

Installation and Operation Manual

X-VA-1110-1140-eng

Part Number: 541B040AHG

March, 2008

Glass Tube Full-View[®] Flowmeters



Model 1110
Full-View Flowmeter
(NPT Connections)



Model 1140
Full-View Flowmeter
(Flange Connections)

Essential Instructions

Read this page before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brooks Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

Pressure Equipment Directive (PED)

All pressure equipment with an internal pressure greater than 0.5 bar (g) and a size larger than 25mm or 1" (inch) falls under the Pressure Equipment Directive (PED). The Directive is applicable within the European Economic Area (EU plus Norway, Iceland and Liechtenstein). Pressure equipment can be traded freely within this area once the PED has been complied with.

- Section 1 of this manual contains important safety and operating instructions related to the PED directive.
- Meters described in this manual are in compliance with EN directive 97/23/EC module H *Conformity Assessment*.
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Meters larger than 25mm or 1" (inch) are in compliance with category I, II, III of PED.
- Meters of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).



! WARNING

GLASS TUBE EXPLOSION HAZARD

Plastic protective sleeve must remain over glass tube. (Meter sizes 7 -13 only)

Fasten meter windows securely.

Do not operate above pressure and temperature limits.

Avoid pressure and flow surges.

Do not service or repair while pressurized.

Read and understand instruction manual.

Failure to comply could result in serious personal injury or property damage.

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Brooks® 1110 and 1140 Series

Dear Customer,

We appreciate this opportunity to service your flow measurement and control requirements with a Brooks Instrument device. Every day, flow customers all over the world turn to Brooks Instrument for solutions to their gas and liquid low-flow applications. Brooks provides an array of flow measurement and control products for various industries from biopharmaceuticals, oil and gas, fuel cell research and chemicals, to medical devices, analytical instrumentation, semiconductor manufacturing, and more.

The Brooks product you have just received is of the highest quality available, offering superior performance, reliability and value to the user. It is designed with the ever changing process conditions, accuracy requirements and hostile process environments in mind to provide you with a lifetime of dependable service.

We recommend that you read this manual in its entirety. Should you require any additional information concerning Brooks products and services, please contact your local Brooks Sales and Service Office listed on the back cover of this manual or visit www.BrooksInstrument.com

Yours sincerely,

Brooks Instrument

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1-1 Description

The Brooks® Full-View® glass tube meters are designed to offer a wide variety of meter configurations to meet a broad range of metering applications. The packing gland seal construction provides for long-term, leak-free, and reliable flow measurement.

1-2 Design Features

- Wide choice of application-specific materials and connections
- Rugged dowel-pin, side-plate construction
- Precision-bore, plain or ribbed borosilicate glass metering tubes
- Reliable, externally-adjustable packing glands for ease of maintenance
- Flanged or NPT connections with horizontal or vertical inlet and outlet orientation
- Connections rotatable 360° at 90° intervals

1-3 Specifications

⚠ WARNING

Do not operate this instrument in excess of the specifications listed below. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

⚠ WARNING

Glass metering tubes are designed for operation up to the maximum operating pressures and temperatures as specified herein. Due to the inherent brittle characteristics of glass and conditions beyond our control, tube breakage could result below specified operating conditions. Do not use glass tube meters with fluids that are toxic, or chemically react with glass such as water above 140°F, steam, alkalis, flourine, hydrofluoric acid, or molten metal. Failure to heed warning can result in serious personal injury and/or damage to the equipment.

Capacities and Pressure Drops

- 150mm scale, Rib Guided Tubes, Spherical Float: Refer to Table 1-3
- 250mm scale, Rib Guided Tubes, Spherical Float: Refer to Table 1-4
- 250mm scale, Rib Guided Tubes, Standard Float: Refer to Table 1-5
- 127mm scale, Rib Guided Tubes, Standard Float: Refer to Table 1-6
- 250mm scale, Plain Tapered Tubes, Rod Guided Float: Refer to Table 1-7

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Accuracy

Standard Flow Accuracy (127, 150, 250mm Tubes): $\pm 2\%$ Full Scale

Optional Flow Accuracy (127, 150, 250mm Tubes): $\pm 1\%$ Full Scale

Repeatability

0.5% Full Scale

Pressure Ratings

Refer to Table 1-1 for maximum non-shock pressure for rib guided and plain tapered tubes.

Pressure Equipment Directive (PED) 97/23/EC See Table 1-1.

Scales

Standard: Detachable aluminum plate.

Length: 127mm, 150mm and 250mm.

Graduations: Choice of direct reading units, millimeter or percentage of maximum flow.

Ambient Temperature Limits

33°F to 125°F (1°C to 52°C).

Operating Fluid Temperature Limits

Maximum: 250°F (121°C) for metallic end fittings

Reduced ratings on meters with nonmetallic end fittings. Refer to Table 1-1.

Minimum: 33°F (1°C)

Materials of Construction:**Metering Tube**

Borosilicate glass.

Protective Tube Sleeve, Size 7 (1/2") and larger

UV stabilized polycarbonate.

Floats (Figure 1-3)

Standard Sizes 2-7 (spherical): sapphire, tantalum, glass, Carboloy®, 316 stainless steel, Monel® (Size 7 only).

Standard Sizes 8-13: 316 stainless steel.

Optional Sizes 8-13: Hastelloy C®.

Float Stops

Standard, Sizes 2-8: 316 SS spring.


Optional, Sizes 2-8: Hastelloy C.

Standard, Sizes 9-13: Aluminum for brass & steel fittings, 316 SS for 316 stainless steel fittings.

Guide Rods and Cartridges

Standard: 316 stainless steel.

Optional: Hastelloy C.



! WARNING

**GLASS TUBE
EXPLOSION
HAZARD**

Plastic protective sleeve must remain over glass tube. (Meter sizes 7 -13 only)
Fasten meter windows securely.
Do not operate above pressure and temperature limits.
Avoid pressure and flow surges.
Do not service or repair while pressurized.
Read and understand instruction manual.
Failure to comply could result in serious personal injury or property damage.

Table 1-1 Pressure Ratings and PED Category

Meter Size	End Fitting Material	Maximum Operating Pressure (psig) ²			PED CAT.
		@ 70°F (21°C)	@ 150°F ¹ (66°C)	@ 250°F (121°C)	
2	CPVC	100	100	Not Available	SEP
	Metal	500	500	500	
6	CPVC	100	100	Not Available	
	Metal	450	450	450	
7	CPVC	100	100	Not Available	
	Metal	350	350	350	
8	CPVC	100	100	Not Available	
	Metal	300	300	300	
9	PVC	100	100 (Note 1)	Not Available	
	Metal	175	175	175	
10	PVC	100	100 (Note 1)	Not Available	
	Metal	100	100	100	
12	Metal	75	75	75	SEE NOTE 3
13	Metal	100	100	100	

NOTES:

- ¹ Maximum temperature rating for nonmetal end fittings is 150°F (66°C) for all materials except PVC, which is 140°F.
- ² Flanged unit pressure ratings are limited to ANSI flange ratings whichever is lower.
- ³ Sizes 12 and 13 do not conform to Pressure Equipment Directive 97/23/EC, therefore it cannot be sold or used in the EU/EFTA.

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Housing and Window Bezel

Standard: Aluminum with polyurethane paint.

Optional: 18-8 stainless steel.

End Fittings

316 stainless steel, steel, Hastelloy C, CPVC Sizes 2-8,
PVC Sizes 9-10, brass.

(Brass, Hastelloy C, CPVC/PVC fittings not available with flanged connection).

Window

Scratch resistant, UV stabilized polycarbonate.

 WARNING
GLASS TUBE EXPLOSION HAZARD
Protective sleeve must remain over glass tube. (Meter sizes 7 - 13 only) Fasten meter windows securely. Failure to comply could result in serious personal injury or property damage.

Packing Material

Standard: Teflon®, Neoprene®, Viton® fluoroelastomers.

O-rings

Standard: Teflon.

Optional: Buna, Viton® fluoroelastomers.

Gland Rings

Standard: Steel, 18-8 stainless steel.

Gland Followers

Standard: Sizes 2-9 aluminum, Sizes 10-13 steel.

Optional: 18-8 stainless steel.

Side Plate Gaskets

Anchorite.

Bolts

18-8 stainless steel.

Connections (Refer to Table 1-2)

Standard:

150 lbs, 300 lbs RF flanges per ANSI B 16.5
NPT female connections.

Optional:

125/175 RA flange finish
Flat faced flanges.

Connection Orientation

Vertical or horizontal optional on inlets and outlets.


Connection rotatable 360° at 90° intervals.

Meter Dimensions

127mm to 250mm (Refer to Figure 1-1)

Table 1-2 Connections

Meter Size	Model 1110 Inlet&Outlet Horizontal (NPT)	Model 1114 Inlet&Outlet Vertical (NPT)	Model 1140 Inlet&Outlet Horizontal (Flange)	Model 1144 Inlet&Outlet Vertical (Flange)
2 to 6	1/4"	1/4"	1/2"	1/2"
7 and 8	1/2"	1/2"	1/2"	1/2"
9	3/4"	3/4"	1"	1"
10	3/4"	1"	1"	1"
12	1-1/2"	1-1/2"	1-1/2"	1-1/2"
13	1-1/2"	2"	2"	2"



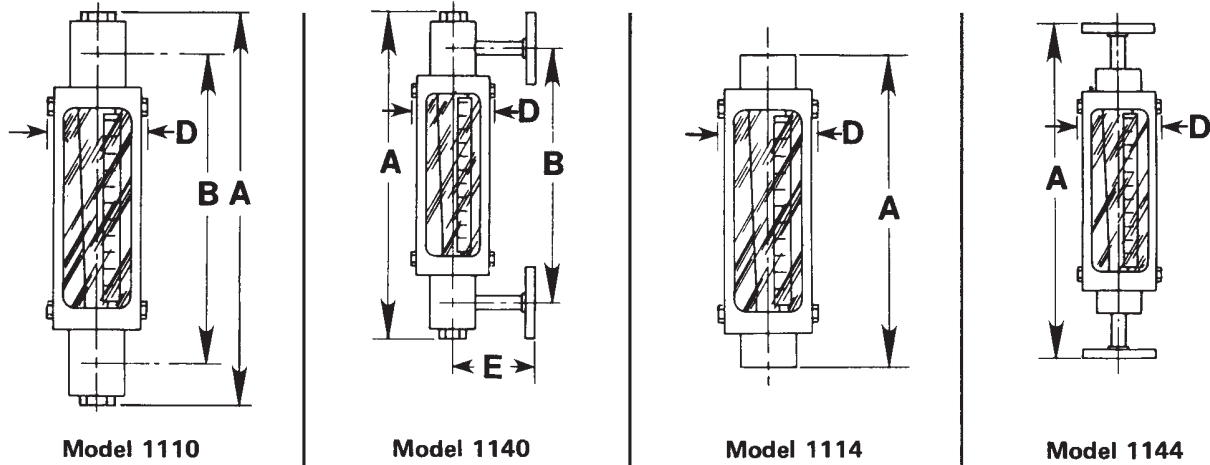
⚠ WARNING

METER/CONTROLLER SEAL COMPATIBILITY

Products in this manual may contain metal or elastomeric seals, gaskets, O-rings or valve seats. It is the "user's" responsibility to select materials that are compatible with their process and process conditions. Using materials that are not compatible with the process or process conditions could result in the Meter or Controller leaking process fluid outside the pressure boundary of the device, resulting in personnel injury or death.

It is recommended that the user check the Meter or Controller on a regular schedule to ensure that it is leak free as both metal and elastomeric seals, gaskets, O-rings and valve seats may change with age, exposure to process fluid, temperature, and /or pressure.

Brooks® 1110 and 1140 Series



All Dimensions in Inches

Meter Size	1110 - 1140				1114		1144		All Meters	All Meters
	Nominal Scale Length (MM)				Nominal Scale Length (MM)		Nominal Scale Length (MM)			
	127		250		127	250	127	250		
	A	B	A	B	A	A	A	A		
2-6*	10.12	8.59	15.12	13.59	9.63	14.63	14.88	19.88	2.38	3.5
7&8	15.38	11.5	20.38	16.5	12	17	17.88	22.88	3.25	3.5
9	17	12.5	22	17.5	12.25	17.25	17.75	22.75	3.75	4
10	17.88	12.5	22.88	17.5	12.25	17.25	17.5	22.5	4.44	4
12	20.12	15.5	25.12	20.5	15.88	20.88	21.38	26.38	4.38	5
13	21.25	15.5	26.25	20.5	15.12	20.12	20.63	25.63	4.88	5

* Also available in 150mm scale length. Dimensions are identical to 127mm scale length
 Flange dimensions apply to 150# & 300# raised face or flat face flanges

All Dimension in Millimeters

Meter Size	1110 - 1140				1114		1144		All Meters	All Meters
	Nominal Scale Length (MM)				Nominal Scale Length (MM)		Nominal Scale Length (MM)			
	127		250		127	250	127	250		
	A	B	A	B	A	A	A	A		
2-6*	257.0	218.2	384.0	345.2	244.6	371.6	378.0	505.0	60.5	88.9
7&8	390.7	292.1	517.7	419.1	304.8	431.8	454.2	581.2	82.6	88.9
9	431.8	317.5	558.8	444.5	311.2	438.2	450.9	577.9	95.3	101.6
10	454.2	317.5	581.2	444.5	311.2	438.2	444.5	571.5	112.8	101.6
12	511.0	393.7	638.0	520.7	403.4	530.4	543.1	670.1	111.3	127.0
13	539.8	393.7	666.8	520.7	384.0	511.0	524.0	651.0	124.0	127.0

* Also available in 150mm scale length. Dimensions are identical to 127mm scale length
 Flange dimensions apply to 150# & 300# raised face or flat face flanges

Figure 1-2 Dimensions 127mm and 250mm Full-View Flowmeters

1-4 Optional Equipment (Mountings, Valves and Flow Controllers)

- **Mountings:** Brackets for panel mounting flush or front of panel
- **Valves:** Available for connection sizes 1/4" through 1" only. Horizontal stem in outlet or inlet and fitting Sizes 2 through 10.
- **Flow Controller:** Brass or 316 Stainless steel integrally piped to Sizes 2-6. See Brooks publication DS-FCA.

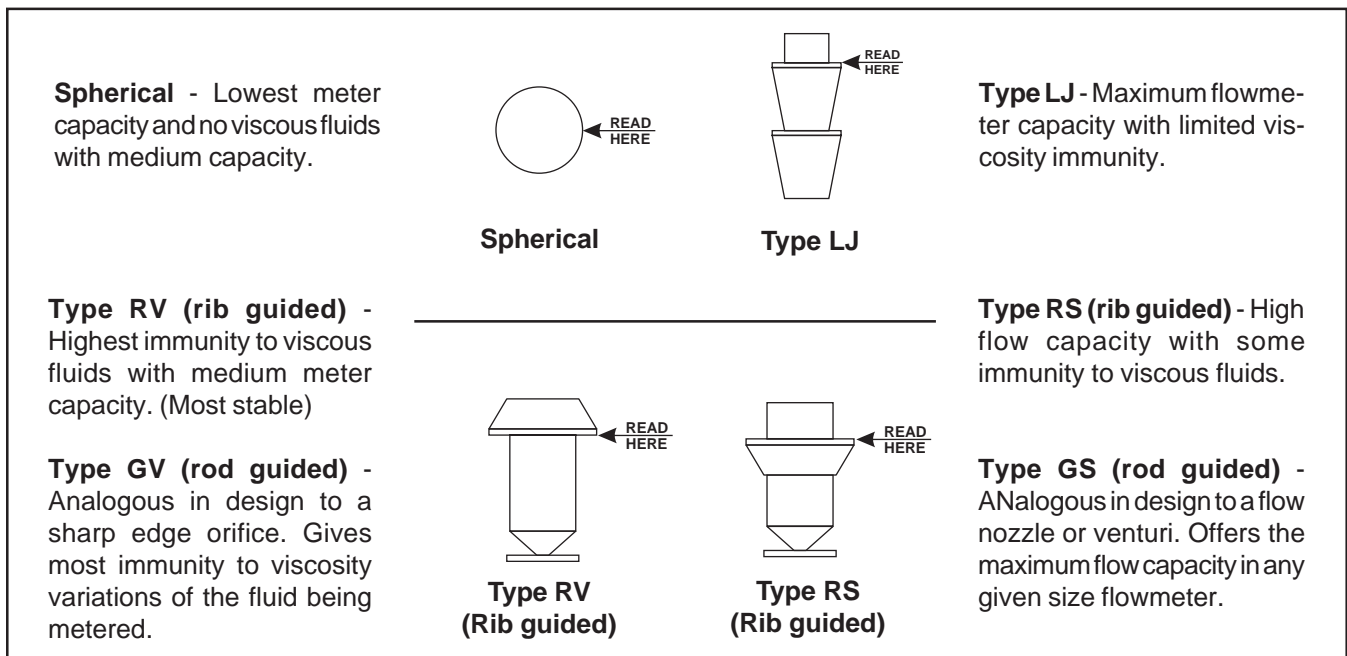


Figure 1-3 Float Types

Brooks® 1110 and 1140 Series

Table 1-3 Capacities,
 150mm Scale, Rib Guided Tube, Spherical Float

METER SIZE	TUBE	FLOAT	MAXIMUM FLOW RATE		
			WATER (CC/MIN.)	AIR @ 14.7 PSIA AND 70°F (21°C)	
2	R-2-15-AAA SEE NOTE BELOW *	GLASS *	0.524	47.1	SCC/MIN
		SAPPHIRE	1.02	73.3	SCC/MIN
		STN. STL.	2.42	140.0	SCC/MIN
		CARBOLOY	4.77	238.0	SCC/MIN
		TANTALUM	5.31	260.0	SCC/MIN
	R-2-15-AA	GLASS	0.96	83.8	SCC/MIN
		SAPPHIRE	1.86	128.0	SCC/MIN
		STN. STL.	4.34	245.0	SCC/MIN
		CARBOLOY	8.37	416.0	SCC/MIN
		TANTALUM	9.30	454.0	SCC/MIN
	R-2-15-D	GLASS	5.58	361.0	SCC/MIN
		SAPPHIRE	10.20	491.0	SCC/MIN
		STN. STL.	19.80	790.0	SCC/MIN
		CARBOLOY	31.90	1170.0	SCC/MIN
		TANTALUM	34.40	1250.0	SCC/MIN
	R-2-15-A	GLASS	16.1	0.8	SLPM
		SAPPHIRE	25.2	1.0	SLPM
		STN. STL.	44.2	1.6	SLPM
		CARBOLOY	67.7	2.3	SLPM
		TANTALUM	72.5	2.5	SLPM
	R-2-15-B	GLASS	50.6	2.3	SLPM
		SAPPHIRE	76.2	2.9	SLPM
		STN. STL.	127	4.4	SLPM
		CARBOLOY	189	6.4	SLPM
TANTALUM		202	6.7	SLPM	
R-2-15-C	GLASS	81.1	3.7	SLPM	
	SAPPHIRE	123	4.8	SLPM	
	STN. STL.	208	7.2	SLPM	
	CARBOLOY	312	10.1	SLPM	
	TANTALUM	333	10.6	SLPM	
6	R-6-15-A	GLASS	191	8.3	SLPM
		SAPPHIRE	284	10.6	SLPM
		STN. STL.	468	15.7	SLPM
		CARBOLOY	690	22.0	SLPM
		TANTALUM	735	23.3	SLPM
	R-6-15-B	GLASS	548	22.6	SLPM
		SAPPHIRE	809	28.6	SLPM
		STN. STL.	1290	41.6	SLPM
		CARBOLOY	1850	58.1	SLPM
		TANTALUM	1960	61.4	SLPM

* R-2-15-AAA TUBE WITH GLASS FLOAT NOT AVAILABLE WITH 1% ACCURACY.

Table 1-4 Capacities,
 250mm Scale, Rib Guided Tube, Spherical Float

Meter Size	Tube	Float	Maximum Flow Rate	
			Water (cc/min.)	Air @ 14.7 psia and 70°F (21°C)
2	R-2-25-D	Glass	5.5	366 sccm
		Sapphire	10.1	500 sccm
		Stn. Steel	19.8	810 sccm
		Carboloy	32.2	1,200 sccm
		Tantalum	34.8	1,280 sccm
	R-2-25-A	Glass	16.8	0.84 slpm
		Sapphire	26.8	1.11 slpm
		Stn. Steel	46.5	1.70 slpm
		Carboloy	71.5	2.46 slpm
		Tantalum	77.0	2.62 slpm
	R-2-25-B	Glass	49.0	2.20 slpm
		Sapphire	74.5	2.86 slpm
Stn. Steel		124	4.3 slpm	
Carboloy		186	6.2 slpm	
Tantalum		198	6.6 slpm	
R-2-25-C	Glass	82	3.78 slpm	
	Sapphire	125	4.95 slpm	
	Stn. Steel	212	7.45 slpm	
	Carboloy	318	10.3 slpm	
	Tantalum	342	10.9 slpm	
6	R-6-25-A	Glass	196	8.6 slpm
		Sapphire	292	11.0 slpm
		Stn. Steel	485	16.2 slpm
		Carboloy	715	22.8 slpm
		Tantalum	760	24.2 slpm
	R-6-25-B	Glass	550	22.8 slpm
		Sapphire	810	29.0 slpm
		Stn. Steel	1,300	42.0 slpm
		Carboloy	1,860	58.5 slpm
		Tantalum	1,980	62.0 slpm
R-6M-25-1	Glass	275	12.3 slpm	
	Sapphire	412	15.6 slpm	
	Stn. Steel	676	22.8 slpm	
	Tantalum	1,087	33.9 slpm	
	7	R-7M-25-1	Glass	605
Stn. Steel			1,286	42.7 slpm
Monel			1,360	44.8 slpm

Table 1-5 Capacities, 250mm Scale , Rib Guided Tubes, Standard Float

Meter Size	Tube	Float	Water				Air @ 14.7 psia and 70°F (21°C)			
			gpm	lpm	Pressure Drop Inches W.C.	Viscosity Immunity Ceiling, CS ¹	scfm	slpm	Pressure Drop Inches W.C.	psi Critical ²
8	R-8M-25-2	8-RV-3	0.55	2.08	2.0	2.0	2.22	62.9	3.0	0
		8-RV-8	0.78	2.95	5.0	3.3	3.22	91.2	6.0	0
		8-RS-8	1.00	3.79	6.0	1.7	4.18	118.4	7.0	0
		8-RV-14	1.04	3.94	8.0	4.6	4.28	121.2	9.0	0
		8-RS-14	1.32	5.00	11.0	1.8	5.48	155.2	12.0	0
		8-RV-31	1.50	5.68	17.0	6.0	6.12	173.3	19.0	30
	8-RS-31	1.89	7.15	22.0	2.6	7.76	219.8	25.0	30	
	8-LJ-48	3.01	11.39	45.0	1.0	13.01	368.4	51.0	30	
	R-8M-25-4	8-RV-3	0.78	2.95	4.0	2.0	3.17	89.8	4.0	0
		8-RV-8	1.09	4.13	7.0	3.7	4.45	126.0	8.0	0
		8-RS-8	1.40	5.30	10.0	1.8	5.86	166.0	11.0	0
		8-RV-14	1.45	5.49	12.0	5.4	5.88	166.5	14.0	0
		8-RS-14	1.83	6.93	17.0	1.9	7.56	214.1	19.0	0
		8-RV-31	2.06	7.80	23.0	7.0	8.32	235.6	28.0	30
8-RS-31	2.59	9.80	33.0	3.1	10.66	301.9	37.0	30		
8-LJ-48	4.88	18.47	93.0	1.0	20.32	575.5	106.0	30		
9	R-9M-25-1	9-RV-33	1.90	7.19	5.0	10.0	7.96	225.4	6.0	0
		9-RS-33	2.52	9.54	6.0	2.3	10.46	296.2	7.0	0
		9-RV-87	3.08	11.66	12.0	15.0	12.56	355.7	14.0	30
		9-RS-87	4.04	15.29	14.0	3.4	16.84	476.9	16.0	30
	9-LJ-160	6.88	26.04	31.0	1.0	30.45	862.3	35.0	30	
	R-9M-25-3	9-RV-33	2.53	9.58	6.0	11.0	10.45	295.0	7.0	0
		9-RS-33	3.24	12.26	7.0	2.4	13.45	380.9	8.0	0
		9-RV-87	3.92	14.84	14.0	17.0	16.25	460.2	16.0	30
		9-RS-87	5.12	19.38	17.0	3.5	21.20	600.4	20.0	30
		9-LJ-160	9.65	36.53	43.0	1.0	44.18	1,251.2	49.0	30
10		R-10M-25-1	10-RV-64	4.54	17.18	8.0	14.0	18.05	511.2	9.0
	10-RS-64		5.64	21.35	10.0	3.0	23.65	669.8	12.0	0
	10-RV-138		6.42	24.30	17.0	22.0	26.60	753.3	19.0	30
	10-RS-138		8.02	30.36	21.0	5.0	34.60	979.9	23.0	30
	10-LJ-238	14.91	56.43	52.0	1.0	66.00	1,869.1	59.0	30	
	R-10M-25-3	10-RV-64	6.28	23.77	11.0	15.0	25.76	729.5	13.0	0
		10-RS-64	7.84	29.67	15.0	3.7	32.15	910.5	17.0	0
		10-RV-138	8.84	33.46	23.0	23.0	36.10	1,022.4	26.0	30
		10-RS-138	10.93	41.37	29.0	5.5	45.90	1,299.9	33.0	30
		10-LJ-238	23.10	87.43	98.0	1.0	105.70	2,993.4	112.0	30
12		R-12M-25-4	12-RV-221	9.33	35.31	8.0	28.0	37.81	1,070.8	9.0
	12-RV-343		11.71	44.32	12.0	35.0	47.12	1,334.4	14.0	30
	12-RS-221		12.46	47.16	9.0	4.0	50.65	1,434.4	10.0	0
	12-RS-343		15.43	58.40	13.0	4.3	62.75	1,777.1	15.0	30
	12-LJ-740	30.00	113.55	31.0	1.0	123.30	3,491.9	36.0	30	
	R-12M-25-5	12-RV-221	17.21	65.14	10.0	29.0	70.80	2,005.1	11.0	0
		12-RV-343	20.95	79.30	15.0	36.0	86.45	2,448.3	17.0	30
		12-RS-221	22.40	84.78	12.0	4.2	91.85	2,601.2	14.0	0
		12-RS-343	26.90	101.82	18.0	4.5	112.00	3,171.8	20.0	30
		12-LJ-740	67.60	255.87	65.0	1.0	299.50	8,481.8	75.0	30
13		R-13M-25-1	13-RV-510	19.94	75.47	12.0	40.0	81.55	2,309.5	14.0
	13-RV-760		23.79	90.05	18.0	50.0	96.00	2,718.7	20.0	30
	13-RS-510		26.89	101.78	15.0	7.3	108.00	3,058.6	17.0	0
	13-RS-760		31.85	120.55	21.0	9.0	131.00	3,709.9	24.0	30
	13-LJ-1394	54.60	206.66	46.0	1.0					
	R-13M-25-3	13-RV-510	31.78	120.29	17.0	42.0	130.90	3,707.1	19.0	0
		13-RV-760	37.60	142.32	24.0	52.0	155.20	4,395.3	27.0	30
		13-RS-510	42.52	160.94	23.0	7.6	176.60	5,001.3	26.0	0
		13-RS-760	49.55	187.55	32.0	9.3	217.70	6,165.3	36.0	30
		13-LJ-1394	98.60	373.20	92.0	1.0				

¹ Viscosity immunity ceiling listed is for stainless steel float and fluid specific gravity 1.0.

² Minimum operating downstream pressure for gas service (psig)

Brooks® 1110 and 1140 Series

Table 1-6 Capacities, 127mm Scale, Rib Guided Tubes, Standard Float

Meter Size	Tube	Float	Water				Air @ 14.7 psia and 70°F (21°C)			
			gpm	lpm	Pressure Drop Inches W.C.	Viscosity Immunity Ceiling, CS ¹	scfm	slpm	Pressure Drop Inches W.C.	psi Critical ²
8	R-8M-127-1	8-RV-3	0.50	1.89	2.0	2.0	2.05	58.1	2.0	0
		8-RV-8	0.74	2.80	3.0	3.3	3.01	85.2	4.0	0
		8-RS-8	0.92	3.48	4.0	1.7	3.84	108.7	4.0	0
		8-RV-14	0.96	3.63	6.0	4.6	3.95	111.9	6.0	0
		8-RS-14	1.22	4.62	6.0	1.8	5.03	142.4	7.0	0
		8-RV-31	1.38	5.22	11.0	6.0	5.60	158.6	13.0	30
	R-8M-127-4	8-RS-31	1.70	6.43	13.0	2.6	6.98	197.7	15.0	30
		8-LJ-48	2.59	9.80	22.0	1.0	10.93	309.5	15.0	30
		8-RV-3	0.72	2.73	2.0	2.0	2.94	83.3	2.0	0
		8-RV-8	1.02	3.86	4.0	3.7	4.19	118.7	5.0	0
		8-RS-8	1.30	4.92	5.0	1.8	5.40	152.9	6.0	0
		8-RV-14	1.34	5.07	7.0	5.4	5.46	154.6	8.0	0
		8-RS-14	1.69	6.40	8.0	1.9	6.98	197.7	10.0	0
		8-RV-31	1.85	7.00	14.0	7.0	7.53	213.2	15.0	30
		8-RS-31	2.30	8.71	16.0	3.1	9.45	267.6	18.0	30
		8-LJ-48	4.40	16.65	35.0	1.0	18.10	512.6	40.0	30
9	R-9M-127-1	9-RV-33	1.70	6.43	4.6	10.0	7.00	198.2	6.0	0
		9-RS-33	2.20	8.33	5.3	2.3	9.05	256.3	6.0	0
		9-RV-87	2.64	9.99	11.5	15.0	11.08	313.8	13.0	30
		9-RS-87	3.46	13.10	13.0	3.4	14.40	407.8	15.0	30
		9-LJ-160	5.91	22.37	26.6	1.0	26.03	737.2	31.0	30
	R-9M-127-3	9-RV-33	3.90	14.76	8.4	11.0	15.75	446.0	10.0	0
		9-RS-33	4.90	18.55	10.8	2.4	20.35	576.3	13.0	0
		9-RV-87	5.55	21.01	18.1	17.0	23.30	659.9	21.0	30
		9-RS-87	6.75	25.55	21.7	3.5	28.75	814.2	25.0	30
		9-LJ-160	17.20	65.10	79.0	1.0	83.40	2,361.9	90.0	30
10	R-10M-127-1	10-RV-64	4.28	16.20	7.0	14.0	17.90	506.9	8.0	0
		10-RS-64	5.40	20.44	8.4	3.0	22.85	647.1	10.0	0
		10-RV-138	5.93	22.45	14.0	22.0	25.30	716.5	16.0	30
		10-RS-138	7.41	28.05	16.2	5.0	31.50	892.1	19.0	30
		10-LJ-238	13.65	51.67	36.0	1.0	57.90	1,639.7	41.0	30
	R-10M-127-3	10-RV-64	6.02	22.79	9.2	15.0	24.33	689.0	11.0	0
		10-RS-64	7.56	28.61	11.4	3.7	30.80	872.3	13.0	0
		10-RV-138	8.01	30.32	17.2	23.0	33.45	947.3	20.0	30
		10-RS-138	9.94	37.62	21.0	5.5	41.63	1,179.0	24.0	30
		10-LJ-238	22.47	85.05	61.0	1.0	109.30	3,095.4	70.0	30
12	R-12M-127-1	12-RV-221	8.60	32.55	8.0	28.0	35.23	997.7	9.0	0
		12-RV-343	10.74	40.65	12.0	35.0	43.55	1,233.3	14.0	30
		12-RS-221	11.49	43.49	8.0	4.0	47.10	1,333.9	10.0	0
		12-RS-343	13.97	52.88	13.0	4.3	59.70	1,605.7	15.0	30
		12-LJ-740	24.30	91.98	28.0	1.0	99.80	2,826.3	32.0	30
	R-12M-127-3	12-RV-221	16.61	62.87	10.0	29.0	67.65	1,915.8	11.0	0
		12-RV-343	19.68	74.49	14.0	36.0	80.30	2,274.1	17.0	30
		12-RS-221	21.83	82.63	12.0	4.2	89.70	2,540.3	13.0	0
		12-RS-343	24.72	93.57	16.0	4.5	101.80	2,883.0	19.0	30
		12-LJ-740	72.00	272.52	57.0	1.0				
13	R-13M-127-1	13-RV-510	19.28	72.97	12.0	40.0	78.25	2,216.0	14.0	0
		13-RV-760	22.90	86.68	17.0	50.0	92.80	2,628.1	20.0	30
		13-RS-510	26.35	99.73	14.0	7.3	105.30	2,982.1	16.0	0
		13-RS-760	31.30	118.47	20.0	9.0	126.10	3,571.2	23.0	30
		13-LJ-1394	47.45	179.60	38.0	1.0				
	R-13M-127-3	13-RV-510	30.40	115.06	16.0	42.0	125.00	3,540.0	18.0	0
		13-RV-760	34.90	132.10	22.0	52.0	144.20	4,083.7	25.0	30
		13-RS-510	41.30	156.32	20.0	7.6	175.25	4,963.1	23.0	0
		13-RS-760	46.50	176.00	27.0	9.3	199.80	5,658.3	31.0	30
		13-LJ-1394	93.80	355.03	70.0	1.0				

¹ Viscosity immunity ceiling listed is for stainless steel float and fluid specific gravity 1.0.

² Minimum operating downstream pressure for gas service (psig)

Table 1-7 Capacities, 250mm Scale, Plain Tapered Tubes, Rod Guided Float

Meter Size	Tube	Float	Water				Air @ 14.7 psia and 70°F (21°C)			
			gpm	lpm	Pressure Drop Inches W.C.	Viscosity Immunity Ceiling, CS ¹	scfm	slpm	Pressure Drop Inches W.C.	psi Critical ²
8	8M-25-3	8-GV-7	1.18	4.47	11.0	4.7	4.82	136.5	12.0	0
		8-GS-7	1.54	5.83	17.0	1.6	6.50	184.1	19.0	0
		8-GV-12	1.56	5.90	19.0	6.2	6.40	181.2	21.0	0
		8-GS-12	2.06	7.80	31.0	1.6	8.60	243.6	35.0	0
		8-GV-26	2.24	8.48	39.0	9.1	9.23	261.4	45.0	30
		8-GS-26	2.96	11.20	64.0	1.7	12.45	352.6	74.0	30
		8-LG-27	3.84	14.53	106.0	1.0				
		8-LG-28	5.33	20.17	202.0	1.0				
		8-LG-37	6.40	24.22	293.0	1.0				
9	9M-25-2	9-GV-29	2.30	8.71	8.0	10.1	9.66	273.6	10.0	0
		9-GS-29	3.23	12.23	13.0	1.8	13.53	383.2	15.0	0
		9-GV-75	3.90	14.76	23.0	16.3	16.40	464.4	26.0	0
		9-GS-75	5.22	19.76	34.0	2.1	21.60	611.7	38.0	0
		9-LG-60	7.02	26.57	52.0	1.0				
		9-LG-88	8.91	33.72	81.0	1.0				
		9-LG-124	11.00	41.64	121.0	1.0				
10	10M-25-2	10-GV-54	5.60	21.20	22.0	13.0	23.52	666.1	25.0	0
		10-GS-54	7.84	29.67	48.0	1.7	33.12	938.0	55.0	0
		10-GV-119	8.52	32.25	38.0	19.4	35.48	1,004.8	43.0	30
		10-GS-119	11.71	44.32	81.0	2.0	49.75	1,408.9	93.0	30
		10-LG-191	16.00	60.56	146.0	1.0				
		10-LG-113	19.14	72.44	194.0	1.0				
		10-LG-164	25.20	95.38	327.0	1.0				
		10-LG-194	31.39	118.81	493.0	1.0				
12	12M-25-3	12-GV-201	11.44	43.30	15.0	26.7	48.00	1,359.4	17.0	0
		12-GV-315	14.43	54.62	23.0	33.3	60.25	1,706.3	27.0	30
		12-GS-201	16.06	60.79	23.0	4.0	66.35	1,879.0	27.0	0
		12-GS-315	20.05	75.89	35.0	5.0	82.70	2,342.1	41.0	30
		12-LG-391	36.58	138.46	94.0	1.0				
		12-LG-490 ³	43.90	166.16	131.0	1.0				
		12-LG-461	58.95	223.13	220.0	1.0				
13	13M-25-2	13-GV-465	23.66	89.55	28.0	40.0	100.00	2,832.0	32.0	0
		13-GV-696	29.60	112.04	43.0	48.8	122.20	3,460.7	49.0	30
		13-GS-465	33.31	126.08	47.0	6.0	139.00	3,936.5	53.0	0
		13-GS-696	41.50	157.08	71.0	7.3	117.10	5,015.5	81.0	30
		13-LG-822	64.40	243.75	151.0	1.0				
		13-LG-844	69.20	261.92	172.0	1.0				
		13-LG-866 ³	85.60	324.00	252.0	1.0				
		13-LG-950 ³	102.6	388.34	352.0	1.0				
		13-LG-1402	118.0	446.63	464.0	1.0				
		13-LG-1465	129.5	490.16	551.0	1.0				

¹ Viscosity immunity ceiling listed is for stainless steel float and fluid specific gravity 1.0.

² Minimum operating downstream pressure for gas service (psig).

³ Float does not provide 10:1 flow range. Range will be 5:1 or better.

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2-1 General

This section contains the procedures for the receipt and installation of the instrument. Do not attempt to start the system until the instrument has been permanently installed. It is extremely important that the start-up procedures be followed in the exact sequence presented.

2-2 Receipt of Equipment

When the instrument is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability. A report should be submitted to your nearest Product Service Department.

Brooks Instrument

407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554-FLOW (3569)
Tel (215) 362-3700
Fax (215) 362-3745
E-mail: BrooksAm@EmersonProcess.com
www.BrooksInstrument.com

Brooks Instrument

Neonstraat 3
6718 WX Ede, Netherlands
P.O. Box 428
6710 BK Ede, Netherlands
Tel 31-318-549-300
Fax 31-318-549-309
E-mail: BrooksEu@EmersonProcess.com

Brooks Instrument

1-4-4 Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel 011-81-3-5633-7100
Fax 011-81-3-5633-7101
Email: BrooksAs@EmersonProcess.com

Remove the envelope containing the packing list. Carefully remove the instrument from the packing case. Make sure spare parts are not discarded with the packing materials. Inspect for damaged or missing parts.

2-3 Recommended Storage Practice

If intermediate or long-term storage of equipment is required, it is recommended that the equipment be stored in accordance with the following:

- a. Within the original shipping container.
- b. Stored in a sheltered area, preferably a warm, dry, heated warehouse.
- c. Ambient temperature of 70° F (21° C) nominal, 109° F (43° C) maximum, 45° F (7° C) minimum.
- d. Relative humidity 45% nominal, 60% maximum, 25% minimum.
Upon removal from storage a visual inspection should be conducted to verify the condition of equipment is "as received".

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2-4 Return Shipment

Prior to returning any instrument to the factory, contact your nearest Brooks location for a Return Materials Authorization Number (RMA#). This can be obtained from one of the following locations:

Brooks Instrument

407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554-FLOW (3569)
Tel (215) 362-3700
Fax (215) 362-3745
E-mail: BrooksAm@EmersonProcess.com
www.BrooksInstrument.com

Brooks Instrument

Neonstraat 3
6718 WX Ede, Netherlands
P.O. Box 428
6710 BK Ede, Netherlands
Tel 31-318-549-300
Fax 31-318-549-309
E-mail: BrooksEu@EmersonProcess.com

Brooks Instrument

1-4-4 Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel 011-81-3-5633-7100
Fax 011-81-3-5633-7101
Email: BrooksAs@EmersonProcess.com

⚠ WARNING

Before returning the device purge thoroughly with a dry inert gas such as Nitrogen before disconnecting gas connections. Failure to correctly purge the instrument could result in fire, explosion or death. Corrosion or contamination may occur upon exposure to air.

All flow instruments returned to Brooks requires completion of Form RPR003-1, Brooks Instrument Decontamination Statement, along with a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. Failure to provide this information will delay processing by Brooks personnel. Copies of these forms can be downloaded from the Brooks website www.BrooksInstrument.com or are available from any Brooks Instrument location listed above.

2-5 Transit Precautions

To safeguard against damage during transit, transport the instrument to the installation site in the same container used for transportation from the factory if circumstances permit.

2-6 Removal from Storage

Upon removal of the instrument from storage, a visual inspection should be conducted to verify its "as-received" condition.

2-7 Installation of meter

NOTICE

Ribbed tube meters only - prior to meter installation, remove the plastic shipping tube to prevent float movement during shipping.

A. Location

For proper operation of the Full-View flowmeter it must be mounted within 6 degrees of true vertical, with the inlet connection at the bottom of the meter, and the outlet at the top. The use of a level is recommended to assure vertical positioning.

B. Piping Arrangement

Installation of a bypass piping arrangement is strongly recommended, Figure 2-1. Bypass piping permits the meter to be isolated from the flow line for servicing and cleaning. For more details refer to Brooks T-023 Technical Bulletin Guide for bypass meters.

CAUTION

Do not allow the float to fall out of the metering tube. A damaged float will affect the accuracy of the meter. Be careful not to break the tube by pulling on it at an extreme angle or applying excessive force.

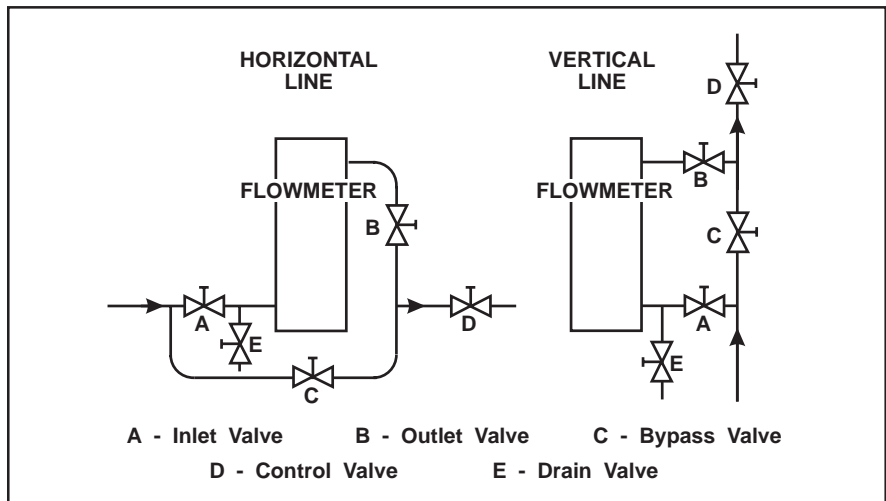


Figure 2-1 Typical Bypass Installation

CAUTION

Failure to drain the flowmeter when isolated in a bypass loop may result in tube breakage caused by thermal expansion of the process liquid.

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3-1 General


After the flowmeter has been properly installed in the process, it is ready for operation. When initiating flow, slowly open the valve to avoid a flow surge. Bypass is a help in bringing the flow on smoothly. Avoid starting a pump to supply the flowmeter without the use of a valve upstream of the flowmeter.

⚠ WARNING
Before operating the flowmeter, ensure all fluid connections have been properly tightened and, where applicable, all electrical connections have been properly terminated.

3-2 Operational Check

Prior to initial start-up and each time the flowmeter is reassembled, the zero alignment should be checked. If the zero line on the tube is aligned with the zero line on the scale, the flowmeter is ready for operation. If the zero lines are not aligned, loosen the screws securing the scale and move it until the marks are in alignment. Then tighten the screws.

3-3 Operating Instructions

	⚠ WARNING
GLASS TUBE EXPLOSION HAZARD	
<p>Plastic protective sleeve must remain over glass tube. (Meter sizes 7 -13 only) Fasten meter windows securely. Do not operate above pressure and temperature limits. Avoid pressure and flow surges. Do not service or repair while pressurized. Read and understand instruction manual. Failure to comply could result in serious personal injury or property damage.</p>	

⚠ WARNING
GLASS TUBE EXPLOSION HAZARD
<p>Protective sleeve must remain over glass tube. (Meter sizes 7 - 13 only) Fasten meter windows securely. Failure to comply could result in serious personal injury or property damage.</p>

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To initiate flow through a flowmeter using bypass piping, refer to Figure 3-1.

1. Close flowmeter isolation valves (A) and (B).
2. Fully open bypass valve (C) and slightly open control valve (D).
3. Initiate process flow. When flow has stabilized, fully open isolation valve (B), then slowly open isolation valve (A) fully.
4. Close bypass valve (C).
5. Regulate process flow using control valve (D).
6. If meter is left in bypass configuration, open drain valve (E) to prevent tube damage caused by thermal expansion of the process liquid.

CAUTION

Failure to drain the flowmeter when isolated in a bypass loop may result in tube breakage caused by thermal expansion of the process liquid.

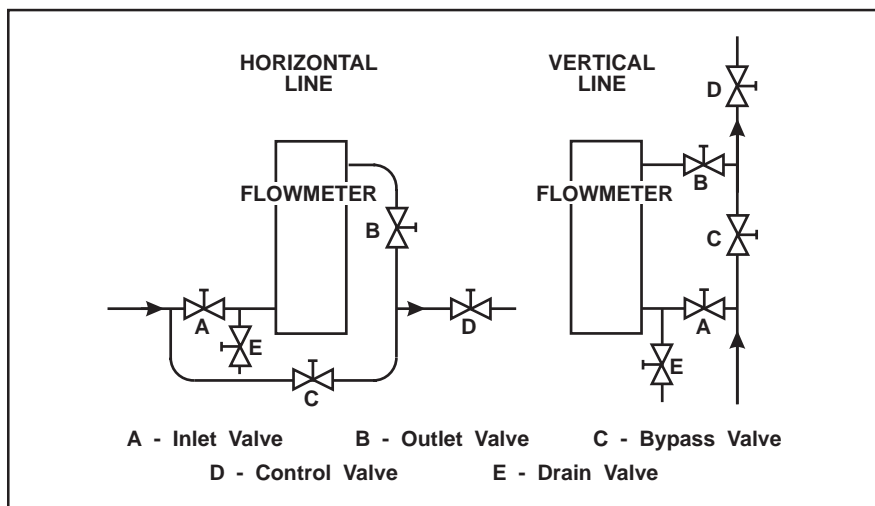


Figure 3-1 Typical Bypass Installation

4-1 General

This section provides the assembly and disassembly procedures for the Brooks Full-View flowmeters.

	<p>⚠ WARNING</p> <p>METER/CONTROLLER SEAL COMPATIBILITY</p>
<p>Products in this manual may contain metal or elastomeric seals, gaskets, O-rings or valve seats. It is the "user's" responsibility to select materials that are compatible with their process and process conditions. Using materials that are not compatible with the process or process conditions could result in the Meter or Controller leaking process fluid outside the pressure boundary of the device, resulting in personnel injury or death.</p> <p>It is recommended that the user check the Meter or Controller on a regular schedule to ensure that it is leak free as both metal and elastomeric seals, gaskets, O-rings and valve seats may change with age, exposure to process fluid, temperature, and /or pressure.</p>	

<p>⚠ WARNING</p>
<p>If it becomes necessary to remove the flowmeter from the system after exposure to toxic, pyrophoric, flammable or corrosive gas, purge the flowmeter thoroughly with a dry inert gas such as Nitrogen before disconnecting the gas connections. Failure to correctly purge the flowmeter could result in fire, explosion or death. Corrosion or contamination of the flowmeter upon exposure to air, may also occur.</p>

<p>⚠ CAUTION</p>
<p>It is important that this device only be serviced by properly trained and qualified personnel.</p>

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4-2 Disassembly and Reassembly

Note: Step number preceded by an asterisk (*) apply only to rod guided floats.

⚠ NOTICE

Anytime the meter is removed for service, new O-rings should be installed in both the inlet and outlet end fittings.

A. Disassembly

1. Remove the four bolts attaching each window frame. Carefully remove both windows and frames.
2. Loosen, but do not remove, the four gland bolts in each end fitting.
3. Remove the four bolts attaching each side plate. Remove the side plates.
4. Remove the four gland bolts in each end fitting, being careful to keep the gland followers from sliding down the glass tube.
5. Remove the tube and packing assemblies from the end fittings.
6. Remove the inlet packing (narrow end), both gland rings, polycarbonate sleeve, Size 7 (1/2") and larger, and gland followers from the tube.
7. Remove the float from the tube.

⚠ CAUTION

In the following procedure, do not allow the guide rod or float to strike the tube.

- *8. Remove the nuts on the guide rod by using two wrenches; one to hold the inner nut, and one to remove the outer nut from the rod.
- *9. Hold the cartridge in position and remove the inner nut. Remove the cartridge and gasket.
- *10. Remove the float and the guide rod from the tube.

⚠ NOTICE

Carefully inspect the guide rod. Should the guide rod become bent or its polished surfaces marred, it is advisable to replace it. NEVER attempt to straighten a bent guide rod.

B. Reassembly

- *1. Install a cartridge and gasket on the guide rod. Insert the guide rod in the tube. Install the float, cartridge gasket, and cartridge on the guide rod and secure with one nut. Refer to Figure 1-2 for the correct orientation of the float.
- *2. Tighten the single guide rod nut until the rod is under slight tension.
- *3. Hold the single guide rod nut in position. Install and tighten the second nut against it.

⚠ CAUTION

In the following procedure, the guide rod nut should be tightened only until finger pressure cannot rotate the guide rod. Over tightening can result in tube breakage.

4. Install the gland followers, polycarbonate sleeve, Size 7 (1/2") and larger, gland rings, and packing on the tube.

Note: Both hat gaskets are purposely tight fitting and can be installed more easily from the inlet (narrower) end of the tube. The inlet (smaller) 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 flat surface prior to installation and carefully work the tube through the gasket and ring. This will stretch the gasket enough that it can be removed and reassemble on the tube in the proper order. Immersing the hat gaskets in warm water will further increase their elasticity. If the outlet gasket on larger tubes is unable to be moved into position when being driven by the packing ring, a small amount of silicone lubricant may be used.

5. Install the end fittings onto the tube and packing assembly. Insure that the outlet (large) end of the tube fits flush against the tube seat gasket in the outlet (top) end fitting.
6. Rotate the tube so that the zero line or scale is in the proper, legible position.
7. Secure the outlet gland ring and follower with the four gland bolts. Do not tighten the bolts more than finger tight at this time.
8. Install the inlet end fitting on the tube. Secure the inlet gland ring and follower with the four gland bolts. Do not tighten the bolts more than finger-tight at this time.
9. Install the scale side plate (if applicable). Secure with the four side plate bolts.
10. Install the second side plate. Secure with the four side plate bolts.
11. Tighten the gland bolts on the outlet fitting to prevent the tube from pulling away from the seating gasket.
12. Perform final alignment of the detachable scale (if applicable) with the zero line on the tube.
13. Install the windows and window frames. Secure the window and frame assemblies with the four window frame bolts. Tighten the bolts to one quarter turn past snug.

⚠ WARNING

Pressure test the meter before returning it to service. Hydrostatic pressure testing should be performed by qualified personnel or serious injury and/or damage to the equipment can result.

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5-1 General

See Optional Equipment, Section 1-4, for specifications, dimensions, and options. Refer to both parts of Figures 5-1a thru 5-1c and Table 5-1 for exploded drawing and parts.

Table 5-1 Model 1110 Exploded Parts List

SEQ #	PART DESCRIPTION	Component Applicable to			Retro-Fi Kits					
		Sz 2 & 6	Sz 7 - 10	Sz 12 & 13	Sz 7	Sz 8	Sz 9	Sz 10	Sz 12	Sz 13
1	Glass Tube	X	X	X	X	X	X	X	X	X
2	Inlet Tube Packing	X	X	X	X	X	X	X	X	X
3	Outlet Tube Packing	X	X	X	X	X	X	X	X	X
4	Tube Seat Gasket	X	X	X	X	X	X	X	X	X
5	Inlet Gland Ring	X	X	X	X	X	X	X	X	X
6	Outlet Gland Ring	X	X	X	X	X	X	X	X	X
7	Gland Followers	X	X	X	X	X	X			
8	Float	X	X	X						
9	Inlet Float Stop/Plug	X	X	X						
10	Inlet Spring Stop/Valve stop	X	X	X						
11	Outlet Float stop	X	X	X						
12	Outlet Spring Stop/Valve stop	X	X	X						
13	Inlet End Fitting	X	X	X						
14	Inlet Stuffing Box Ring	X	X	X						
15	Outlet End fitting	X	X	X						
16	O'Rings	X	X	X						
17	Right Scale Plate	X	X	X						
18	Scale	X	X	X						
19	Left Scale Plate	X	X	X						
20	Window Frame	X	X	X						
21	Window	X	X	X	X	X	X	X	X	X
22	Window Gasket	X	X	X	X	X	X	X	X	X
23	Warning Label	X	X	X						
24	Valve Seat Assembly	X	X	O						
25	Tripod Base Plate									
26	Panel Mounting Bracket									
27	Inlet Tube Seat Insert	X	O	O						
28	Outlet Tube Seat Insert	X	O	O						
29	Warning Label (Side Plate)									
30	Warning Label (Window)									
31	Sleeve	O	X	X	X	X	X	X	X	X
32	Bracket Cleat									
33	Bracket Washer									
34	Scale Mounting Screws	X	X	X						
35	Follower Screws	X	X	X						
36	Window Frame Screws	X	X	X						
37	Side Plate Screws	X	X	X						
38	Valve Assembly	X	X	O						

X = Available O = Not Available

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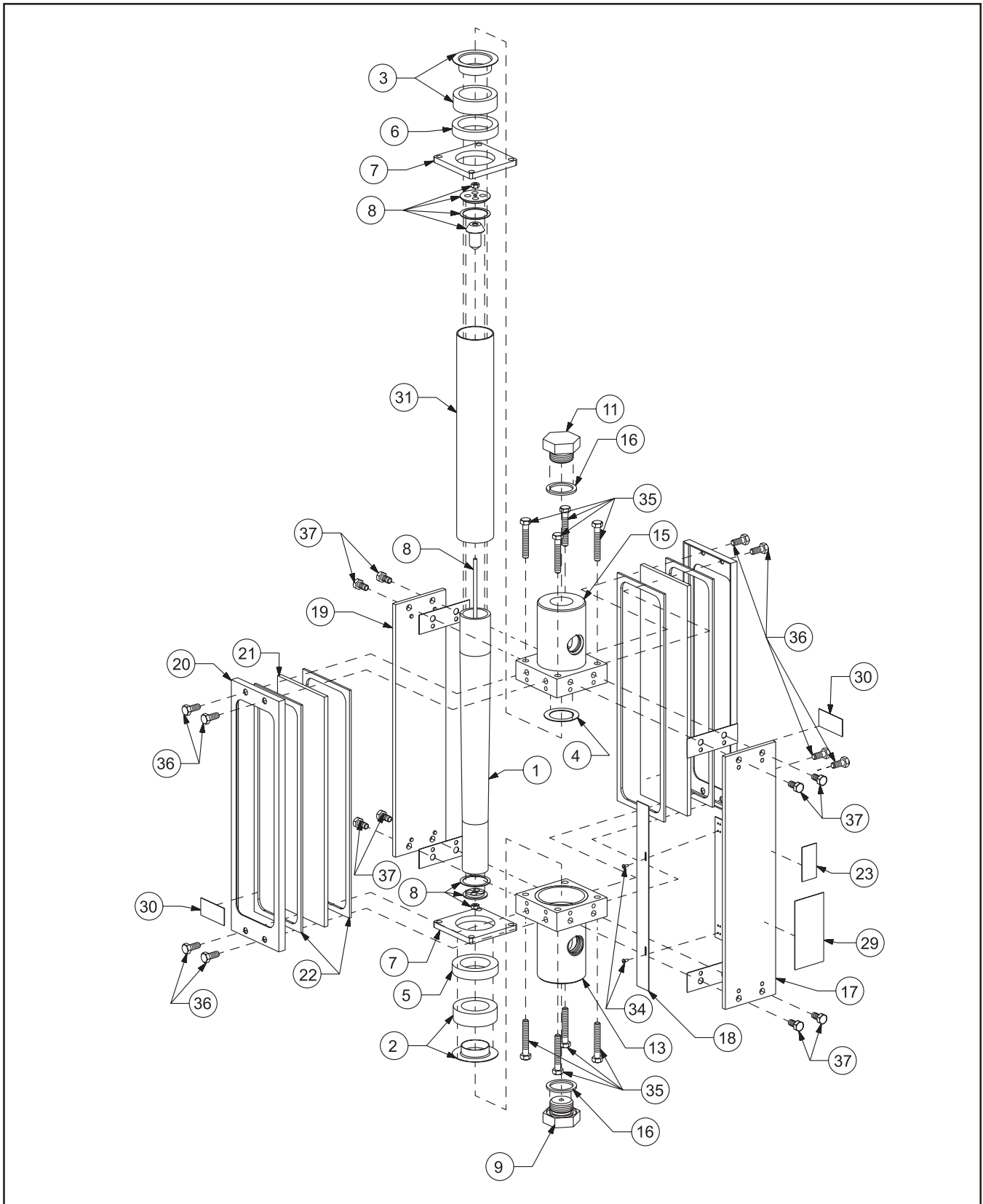


Figure 5-1a Model 1110 Exploded Parts Drawing

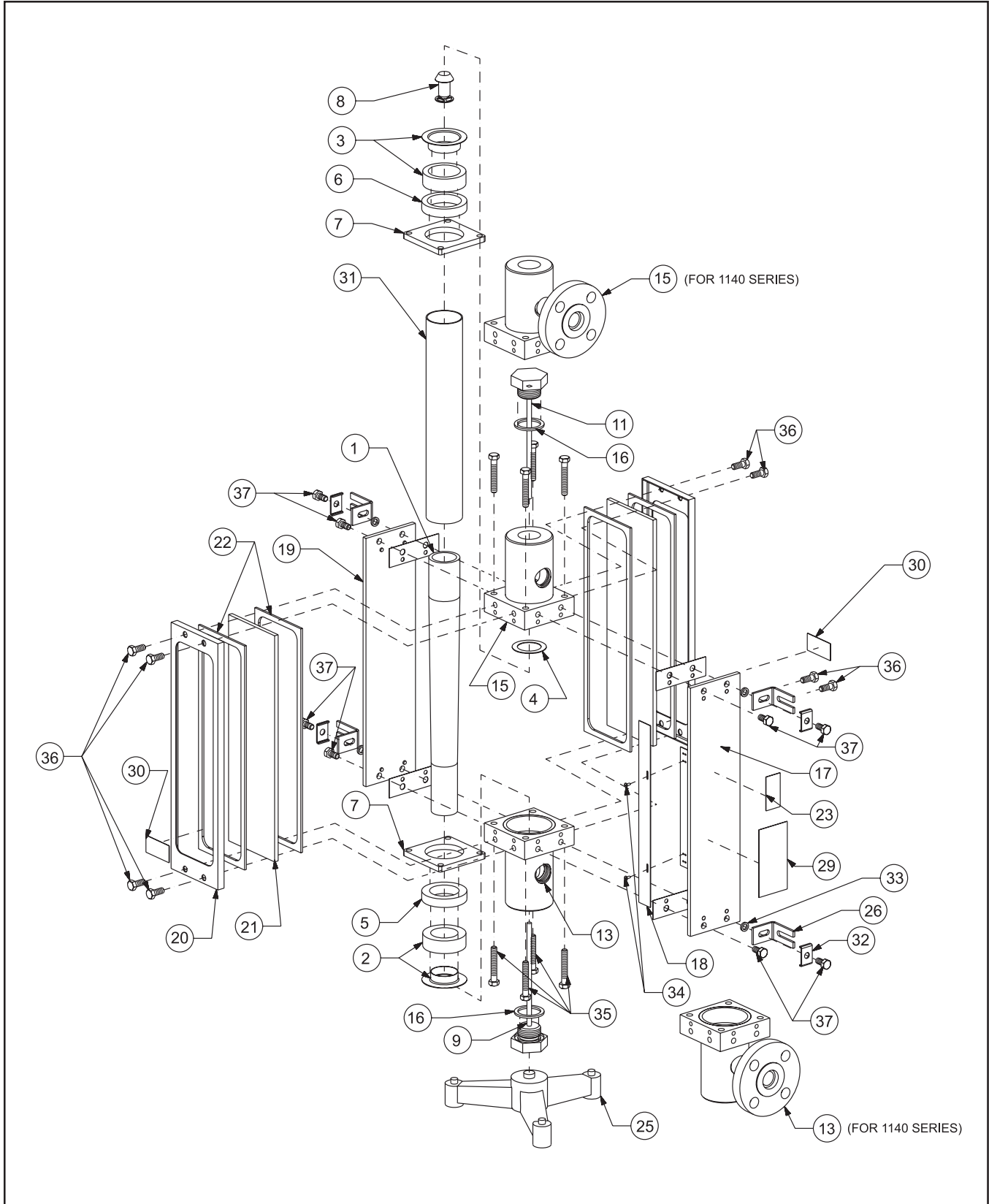


Figure 5-1b Model 1110 Exploded Parts Drawing (Continued)

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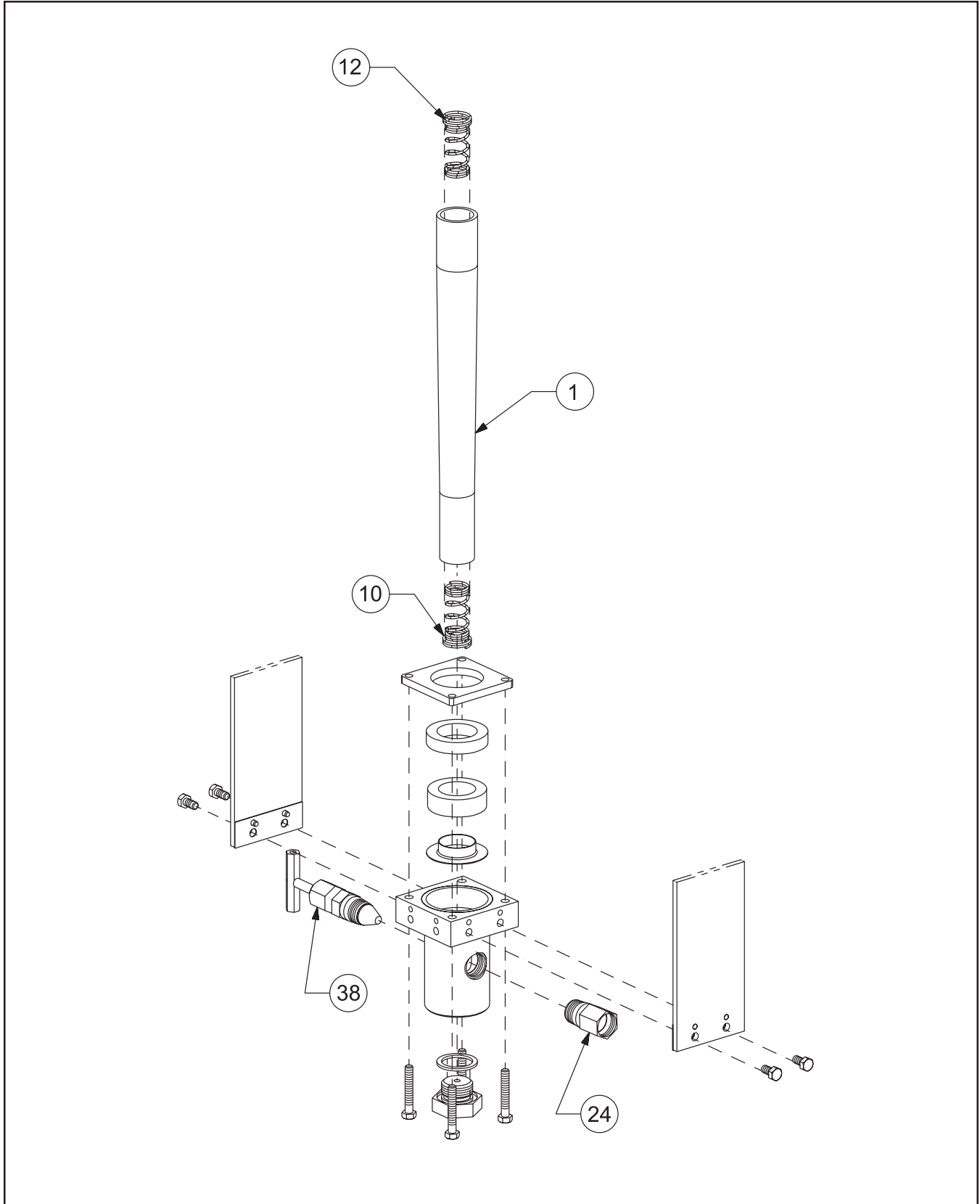


Figure 5-1c Model 1110 Exploded Parts Drawing (Continued)

Installation and Operation Manual

X-VA-1110-1140-eng
Part Number: 541B040AHG
March, 2008

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LIMITED WARRANTY

Seller warrants that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and service and that the Software will execute the programming instructions provided by Seller until the expiration of the earlier of twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer.

All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense.

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BROOKS LOCAL AND WORLDWIDE SUPPORT

Brooks Instrument provides sales and service facilities around the world, ensuring quick delivery from local stock, timely repairs and locally based sales and service facilities.

Our dedicated flow experts provide consultation and support, assuring successful applications of the Brooks flow measurement and control products.

Calibration facilities are available in local sales and service offices. The primary standard calibration equipment to calibrate our flow products is certified by our local Weights and Measures Authorities and traceable to the relevant international standards.

START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required.

For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

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Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

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