# **Installation & Operation Manual**

# Sho-Rate<sup>™</sup> Series Model 1358 Variable Area Flow Meters



### 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.
- A 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.
- A 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.
- A 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)

 $\label{eq:control} {\bf A} \ {\bf CAUTION: This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.$ 

#### 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.
- 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.



## 

**GLASS TUBE EXPLOSION** HAZARD

Plastic protective sleeve must remain over glass tube.

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 per-sonal injury or property damage.

## **WARNING**

**GLASS TUBE EXPLOSION HAZARD** 

Protective sleevemustremainoverglasstube. Fasten meter windows securely. Failure to comply could result in serious personal injury or property damage.

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#### Description

The Brooks<sup>®</sup> Sho-Rate "50" Series of low flow indicators provides a cost-effective means of flow indication where the accuracy requirements are not severe. Available options include an integral needle control valve as well as flow controllers piped to the inlet or outlet of the meter.

#### **Design Features**

- Ten-to-one rangeability
- Heavy-wall, precision bore borosilicate glass metering tube
- A wide range of scales on the metering tube
- Tube removable without disconnecting the instrument
- Interchangeable tubes and floats
- Piping connections rotatable through 360° at 90° intervals
- Easily panel mounted

#### Specifications

## 

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.

## 

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, steam, alkalis, flourine, hydrofluoric acid, or molten metal. Failure to heed warning can result in serious personal injury and/ or damage to the equipment.

#### Pressure/Temperature

200 psig at 33°F to 250°F (1°C to 121°C) Fluid temperatures below 32°F (0°C) will cause frosting of the glass metering tube. Consult factory for applications below this temperature. 100 psig at 33°F to 250°F (1°C to 121°C) (CRN Certification)

#### Pressure Equipment Directive (PED) 97/23/EC

Flowmeters mentioned in this instruction manual are Sound Engineering Practice (SEP).

#### Scales

Type (Standard): Fused on meter tube Length: 75 mm, nominal Graduations:

Standard: direct read on tube in gpm water or scfm air. Optional: special direct read decal on tube. Consult factory for available ranges. Direct read on metal scale plate mounted beside tube.

#### **Capacities and Pressure Drops**

Refer to Table 1-1

#### **Standard Accuracy**

±10% of full scale from 100% to 10% of scale reading.

#### Repeatability

0.5% full scale

#### Rangeability

Ten to one

#### Table 1-1 Capacities

Capacities			Pressure Drop without Valve Inches W.C.	Pressure Drop with Valve Inches W.C.	Float
		0.8	12.6	13.6	8-RV-8
	14/-1	1.5	22.2	27.0	8-RJ-10
	Water	2.5	61.0	85.2	8-RJ-23
Maximum	(gpm)	3.5	88.7	121.0	8-RJ-30
Flow Rate		5.0	172	238.0	8-RJ-39
Flow Rate		3.4	14.34	15.5	8-RV-8
	Air (scfm)	6.0	25.34	30.8	8-RJ-10
		12.0	69.34	97.3	8-RJ-23
		15.0	101.34	138.3	8-RJ-30

NOTE: All air flows are at 14.7 psia and 70°F. Reference conditions 70°F @ latm.

#### Connections

Standard: Horizontal female 3/8" NPT threaded adaptors.

#### Dimensions

See Figure 1-1

#### Materials of Construction

Metering Tube Borosilicate glass

#### Protective Tube Sleeve

UV stabilized polycarbonate



316 stainless steel

#### End Fittings

Chrome plated brass or 316 stainless steel

#### Side Plates

Standard: Black anodized aluminum Optional: 316 stainless steel

#### Window

Scratch resistant, UV stabilized polycarbonate



Protective sleeve must remain over glass tube. Fasten meterwindows securely. Failure to comply could result in seriouspersonal injury or property damage.

#### Back Cover

Milk white polycarbonate

#### Float Stops

Stainless steel

#### **Tube Packing**

Standard: Neoprene<sup>®</sup> (Brass meters), Viton-A<sup>®</sup> fluoroelastomers (316 stainless steel meters). Optional: Teflon<sup>®</sup>, EPM

#### **O-Rings**

Standard: Buna-N (Brass meters), Viton-A Optional: (316 stainless steel meters): EPM, Kalrez®



Figure 1-1 Model 1358 Dimensions

#### **Optional Equipment**

#### Mounting

Flush panel mounting bezel Front of panel mounting locknuts

#### **Standard Needle Valve**

The standard needle valve can be supplied integrally mounted or externally piped to the inlet or outlet of the instrument.

#### **Flow Contollers**

Flow controllers can be supplied integrally mounted or externally piped to the inlet or outlet of the instrument. For the flow controller's complete instruction manual go to our website: <u>BrooksInstrument.com</u>, select Documentation, Precision Valves & Flow Controllers, select FC8800, or FC8900.

#### **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.

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.

#### **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".

#### **Return Shipment**

Prior to returning any instrument to the factory, contact your nearest Brooks location for a Return Materials Authorization Number (RMA#).

Any instrument returned to Brooks requires completion of Form RPR003-1, Brooks Instrument Decontamination Statement, as well as, a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. This is required before any Brooks Personnel can begin processing. Copies of the form can be obtained from any Brooks Instrument location listed above.

#### **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.

#### Installation

A. Location

For proper operation the Model 1358 must be mounted within 6 degrees of true vertical. The inlet connection to the flowmeter is in the bottom end fitting. The connections are normally horizontal female NPT. The use of a level is recommended to assure vertical positioning. Piping must be adequately supported to prevent undue strain on the flowmeter.

B. Piping Arrangement

It is recommended that bypass piping be installed around the flowmeter so it may be isolated from the process line for servicing and cleaning. Refer to Figure 2-1 for a typical installation.

## 

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

## **A**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 2-2 Front Panel Mounting

#### **Operating Instructions**

After the flowmeter has been properly installed in the system, it is ready for operation.



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.

### 

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.

## 

#### **GLASS TUBE EXPLOSION HAZARD**

Protective sleeve must remain over glass tube. Fasten meterwindows securely. Failure to comply could result in seriouspersonal injury or property damage. Rate of flow is indicated by reading the increments inscribed on the metering tube or direct etched scale parallel with the metering edge of the float. For the correct reading edge of the float, refer to Figure 3-2.

## 

A built-in needle control valve may be provided to control the flow through the flowmeter. These control valves are designed for fine control. Excessive tightening may damage the valve seat and limit its effectiveness as a control valve. If tight shut-off is required, it is recommended that a separate shut-off valve be installed in the line immediately before the flowmeter.



Figure 3-1 Typical Bypass Installation



Figure 3-2 Reading Edge of floats

#### General



## 

#### 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.

Model 1358 flowmeters require little maintenance except routine cleaning. It is necessary to remove the flowmeter from the line for tube and float cleaning. The tube and float may be cleaned with a soft absorbent swab. To disassemble the flowmeter proceed as follows:

- a. Remove the front and rear window shields.
- b. Loosen the seal spindle or jack screw by turning it counterclockwise with a 5/32" hex wrench.
- c. The tube may now be canted out of the meter housing.
- d. Remove the polycarbonate sleeve surrounding the flow tube.
- e. Remove the float and float stops from the tube.

### 

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.

- f. Using a suitable solvent, carefully swab and flush the inside of the metering tube. Clean the float and blow dry all parts thoroughly.
- g. The packing seats may now be removed. It is recommended that the packing be replaced each time the meter is serviced.
- h. With the metering tube out, the seal spindle or jack screw may be rotated clockwise for removal. It should not be necessary to remove the seal spindle unless the O-ring which seals the spindle requires replacement. The O-ring may be used as long as it is not torn or distorted.
- i. The needle control valve assembly may be removed by turning the valve body counterclockwise. The valve seat, stem and packing then may be removed easily from the valve body for cleaning or replacement.

Reassemble the flowmeter as follows:

- a. Use the reverse of Steps a through e of the disassembly procedure to reassemble the meter.
- b. Prior to installing the needle control valve assembly make certain that the valve stem is turned completely counterclockwise (fully open position) to prevent damage to the valve seat.

## 

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.

#### General

When ordering parts please specify:

Brooks Serial Number, Model Number, Part Number, Description and Quantity. Refer to Figures 5-1 and Tables 5-1.



Figure 5-1 Exploded View, Size 8 Model 1358 Brooks Sho-Rate

Table 5-1 Model 1358 Parts List

REF NO	QTY	DESCRIPTION	PART NO
1	1	GLASS METERING TUBE	PER S/N
2	1	316 S.S. FLOAT 8-RV-8 8-RJ-10 8-RJ-23 8-RJ-30 8-RJ-39	S346B148BMA 349D078BMA 349D080BMA 349D077BMA 349D076BMA
3	1	INLET FLOAT STOP SPRING FLOAT STOP 0.8, 3.5 & 5 GPM SPRING FLOAT STOP 1.5 & 2.5 GPM	820B253BMA 820B254BMA
4	1	OUTLET FLOAT STOP SPRING FLOAT STOP 0.8, 3.5 & 5 GPM SPRING FLOAT STOP 1.5 & 2.5 GPM	820B253BMA 820B254BMA
5	2	TUBE SEAL PACKING VITON EPM NEOPRENE TEFLON	589B043QTA 589B043SYA 589B043TDA 589B241QMA
6	1	SEAL END FITTING 316 SS BRASS	325G001BMF 325G001GGL
7	1	SEAL SPINDLE 316 SS BRASS	817A055BMA 817A055GGJ
8	1	SEAL SPINDLE O-RING VITON BUNA-N EPM KALREZ	375B010QTA 375B010SUA 375B010SYA 375B010TTA
9	1	SEAL PLUG O-RING VITON BUNA-N EPM KALREZ	375B211QTA 375B211SUA 375B211SYA 375B211SYA 375B211TTA
10	1	JACKSCREW PLUG 316 SS BRASS	618J005BMA 618J005GGJ
11	1	JACKSCREW PLUG O-RING VITON BUNA-N EPM KALREZ	375B905QTA 375B905SUA 375B905SYA 375B905SYA 375B905TTA
12	1	VALVE END FITTING W/VALVE: 316 SS W/VALVE: BRASS W/VALVE, FOR BASEPLATE: 316 SS W/VALVE, FOR BASEPLATE: BRASS NO VALVE: 316 SS NO VALVE: BRASS	325H002BMF 325H002GGL 325H064BMF 325H064GGL 325J006BMF 325J006GGL

Table 5-1 Model 1358 Parts List (Continued)

		ans List (Continued)	
13	2	ADAPTER 3/8" NPT ADAPTER, NO LOCKNUT: 316 SS 3/8" NPT ADAPTER, NO LOCKNUT: BRASS 3/8" NPT ADAPTER, FOR LOCKNUT: 316 SS 3/8" NPT ADAPTER, FOR LOCKNUT: BRASS 1/2" NPT ADAPTER, NO LOCKNUT: 316 SS 1/2" NPT ADAPTER, NO LOCKNUT: BRASS	014C023BMA 014C023GGJ 014C034BMA 014C034GGJ 014C028BME 014C028GGJ
14	2	ADAPTER O-RING VITON BUNA-N EPM KALREZ	375B908QTA 375B908SUA 375B908SYA 375B908SYA 375B908TTA
15	2	LOCKNUT FOR FRONT OF PANEL MOUNTING	573B018AC0
16	1	LEFT SIDE PLATE SS SIDE PLATE ALUMINUM SIDE PLATE SS SIDE PLATE FOR LEFT DET. SCALE ALUMINUM SIDE PLATE FOR LEFT DET. SCALE	614A008BMF 614A008FBJ 614A175BMF 614A175FBJ
17	1	RIGHT SIDE PLATE SS SIDE PLATE ALUMINUM SIDE PLATE SS SIDE PLATE FOR RIGHT DET. SCALE ALUMINUM SIDE PLATE FOR RIGHT DET. SCALE	614A008BMF 614A008FBJ 614A174BMF 614A174FBJ
18	1	RIGHT DETACHABLE SCALE	PER S/N
19	2	SCALE SCREW	753L267CEA
20	2	SCALE WASHER	962A006AWA
21	2	SCALE NUT	573D012AWA
22	1	FRONT WINDOW	794A012NZ%
23	1	BACK WINDOW	615A012PBA
24	16	SCREWS-SIDE PLATES & WINDOWS	753L424AWA
25	1	PLASTIC BEZEL BEZEL, W/VALVE BEZEL, NO VALVE	075B013NZD 075B025NZD
26	4	BEZEL MOUNTING SCREW	753A429AWA
27	1	VALVE KNOB	498C080NCQ
28	1	VALVE KNOB COVER	219Z237NCQ
29	1	VALVE PACKING NUT	573R012GGJ
30	2	VALVE O-RING VITON BUNA-N EPM KALREZ	375B011QTA 375B011SUA 375B011SYA 375B011SYA 375B011TTA

31	1	VALVE BONNET 316 SS BRASS	950Z067BMA 950Z067GGJ
32	1	VALVE STEM	949Z198BMA
33	1	VALVE BACKING O-RING	375B011QMA
34	1	REDUCING BUSHING 3/8" NPT TO 1/4" NPT, SS 3/8" NPT TO 1/4" NPT, BRASS 3/8" NPT TO 3/4" NPT, SS	014B231BMA 014B231GGA 014B234BMA
36	1	WARNING LABEL	502Z969MYA
37	1	LOGO LABEL	502C329AAA
38	1	VALVE PLUG	618Q005BMA
39	1	VALVE PLUG O-RING VITON BUNA-N EPM KALREZ	375B908QTA 375B908SUA 375B908SYA 375B908SYA 375B908TTA
40	1	TRIANGULAR BASE PLATE	594B064NQA
41	1	SPIRIT LEVEL FOR BASEPLATE	515B011AAA
42	3	THUMB SCREW FOR BASEPLATE	753H404GGL
43	1	STANDOFF FOR BASEPLATE	830Z001GGH
44	1	SCREW FOR BASEPLATE	751E510AWA
45	2	SNAP PLUG FOR BASEPLATE	620Z172AAA
46	1	SEAL PLUG 316 SS BRASS	618Z021BMA 618Z021GGJ
47	1	VALVE BONNET O-RING VITON BUNA-N EPM KALREZ	375B908QTA 375B908SUA 375B908SYA 375B908TTA
48	1	LEFT DETACHABLE SCALE	PER S/N
49	1	PROTECTIVE PLASTIC SLEEVE	794Z133NZA
REF NO	QTY.	LABEL	
50	1	WARNING LABEL	502Y449MYA
51	1	WARNING LABEL	502Y445MYA

Table 5-1 Model 1358 Parts List (Continued)

#### LIMITED WARRANTY

Visit www.BrooksInstrument.com for the terms and conditions of our limited warranty.

#### **BROOKS SERVICE AND SUPPORT**

Brooks is committed to assuring all of our customers receive the optimal solution for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration and is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.

Visit www.BrooksInstrument.com to locate the service location nearest to you.

#### 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.

#### SEMINARS AND TRAINING

Brooks Instrument can provide seminars and dedicated training to engineers, end users and maintenance persons.

#### Please contact your nearest sales representative for more details.

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

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Installation-Manual-1358-EN/541B041AAG/2024-12

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