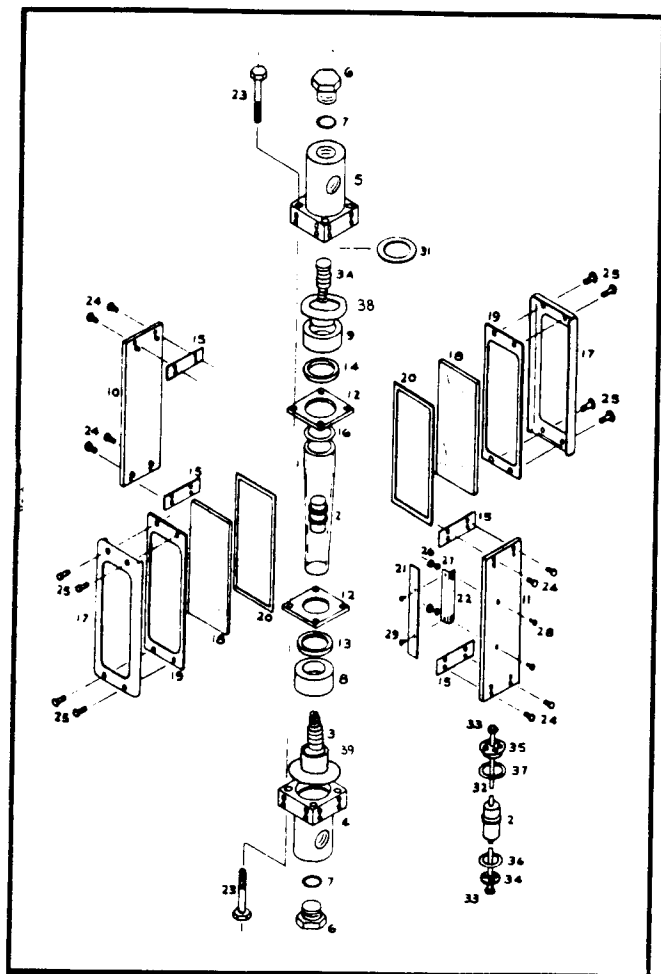


Figure 5-2. Parts Drawing

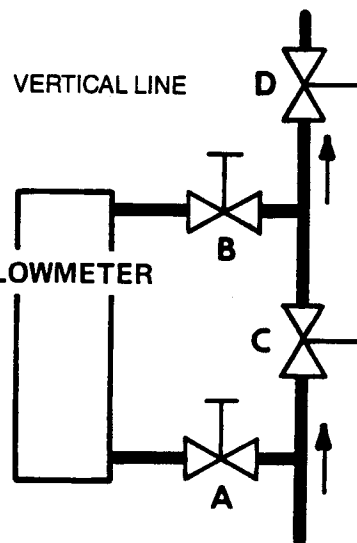
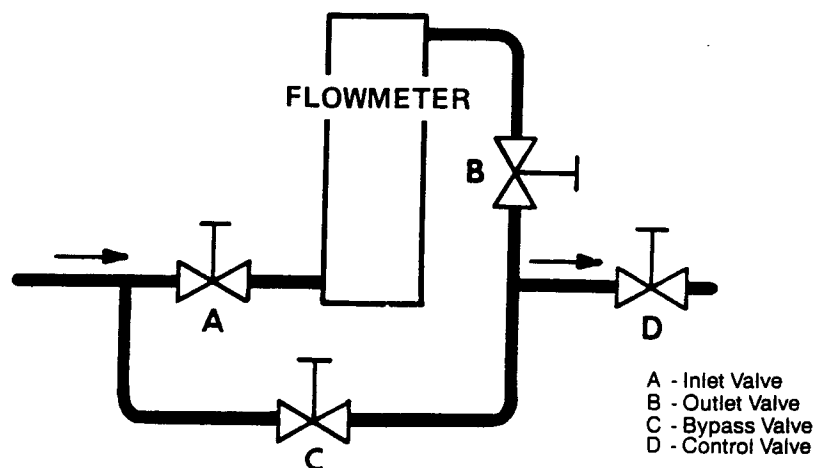
WARNING

FLOWMETER OPERATION

If the inlet and outlet valves adjacent to the flowmeter are to be closed for any reason, the flowmeter must be completely drained. Failure to do so may result in thermal expansion of the liquid which can cause rupture of the meter and possible personal injury.

Ref. No.	Part Description	No. Req'd	Material
1	Metering Tube	1	Glass
2	Float	1	
3	Float Stop - Inlet	1	
3A	Float Stop - Outlet	1	
4	End Fitting - Inlet	1	
5	End Fitting - Outlet	1	
6	End Plug	2	
7	O-Ring Seal	2	
8	Packing - Inlet	1	
9	Packing - Outlet	1	
10	Side Plate	1	Steel
11	Scale Side Plate	1	Steel
12	Gland Follower	2	Steel
13	Gland Ring - Inlet	1	Steel
14	Gland Ring - Outlet	1	Steel
15	Side Plate Gasket	4	Asbestos
16	Tube Seat Gasket	1	Asbestos
17	Window Frame	2	Stn. Stl.
	Milled Shield	1	Stn. Stl.
18	Window Glass	2	Safety Glass
19	Frame Gasket	2	Felt
20	Meter Gasket	2	Cork
21	Scale Blank	1	Aluminum
22	Scale Holder	1	Steel
23	Gland Bolts - Hex Hd.	8	Stn. Stl.
24	Side Plate - Hex Hd.	8	Stn. Stl.
25	Window Frame Screws - Hex Hd.	8	Stn. Stl.
26	Scale Holder Nuts - Hex	2	Stn. Stl.
27	Scale Holder Washers - No. 6 Plain	2	Stn. Stl.
28	Scale Holder Screws - Oval Hd. Self-Tapping	2	Stn. Stl.
29	Scale Holder Screws - Rd. Hd. Self-Tapping	2	Stn. Stl.
30	Stuffing Box Ring - Inlet	1	
31	Stuffing Box Ring - Outlet	1	
32	Guide Rod	1	
33	Guide Rod	2	
34	Cartridge - Inlet	1	
35	Cartridge - Outlet	1	
36	Cartridge Gasket - Inlet	1	
37	Cartridge Gasket - Outlet	1	
38	Teflon Hat Gasket - Inlet	1	
39	Teflon Hat Gasket - Outlet	1	

HORIZONTAL LINE



TYPICAL INSTALLATION