Metering Valves

S, M, and 31 Series

- Straight-pattern flow coefficients (C_V) from 0.004 to 0.04
- Low- and high-pressure service
- Repeatable vernier handles available
- Brass and 316 stainless steel materials

Features

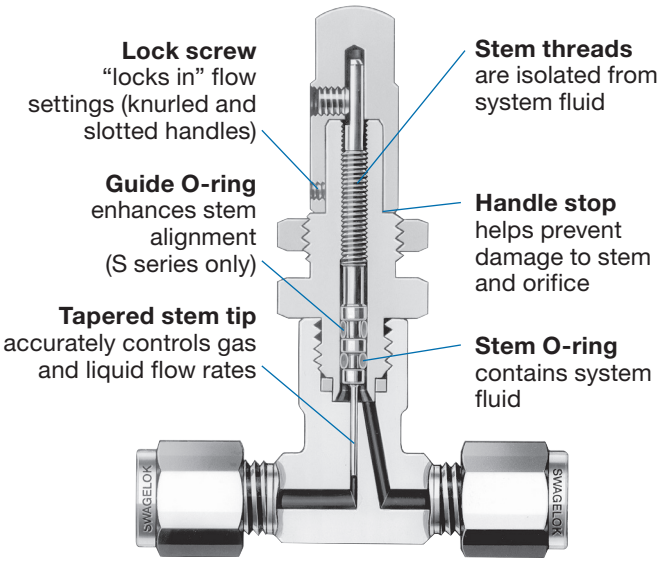
Low-Pressure Valves (S and M Series)

- Straight-pattern flow coefficients (C_v) from 0.004 to 0.03
- Forged-body 316 SS or brass construction
- Straight, angle, cross, and double patterns
- Panel mounting
- Knurled, round, vernier, slotted, and adjustable-torque handles
- Swagelok® tube fitting, male NPT, and integral VCR® fitting end connections

Technical Data

Series	Pressure-Temperature Ratings		Orifice in. (mm)	Shutoff Service	Stem Taper (Included Angle)
	Temperature °F (°C)	Working Pressure psig (bar)			
S	–10 to 400 (–23 to 204) —fluorocarbon FKM O-rings; –10 to 300 (–23 to 148) —Buna N O-rings	2000 (137)	0.032 (0.81)	No	1°
M		1000 (68.9)①	0.056 (1.42)	No	3°

① Downstream pressure 500 psig (34.4 bar) max when valve requires adjustment at pressure due to strength limitations of the fine-pitch threads and high operating torque.



S and M Series

S series valve shown.

High-Pressure Valves (31 Series)

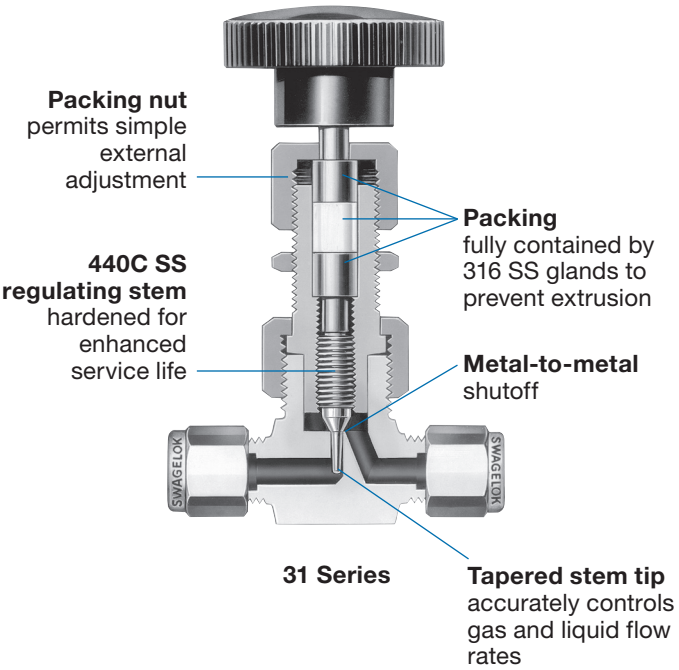
- Flow coefficient of 0.04; orifice of 0.062 in. (1.6 mm)
- 316 SS bar stock body
- Straight and angle patterns
- Metal-to-metal shutoff
- 2° stem taper (included angle)
- Panel mounting
- Round phenolic handle
- Swagelok tube fitting and female NPT end connections

Pressure-Temperature Ratings

Ratings based on optional Grafoil® packing.

Ratings limited to 450°F (232°C) at 3435 psig (236 bar) with standard PTFE packing.

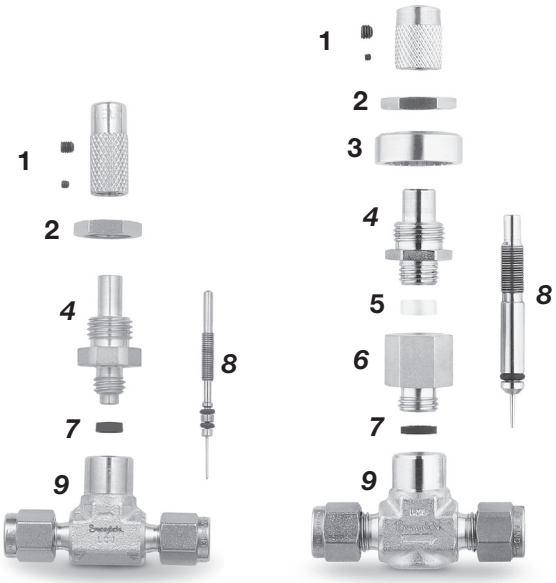
ASME Class	2080
Material Group	2.2
Material Name	316 SS
Temperature, °F (°C)	Working Pressure, psig (bar)
–65 (–53) to 100 (37)	5000 (344)
200 (93)	4295 (295)
300 (148)	3875 (266)
400 (204)	3560 (245)
450 (232)	3435 (236)
500 (260)	3310 (228)
600 (315)	3130 (215)
650 (343)	3080 (212)
700 (371)	3000 (206)
750 (398)	2930 (201)
800 (426)	2880 (198)
850 (454)	2815 (193)



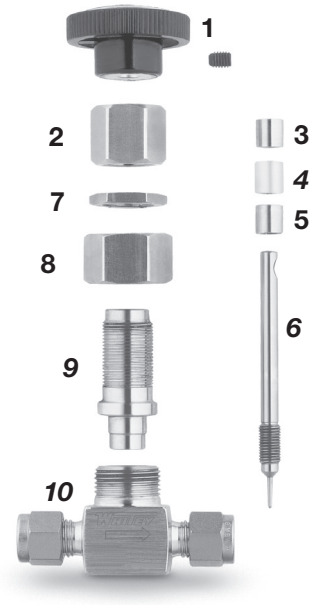
31 Series

Materials of Construction

Low-Pressure Valves (S, and M Series)



High-Pressure Valves (31 Series)



	Component	Valve Body Materials	
		Brass	316 SS
		Material Grade/ASTM Specification	
1	Handle	Silver-mist chrome-plated brass 360/B16	300 SS/A276
	Handle screw Lock screw①	Black oxide and light oil-coated alloy steel/ANSI 18.3	
2	Panel mount nut	Silver-mist chrome-plated brass 360/B16	316 SS/A479—S, M
3	Bonnet sleeve	Sintered 316 SS	
4	*Bonnet*	*Silver-mist chrome-plated brass 345/B453*	*316 SS/A479*
5	Stem guide ring	Glass-filled PTFE	
6	*Body extension②*	*Silver-mist chrome-plated brass 345/B453*	*316 SS/A479*
7	*Body seal③*	*Buna N*	*Fluorocarbon FKM*
8	*Stem*	*S17400 SS/A564—S; 316 SS/A479—M*	*Hard chrome-plated S17400 SS/A564—S; Hard chrome-plated 316 SS/A479—M*
	O-rings	*Buna N*	*Fluorocarbon FKM*
9	*Body*	*Silver-mist chrome-plated brass 377/B283*	*316 SS/A182*
Lubricants		*Molybdenum disulfide-based; silicone-based*	

Component		Material Grade/ ASTM Specification
1	Handle	Phenolic/D4617
	Set screw	18-8 SS
2	Packing nut	316 SS/A276
3	Upper gland	
4	*Packing*	*PTFE/D1710*
5	*Lower gland*	*316 SS/A276*
6	*Stem*	*440C SS/A276*
7	Panel nut	316 SS/B783
8	Union nut	316 SS/A276
9	*Bonnet*	*316 SS/A479*
10	*Body*	
	Lubricant	*Nickel antiseize with hydrocarbon carrier*

Wetted components listed in *italics.*

① Anaerobic-type adhesive.

② Straight and double-pattern M series valves.

③ Angle and cross-pattern M series valves do not contain a body seal.

Testing

Every Swagelok S and M series metering valve is factory tested with nitrogen at 1000 psig (69 bar). Shell testing is performed to a requirement of no detectable leakage with a liquid leak detector.

Every Swagelok 31 series needle valve is factory tested with nitrogen at 1000 psig (69 bar). Seats have a maximum allowable leak rate of 0.1 std cm^3/min.

Cleaning and Packaging

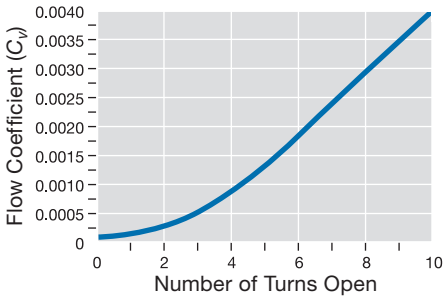
Swagelok metering valves with VCR end connections are processed in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* catalog, MS-06-63, to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C.

Swagelok metering valves with other end connections are processed in accordance with Swagelok *Standard Cleaning and Packaging (SC-10)* catalog, MS-06-62, special cleaning and packaging are available as an option.

Flow Data at 70°F (20°C)

S Series

Flow Coefficient at Turns Open



Maximum Flow—0.004 C_v

Pressure Drop to Atmosphere psi (bar)	Air Flow std ft³/min (std L/min)	Water Flow U.S. gal/min (L/min)
10 (0.68)	0.04 (1.1)	0.01 (0.03)
50 (3.4)	0.10 (2.8)	0.02 (0.07)
100 (6.8)	0.20 (5.6)	0.04 (0.15)

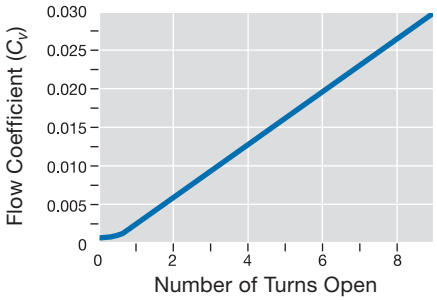
Factory Flow Setting

The handle stop is set at 4 to 10 std cm³/min with 15 psig (1.0 bar) inlet pressure.

⚠ **Adjusting stop to lower flow setting can damage valve and stem tip.**

M Series

Flow Coefficient at Turns Open

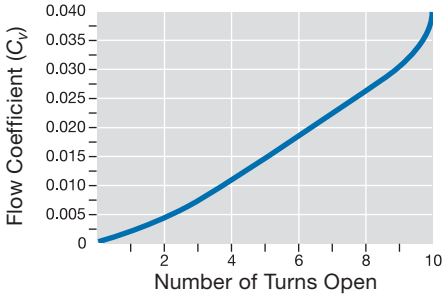


Maximum Flow—0.03 C_v

Pressure Drop to Atmosphere psi (bar)	Air Flow std ft³/min (std L/min)	Water Flow U.S. gal/min (L/min)
10 (0.68)	0.33 (9.3)	0.09 (0.34)
50 (3.4)	0.90 (25.4)	0.21 (0.79)
100 (6.8)	1.5 (42.4)	0.30 (1.1)

31 Series

Flow Coefficient at Turns Open



Maximum Flow—0.04 C_v

Pressure Drop to Atmosphere psi (bar)	Air Flow std ft³/min (std L/min)	Water Flow U.S. gal/min (L/min)
10 (0.68)	0.45 (12.7)	0.12 (0.45)
50 (3.4)	1.2 (33.9)	0.28 (1.0)
100 (6.8)	2.1 (59.4)	0.40 (1.5)

Ordering Information

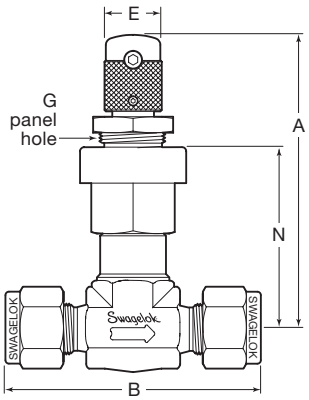
Select an ordering number.

S and M Series

For brass S and M series valves, replace **SS** with **B**.

Example: **B**-SS1

Straight Pattern



M series valve shown.

S series—0.16 in. (4.1 mm) maximum panel thickness.

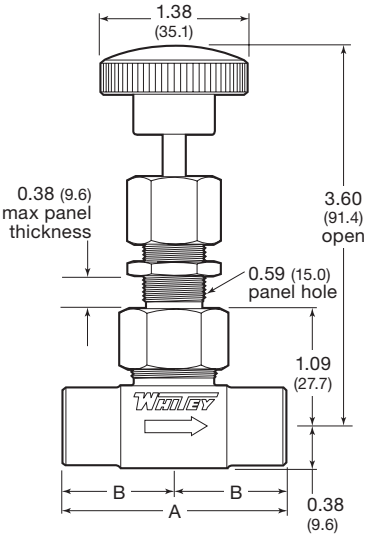
M series—0.13 in. (3.3 mm) maximum panel thickness.

31 Series

For angle-pattern 31 series valves, add **-A** to the ordering number.

Example: SS-31RS4**-A**

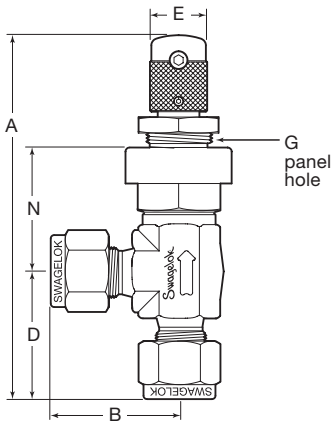
Straight Pattern



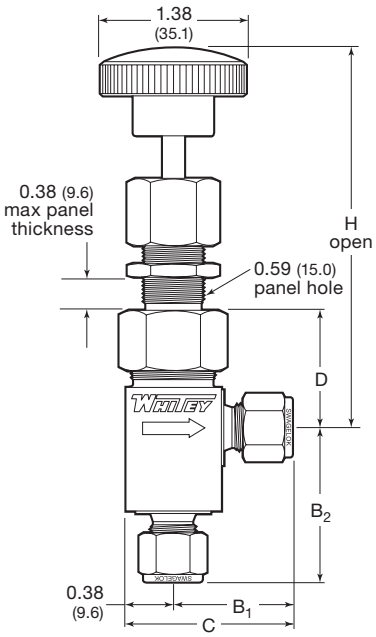
Dimensions

Dimensions, in inches (millimeters), are for reference only and are subject to change.

Angle Pattern



Angle Pattern



End Connections		Ordering Number	Dimensions, in. (mm)					
Inlet/Outlet	Size		A	B	D	E	G	N
S series straight pattern								
Swagelok tube fittings	1/16 in.	SS-SS1	2.34 (59.4)	1.56 (39.6)	—	0.38 (9.6)	0.45 (11.4)	0.92 (23.4)
	1/8 in.	SS-SS2		1.90 (48.3)				
	1/4 in.	SS-SS4		2.04 (51.8)				
	3 mm	SS-SS3MM		1.90 (48.3)				
	6 mm	SS-SS6MM		2.04 (51.8)				
Male VCR fittings	1/4 in.	SS-SVR4		2.06 (52.3)				
S series angle pattern								
Swagelok tube fittings	1/16 in.	SS-SS1-A	3.22 (81.8)	0.81 (20.6)	0.88 (22.4)	0.38 (9.6)	0.45 (11.4)	0.92 (23.4)
	1/8 in.	SS-SS2-A	3.32 (84.3)	0.98 (24.9)				
	1/4 in.	SS-SS4-A	3.36 (85.3)	1.02 (25.9)				
	3 mm	SS-SS3MM-A	3.32 (84.3)	0.98 (24.9)	0.99 (25.1)			
Male NPT/ Swagelok tube fitting	1/8 in.	SS-SM2-S2-A	3.07 (78.0)	0.98 (24.9)				
M series straight pattern								
Swagelok tube fittings	1/8 in.	SS-2MG	2.78 (70.6)	2.02 (51.3)	—	0.50 (12.7)	0.58 (14.7)	1.56 (39.6)
	1/4 in.	SS-4MG		2.20 (55.9)				
	3 mm	SS-3MG-MM		2.02 (51.3)				
	6 mm	SS-6MG-MM		2.20 (55.9)				
Male NPT	1/8 in.	SS-2MG2		1.50 (38.1)				
	1/4 in.	SS-4MG2		1.96 (49.8)				
Female NPT	1/8 in.	SS-2MG4		1.94 (49.3)				
Male VCR fittings	1/4 in.	SS-MGVR4		2.06 (52.3)				
M series angle pattern								
Swagelok tube fittings	1/8 in.	SS-2MA	3.30 (83.8)	1.01 (25.7)		0.50 (12.7)	0.58 (14.7)	1.07 (27.2)
	1/4 in.	SS-4MA	3.39 (86.1)	1.10 (27.9)				
	3 mm	SS-3MA-MM	3.30 (83.8)	1.01 (25.7)				
	6 mm	SS-6MA-MM	3.39 (86.1)	1.10 (27.9)				
Male NPT	1/8 in.	SS-2MA2	3.04 (77.2)	0.75 (19.1)				
	1/4 in.	SS-4MA2	3.27 (83.1)	0.98 (24.9)	1.02 (25.9)			
Male NPT/ Swagelok tube fitting	1/8 in.	SS-2MA1	3.04 (77.2)	1.01 (25.7)	0.75 (19.1)			
Female NPT	1/8 in.	SS-2MA4	3.26 (82.8)	0.97 (24.6)				

End Connections		Ordering Number	Dimensions, in. (mm)						
Type	Size		A	B	B_1	B_2	C	D	H
31 series									
Swagelok tube fitting	1/4 in.	SS-31RS4	2.40 (61.0)	1.20 (30.5)	1.16 (29.5)	1.48 (37.6)	1.54 (39.1)	1.09 (27.7)	3.60 (91.4)
	6 mm	SS-31RS6MM							
Female NPT	1/8 in.	SS-31RF2	2.00 (50.8)	1.00 (25.4)	0.91 (23.1)	1.00 (25.4)	1.28 (32.5)		3.80 (96.5)
	1/4 in.	SS-31RF4	2.06 (52.3)	1.03 (26.2)					

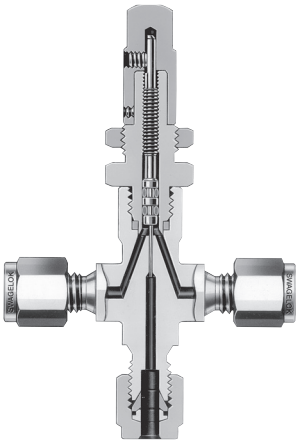
Dimensions shown with Swagelok tube fitting nuts finger-tight.

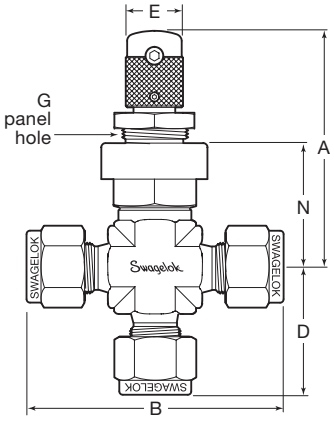
Options and Accessories

Cross Pattern

S and M Series

- Fluid flows between side ports around stem in any stem position.
- Flow through branch port can be metered in both directions.



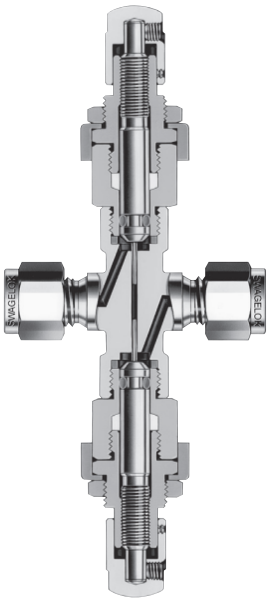


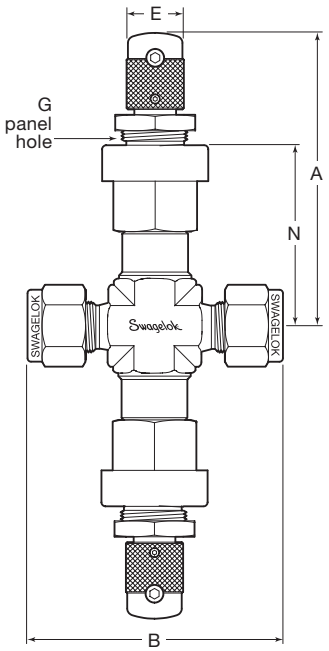
S series valve shown.

Double Pattern

S and M Series

- Inlet valve handle can be set and locked at desired maximum flow.
- Outlet valve handle can be used for fine flow control up to the preset maximum of the inlet valve.





M series valve shown.

Ordering Information and Dimensions

Select an ordering number. For brass valves, replace **SS** with **B**.

Example: **B**-SS2-X

Dimensions are for reference only and are subject to change.

Valve Pattern	End Connections		C_v	Ordering Number	Dimensions, in. (mm)					
	Type	Size			A	B	D	E	G	N
S series										
Cross	Swagelok tube fitting	1/8 in.	0.004	SS-SS2-X	3.32 (84.3)	1.96 (49.8)	0.98 (24.9)	0.38 (9.6)	0.45 (11.4)	0.92 (23.4)
Double		1/8 in.	0.003	SS-SS2-D	2.34 (59.4)	1.90 (48.3)	—			
M series										
Cross	Swagelok tube fitting	1/4 in.	0.03	SS-4MX	3.39 (86.1)	1.10 (27.9)		0.50 (12.7)	0.58 (14.7)	1.07 (27.2)
Double		1/4 in.	0.026	SS-4MGD	2.78 (70.6)	2.20 (55.9)	—			1.56 (39.6)

Dimensions shown with Swagelok tube fitting nuts finger-tight.

Options and Accessories

Vernier Handle

S and M Series

- Helps ensure repeatable flow adjustments.
- Provides readings accurate to 1/25 turn.

To order, add **-VH** to an S series ordering number or **-MH** to an M series ordering number.

Examples: SS-SS1**-VH**
SS-2MG**-MH**

Vernier Handle Kits

Kits contain all parts necessary to add a vernier handle to an existing valve.

Series	Kit Ordering Number
S	NY-5K-S
M	NY-2M-K6

Adjustable-Torque Handle

S Series

- Enhances control for setting flows.
- Features PTFE packing and two top-mounted torque adjustment screws.
- Is available in stainless steel material on stainless steel valves and in chrome-plated brass on brass valves, as standard.

To order, add **-OH** to the ordering number.

Example: SS-SS1**-OH**

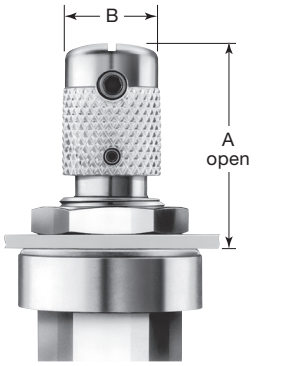
Adjustable-Torque Handle Kits

Kits contain all parts necessary to add an adjustable-torque handle to an existing valve.

Valve Material	Kit Ordering Number
Stainless steel	SS-5K-S-OH
Brass	B-5K-S-OH

Slotted Handle

S and M Series



M series valve shown.

Dimensions, in inches (millimeters), are for reference only and are subject to change.

- Allows flow setting adjustment with a screwdriver.
- Is for use in installations where handle is not easily accessible.
- Is available in stainless steel material on stainless steel valves and in chrome-plated brass on brass valves, as standard.
- Allows valve to be panel mounted without removing handle.

To order, add **-SL** to the ordering number.

Example: SS-SS1**-SL**

Series	Dimensions, in. (mm)	
	A	B
S	1.42 (36.1)	0.38 (9.6)
M	1.22 (31.0)	0.50 (12.7)

Slotted Handle Kits

Kits contain all parts necessary to add a slotted handle to an existing valve.

Series	Kit Ordering Number
S	SS-5K-S-SL
M	SS-2M-K5-SL

Colored Handles

31 Series

Black phenolic handles are standard. To order colored phenolic handles, add a handle color designator to the ordering number.

Example: SS-31RS4**-BL**

Handle Color	Designator
Blue	-BL
Green	-GR
Orange	-OG
Red	-RD
Yellow	-YW

Handle Kits

Handle kits contain handle, brass insert, and instructions.

To order a black phenolic handle, use kit ordering number PH-5K-14K-BK.

For colored phenolic handles, replace **-BK** in the kit ordering number with a handle color designator.

Example: PH-5K-14K**-BL**

Options and Accessories

Stem O-Ring Materials

S and M Series

Buna N O-rings are standard for brass valves; fluorocarbon FKM O-rings are standard for stainless steel valves. When ordering optional stem O-ring materials:

- S series—stem and guide O-rings are replaced with the optional material, *except for* the Kalrez® option; for Kalrez material, the stem O-ring is replaced and the guide O-ring remains the standard material.
- S series and M series—body seal material may change, as shown in the table below.

O-Ring Material	Designator	Temperature Rating °F (°C)	Body Seal Material
Buna N	-BU	–10 to 300 (–23 to 148)	Standard
Ethylene propylene	-EP	–10 to 300 (–23 to 148)	S series—PTFE
Fluorocarbon FKM	-VI	–10 to 400 (–23 to 204)	Standard
Kalrez	-KZ	0 to 300 (–17 to 148)	S series and M series—PTFE
Neoprene	-NE	–10 to 250 (–23 to 121)	S series—PTFE

To order optional O-ring materials, add the desired O-ring material designator to the ordering number.

Example: SS-SS1-**BU**

High-Temperature Stem Packing Material

31 Series

Grafoil packing extends the temperature rating to 850°F (454°C) and requires fluorinated tungsten disulfide-based lubricant. To order, add **-G** to the ordering number.

Example: SS-31RS4-**G**

Stem Packing Kits

PTFE and Grafoil packing kits are available. Kits include packing, lubricant, and instructions. Select a kit ordering number.

Stem Packing Material and Kit Ordering Number	
PTFE	**Grafoil**
T-9K-2	G-9K-2
Lubricant: nickel antiseize, hydrocarbon carrier	Lubricant: fluorinated tungsten disulfide-based

Safe Product Selection
When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

⚠ WARNING
Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.

Special Cleaning and Packaging (SC-11)

All Series

Swagelok metering valves with VCR end connections are processed in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* catalog, MS-06-63, to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C.

To order special cleaning and packaging for metering valves with other end connections, add **-SC11** to the valve ordering number.

Example: SS-SS1-**SC11**

Oxygen Service Hazards

For more information about hazards and risks of oxygen-enriched systems, refer to Swagelok *Oxygen System Safety* technical report, MS-06-13.

⚠ A packing adjustment may be required periodically to increase service life and to prevent leakage.

⚠ To increase service life, ensure proper valve performance, and prevent leakage, apply only as much torque as is required to achieve positive shutoff in 31 series valves that are rated for shutoff service.

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit swagelok.com or contact your authorized Swagelok representative.

MS-01-142, RevO, August 2024