

# Sho-Rate Series Models 1350G/1355G (Sizes 2-6) Glass Tube Variable Area Flow Meters

## Installation & Operation Manual



**BROOKS**<sup>®</sup>  
INSTRUMENT

*Beyond Measure*

## Essential Instructions Read before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. These products must be properly installed, operated and maintained 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, operating and maintaining Brooks Instrument products.

- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- 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.

**⚠ WARNING: Do not operate this instrument in excess of the specifications listed in the Instruction and Operation Manual. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.**

- 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.

**⚠ WARNING: Prior to installation ensure this instrument has the required approval ratings to meet local and national codes. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.**

- 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.
- Operation: (1) Slowly initiate flow into the system. Open process valves slowly to avoid flow surges. (2) Check for leaks around the flow meter inlet and outlet connections. If no leaks are present, bring the system up to the operating pressure.
- Please make sure that the process line pressure is removed prior to service. 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 to prevent electrical shock and personal injury, except when maintenance is being performed by qualified persons.

**⚠ WARNING: For liquid flow devices, if the inlet and outlet valves adjacent to the devices are to be closed for any reason, the devices must be completely drained. Failure to do so may result in thermal expansion of the liquid that can rupture the device and may cause personal injury.**

## European 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 Specifications Section of this manual contains instructions related to the PED directive.
- Products described in this manual are in compliance with EN directive 2014/34/EU.
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Products larger than 25mm or 1" (inch) are in compliance with PED category I, II or III.
- Products of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

## European Electromagnetic Compatibility (EMC)

The Brooks Instrument (electric/electronic) equipment bearing the CE mark has been successfully tested to the regulations of the Electro Magnetic Compatibility (EMC directive 2014/30/EU).

Special attention however is required when selecting the signal cable to be used with CE marked equipment.

**Quality of the signal cable, cable glands and connectors:**

Brooks Instrument supplies high quality cable(s) which meets the specifications for CE certification.

If you provide your own signal cable you should use a cable which is overall completely screened with a 100% shield.

"D" or "Circular" type connectors used should be shielded with a metal shield. If applicable, metal cable glands must be used providing cable screen clamping.

The cable screen should be connected to the metal shell or gland and shielded at both ends over 360 Degrees.

The shield should be terminated to an earth ground.

Card Edge Connectors are standard non-metallic. The cables used must be screened with 100% shield to comply with CE certification.

The shield should be terminated to an earth ground.

For pin configuration : Please refer to the enclosed Instruction Manual.

## ESD (Electrostatic Discharge)

**⚠ CAUTION: This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.**

**Handling Procedure:**

1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

**Comments**

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, SMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

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## Section 1: Introduction

### Description

The Sho-Rate Flowmeters are variable area, glass tube, flow rate indicating meters. The basic elements are a tapered glass metering tube and a metering float. Features include quick and simple removal or installation of the tube and float while the meter remains in the process piping.

### Specifications (Reference Tables 1-1 thru 1-5)

#### **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 even within 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 (60°C), steam, alkalis, fluorine, hydrofluoric acid, or molten metal. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

#### **CAUTION**

It is the user's responsibility to select and approve all materials of construction. Careful attention to metallurgy, engineered materials and elastomeric materials is critical to safe operation.

## Section 1 Introduction

Table 1-1 Specifications for Sho-Rate Models 1350G and 1355G

Performance	1350G	1355G
Accuracy	±5% at reference conditions*	± 3% at reference conditions*
Repeatability	0.25% F.S.	
Pressure/Temperature	200 psig (33°F - 250°F) / 13.8 bar (1°C-121°C)	
Materials of Construction	Borosilicate glass, Brass, Aluminum, 316 Stainless Steel, Clear Polycarbonate, Milk White Polycarbonate, Teflon®	
End Block Options	Stainless Steel and Brass	
Elastomer Seals	Viton® fluor elastomers, Teflon®, Buna, Kalrez® perfluoroelastomers	
Float Materials	Glass, Sapphire, Stainless Steel, Carboloy®, Tantalum	
Connection Materials	Stainless Steel	
Connection Options	1/8" NPT (w/wo locknuts) 1/4" NPT (w/wo locknuts) 1/8" Compression (w/wo locknuts) 1/4" Compression (w/wo locknuts) 6 mm Compression (w/wo locknuts) 1/4" RC (w/wo locknuts) 3/8" RC (w/wo locknuts) 1/4" VCR® 1/4" ID Hose Swagelok® Converters	
Dimensions	See Dimension Drawings	
Alarm Availability	Low Alarm High Alarm Dual Alarm	
Valve Options	Cartridge III Valve and NRS™	
Valve Materials	Stainless Steel	
Flow Controller	Yes	
Certifications	International Calibration Certificate (ICC) CRN Pressure Equipment Directive (97/23/EC) RoHS (II) REACH (coming soon) Materials (2.2)	

\* Reference conditions apply to air or water at 14.7 psia and 70 Degrees F/1.01 Bar and 21.1 Degrees C.

Table 1-2 Capacities - Rib Guide Tubes, Spherical Floats for use with 1350G Series Only

Meter Size	Tube No.	Float Material	Water		Air	
			GPH	LPH	SCFH	NLPH
2	R-2-65-A G	Glass	0.010	0.041	0.12	3.2
		Sapphire	0.021	0.079	0.19	5.0
		Stainless Steel	0.049	0.18	0.37	9.8
		Carboloy	0.10	0.36	0.65	17
		Tantalum	0.10	0.40	0.71	18
	R-2-65-B G	Glass	0.014	0.06	0.16	4.4
		Sapphire	0.028	0.10	0.25	6.7
		Stainless Steel	0.07	0.25	0.48	12
		Carboloy	0.12	0.48	0.80	21
		Tantalum	0.14	0.53	0.87	22
	R-2-65-C G	Glass	0.12	0.47	0.99	26
		Sapphire	0.22	0.83	1.3	35
		Stainless Steel	0.41	1.5	2.1	55
		Carboloy	0.65	2.4	3.1	81
		Tantalum	0.70	2.6	3.3	87
	R-2-65-D G	Glass	0.68	2.5	3.9	100
		Sapphire	0.99	3.7	5.1	130
		Stainless Steel	1.6	6.3	7.9	200
		Carboloy	2.5	9.5	11	290
		Tantalum	2.7	10.0	12	310
6	R-6-65-A G	Glass	2.2	8.5	13	340
		Sapphire	3.3	12	17	440
		Stainless Steel	5.6	21	25	660
		Carboloy	8.3	31	36	940
		Tantalum	8.8	33	38	1000
	R-6-65-B G	Glass	8.7	33	46	1200
		Sapphire	12	47	59	1500
		Stainless Steel	20	76	86	2200
		Carboloy	29	100	110	3100
		Tantalum	30	110	120	3300

Air flows are at 14.7 psia and 70 Degrees F/1.01 Bar and 21.1 Degrees C

Table 1-3 Tube and Float Code - Seventh Digit in Model Code for Scale Configuration

Code	Model 1350 Tube	Model 1355 Tube
A		R-2-15-A G
B		R-2-15-B G
C		R-2-15-C G
D		R-2-15-D G
F		R-6-15-B G
G	R-2-65-A G	R-2-15-AAAA G
H	R-2-65-B G	
J	R-2-65-C G	
K	R-2-65-D G	
L	R-6-65-A G	
M	R-6-65-B G	
N	No Tube	No Tube

Table 1-4 Tube and Float Code - Eighth and Ninth Digit in Model Code for Scale Configuration

Meter Accuracy	Float Material	Decal Scale Inscription			
		MM Scale	Linear Scale	Custom Decal	Percent Scale
Standard (1350-10%) (1355-5%)	Glass	1A	2A	3A	4A
	Stainless Steel	1B	2B	3B	4B
	Sapphire	1C	2C	3C	4C
	Carboloy	1D	2D	3D	4D
	Tantalum	1E	2E	3E	4E
Calibrated (1350-5%) (1355-2%)	Glass	1G	2G	3G	4G
	Stainless Steel	1H	2H	3H	4H
	Sapphire	1J	2J	3J	4J
	Carboloy	1K	2K	3K	4K
	Tantalum	1L	2L	3L	4L

\*Note: Code for No Float/No Scale = "ZZ"

## Section 1 Introduction

Table 1-5 Capacities - Rib Guide Tubes, Spherical Floats for use with 1355G Series Only

Meter Size	Tube No.	Float Material	Maximum Flow Rate*	
			Water (CC/Min)	Air
2	R-2-15-AAAA G	Glass	0.59	50 SCC/M
		Sapphire	1.1	79 SCC/M
		Stainless Steel	2.6	150 SCC/M
		Carboloy	5.2	280 SCC/M
		Tantalum	5.8	310 SCC/M
	R-2-15-D G	Glass	5.5	370 SCC/M
		Sapphire	10	520 SCC/M
		Stainless Steel	20	830 SCC/M
		Carboloy	34	1200 SCC/M
		Tantalum	36	1300 SCC/M
	R-2-15-A G	Glass	17	0.82 SLPM
		Sapphire	26	1.0 SLPM
		Stainless Steel	46	1.6 SLPM
		Carboloy	70	2.4 SLPM
		Tantalum	75	2.5 SLPM
	R-2-15-B G	Glass	53	2.3 SLPM
		Sapphire	80	3.0 SLPM
		Stainless Steel	130	4.6 SLPM
		Carboloy	200	6.7 SLPM
		Tantalum	210	7.1 SLPM
R-2-15-C G	Glass	90	4.0 SLPM	
	Sapphire	130	5.2 SLPM	
	Stainless Steel	220	7.9 SLPM	
	Carboloy	340	11 SLPM	
	Tantalum	360	11 SLPM	
6	R-6-15-A G	Glass	210	9.5 SLPM
		Sapphire	320	12 SLPM
		Stainless Steel	540	18 SLPM
		Carboloy	790	25 SLPM
		Tantalum	840	26 SLPM
	R-6-15-B G	Glass	560	23 SLPM
		Sapphire	820	29 SLPM
		Stainless Steel	1300	43 SLPM
		Carboloy	1900	60 SLPM
		Tantalum	2000	63 SLPM

Air flows are at 14.7 psia and 70 Degrees F/1.01 Bar and 21.1 Degrees C

### Optional Equipment

#### Standard Needle Valve

The standard needle valve can be supplied integrally mounted to the inlet or outlet of the instrument. For more details on the needle valve go to our website: [BrooksInstrument.com](http://BrooksInstrument.com), select Documentation, Precision Valves & Flow Controllers, select Brooks-Line IV, CART, 8503 or 8504 valves.

#### Flow Contollers

Flow controllers can be supplied integrally mounted to the inlet or outlet of the instrument. For the flow controller's complete instruction manual go to our website: [BrooksInstrument.com](http://BrooksInstrument.com), select Documentation, Precision Valves & Flow Controllers, select FC8800, or FC8900.



### Section 2: Installation

#### General

This section provides installation instructions for the Brooks® Sho-Rate Models 1350G/1355G Flowmeters. Refer to Section 1 of this manual for connections.

#### Receipt of Equipment

When the equipment 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 the nearest Brooks Instrument location listed on the Global Service Network page on our website:

[BrooksInstrument.com/GlobalSupportCenters](http://BrooksInstrument.com/GlobalSupportCenters)

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.

#### Unpacking

Carefully unpack the meter and inspect it for any damage that may have occurred during shipment. The flowmeters are shipped completely assembled and tested. It should not be necessary to tighten or adjust any of the parts when it is received.

#### Return Shipment

Prior to returning any instrument to the factory for any reason, visit our website for instructions on how to obtain a Return Materials Authorization Number (RMA #) and complete a Decontamination Statement to accompany it: [BrooksInstrument.com/Service](http://BrooksInstrument.com/Service). All instruments returned to Brooks also require a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. Failure to provide this information will delay processing of the instrument.

Instrument must have been purged in accordance with the following:

#### **WARNING**

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

#### Recommended Storage Practice

If intermediate or long term storage is required for equipment, as supplied by Brooks Instrument, it is recommended that said equipment be stored in accordance with the following:

- Within the original shipping container.
- Stored in a sheltered area, preferably a warm, dry heated warehouse.
- Ambient temperature: 70°F (21.0°C) nominal, 110°F (43°C) maximum, 45°F (7.1°C) minimum.
- Relative humidity 45% nominal, 60% maximum, 25% minimum.

## Section 2 Installation

Upon removal from storage, a visual inspection should be conducted to verify the condition of equipment is “as received”. If the equipment has been in storage for an excess of two (2) years or in conditions in excess of those recommended, all pressure boundary seals should be replaced and the device subject to a hydrostatic/pneumatic pressure test to 150% of rated pressure.

### Installation

The flowmeter should be mounted within 6° of true vertical. The inlet connection to the flowmeter is in the bottom end fitting. The connections are normally horizontal, female NPT. Be sure the piping is adequately supported to prevent undue strain on the meter.

#### **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.

#### **CAUTION**

Care must be taken in the system piping to this instrument to prevent sudden excessive pressure or flow surges. Protective devices should be installed upstream from this instrument, such as flow controllers, pressure regulators, pressure snubbers and rupture discs.

#### **CAUTION**

Any sudden change in system pressure may cause mechanical damage to elastomer materials. Damage can occur when there is a rapid expansion of fluid that has permeated elastomer materials. The user must take the necessary precautions to avoid such conditions.