

One-Piece Instrumentation Ball Valves

40G / 40
SERIES
BALL



40G Series and 40 Series

- On-off, switching, and crossover flow paths
- Working pressures up to 3000 psig (206 bar)
- Temperatures from -65 to 300°F (-53 to 148°C)
- Environmental and heated-process applications
- 1/16 to 3/4 in. and 3 to 12 mm end connections

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Swagelok Instrumentation Ball Valves

Swagelok one-piece instrumentation ball valves have been well accepted and widely used in a variety of industries for many years.

Both the original Swagelok 40 series and the newer 40G series valves accommodate a wide range of actuator, flow path, and handle options, as well as offer ease of packing adjustment while inline.

40G Series and 40 Series Comparison

| Feature | Valve Series | | |
|--|--|---|---|
| | 41G, 42G, 43G | 41, 42, 43 | 44, 45 |
| Valve Body Materials | Stainless steel | Brass, alloy 400 | Stainless steel, brass, alloy 400 |
| Packing Materials | Modified PTFE or UHMWPE | PTFE, PFA ^① , or UHMWPE ^① | PTFE or PFA ^① |
| Working Pressure psig (bar) | Up to 3000 (206), depending on valve size. See page 380. | | |
| Temperature Rating °F (°C) | Modified PTFE packing -65 to 300 (-53 to 148) | PTFE packing: 50 to 150 (10 to 65) Live-loaded PFA or UHMWPE packing: -65 to 150 (-53 to 65) | PTFE packing: 50 to 150 (10 to 65) Live-loaded PFA packing: -65 to 150 (-53 to 65) |
| | UHMWPE packing -65 to 150 (-53 to 65) | | |
| Flow Coefficients (C_v) | 0.08 to 2.4 | 0.05 to 2.4 | 1.5 to 12 |
| End Connection Sizes | 1/16 to 3/8 in.; 3 to 8 mm | | 3/8 to 3/4 in.; 8 to 12 mm |
| Flow Patterns | On-off (2-way); switching (3-way) | On-off (2-way); switching (3-way, 5-way and 7-way); crossover (4-way and 6-way) | On-off (2-way); switching (3-way and 5-way); crossover (4-way) |

40G / 40 SERIES BALL

^① Live-loaded PFA and UHMWPE packing materials. See **40T and 40E Series for Low-Temperature Service**, page 378.

Important Information About Swagelok Instrumentation Ball Valves

- ⚠ **Swagelok ball valves are designed to be used in a fully open or fully closed position.**
- ⚠ **Valves that have not been cycled for a period of time may have a higher initial actuation torque.**
- ⚠ **A packing adjustment may be required periodically to increase service life and to prevent leakage.**
- Service instructions are shipped with each 40G series and 40 series valve.
- 40G and 40 series valves are factory tested with nitrogen at 1000 psig (69 bar), or the rated pressure if lower than 1000 psig (69 bar).
40 series valve packing must be readjusted for service at higher than test pressure.
See page 387 for standard production tests and page 398 for optional production tests.
- Instrumentation ball valves exposed to dynamic temperature conditions before installation may lose their initial packing load. Packing adjustment may be needed.
- 41G and 42G series valves require an 8 mm deep-well socket and 43G series valves require a 9 mm deep-well socket to adjust the packing bolt.
- 41 and 42 series valves require a 3/8 in. open-ended wrench; 44 series valves require a 1/2 in. open-ended wrench; and 45 series valves require a 5/8 in. open-ended wrench to adjust the packing bolt.
- 43 series valves require an adapter to adjust the packing bolt. Ordering number: **MS-WK-43**

Features

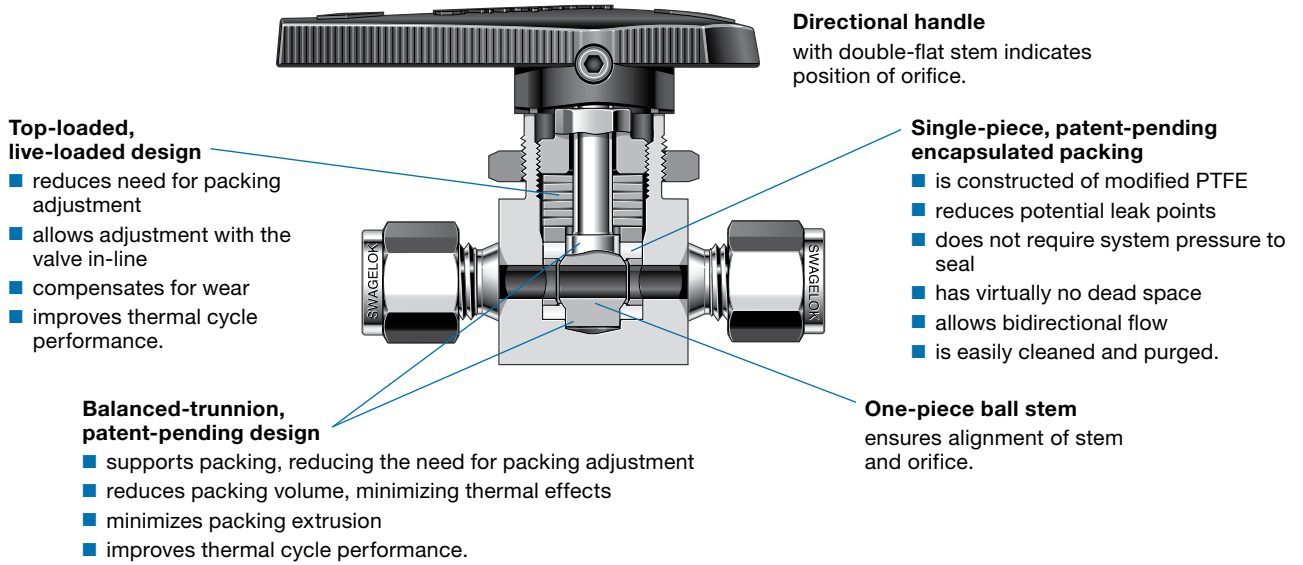
40G Series

Swagelok 41G, 42G, and 43G series valves easily replace original stainless steel 41, 42, and 43 series valves.

- Equivalent dimensions
- Comparable materials of construction

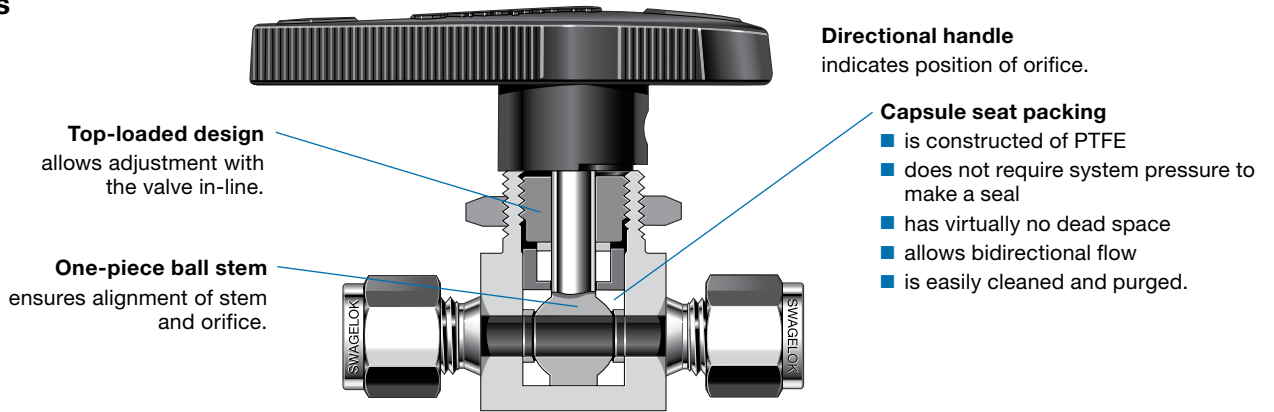
Couplings must be replaced on actuated valves. See pages 393 and 395.

Swagelok 44 and 45 series valves remain available in stainless steel; the full range of 40 series sizes is available in brass and alloy 400.

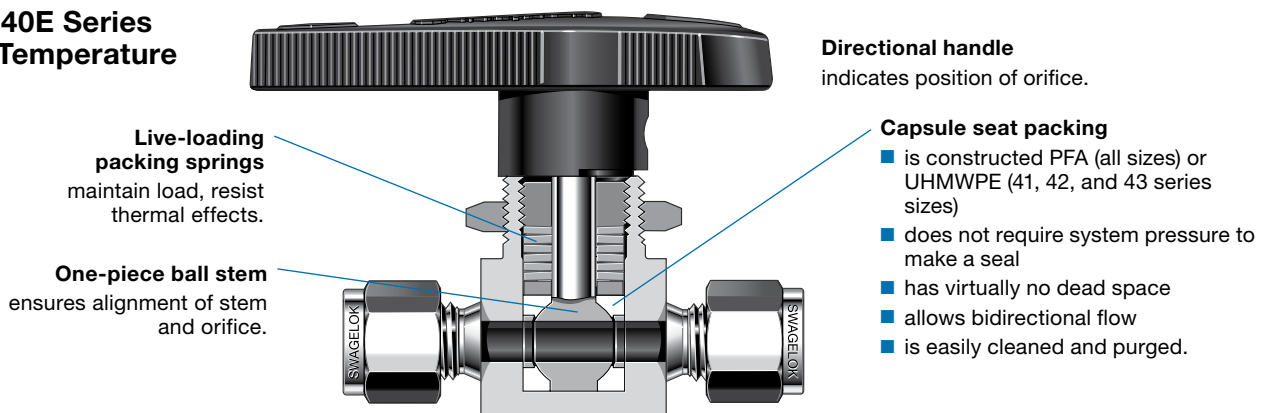


40G / 40 SERIES BALL

40 Series



40T and 40E Series for Low-Temperature Service



Materials of Construction

40G Series

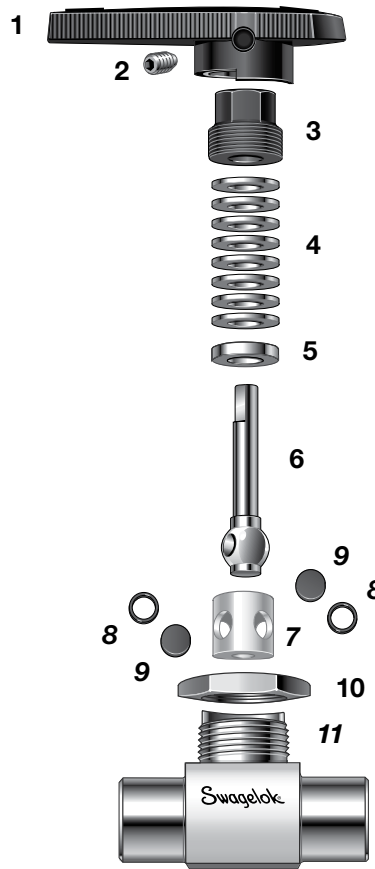
| Component | Stainless Steel Valve Body Material |
|------------------------|---|
| | Material Grade/ASTM Specification |
| 1 Handle | Nylon with powdered metal 300 series SS insert |
| 2 Set screw | S17400/A564 |
| 3 Packing bolt | Powdered metal 300 series SS |
| 4 Springs ^① | S17700/A693 |
| 5 Gland | Powdered metal 300 series SS |
| 6 Ball stem | 316 SS/A276 |
| 7 Packing | <i>Modified PTFE/D1710 type 1, Grade 1, Class B or UHMWPE/D4020</i> |
| 8 Side rings | Powdered metal 300 series SS/B783 ^② |
| 9 Side discs | |
| 10 Panel nut | Powdered metal 300 series SS/B783 |
| 11 Body ^③ | 316 SS/A276 and A479 |
| Wetted lubricant | <i>Silicone-based</i> |
| Nonwetted lubricant | Molybdenum disulfide with hydrocarbon binder coating |

Wetted components listed in *italics*.

① 41G and 42G series: 8 springs; 43G series: 6 springs.

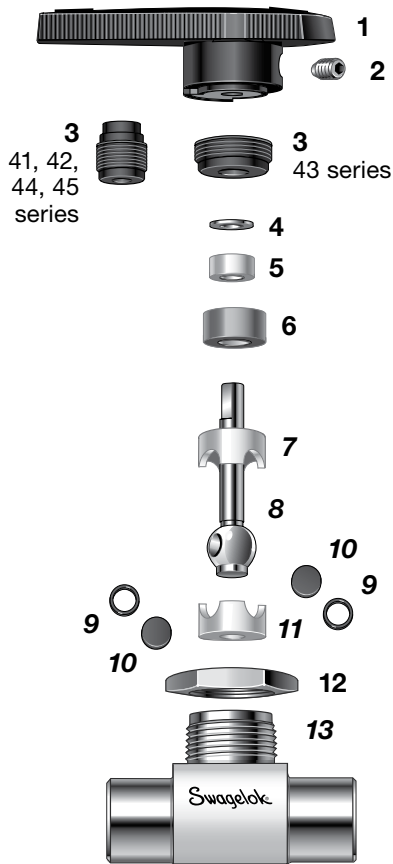
② B783 specification not available on 41G and 42G series; standard on 43G series.

③ Bodies with VCO[®] end connections and modified PTFE packing have fluorocarbon FKM O-rings; bodies with with VCO end connections and UHMWPE packing have ethylene propylene O-rings.



40G / 40 SERIES BALL

40 Series



| Component | Valve Body Materials | | |
|----------------------|--|---|---|
| | Stainless Steel | Brass | Alloy 400 |
| | Material Grade/ASTM Specification | | |
| 1 Handle | Nylon with brass insert | | |
| 2 Set screw | S17400 SS/A564 | | |
| 3 Packing bolt | Powdered metal 300 series SS or 316 SS/A276, A479 | Brass CDA 360/B16 | Alloy 400/B164 |
| 4 Upper gland | 316 SS/A240 | 41, 42, 45 series: brass 260/B36; 43, 44 series: 316 SS/A240 | Alloy 400/B127 |
| 5 Bushing | PTFE/D1710 | | |
| 6 Lower gland | Powdered metal 300 series SS | Brass CDA 360/B16 | Alloy 400/B164 |
| 7 Upper packing | <i>PTFE/D1710</i> | | |
| 8 Ball stem | 316 SS/A276 | Brass CDA 360/B16 ^① | Alloy 400/B164 |
| 9 Side rings | <i>Fluorocarbon-coated powdered metal 300 series SS/B783</i> | <i>Fluorocarbon-coated brass powdered metal^①</i> | <i>Fluorocarbon-coated alloy 400 powdered metal</i> |
| 10 Side discs | | | |
| 11 Lower packing | <i>PTFE/D1710</i> | | |
| 12 Panel nut | Powdered metal 300 series SS/B783 | Brass CDA 360/B16 | Powdered metal 300 series SS/B783 |
| 13 Body ^② | 316 SS/A276, A479 | Brass CDA 356 or 360/B16 | Alloy 400/B164 |
| Wetted lubricant | <i>41, 42, 43 series: silicone-based; 44, 45 series: silicone- and fluorinated-based</i> | | |
| Nonwetted lubricant | Molybdenum disulfide with hydrocarbon binder coating | | |

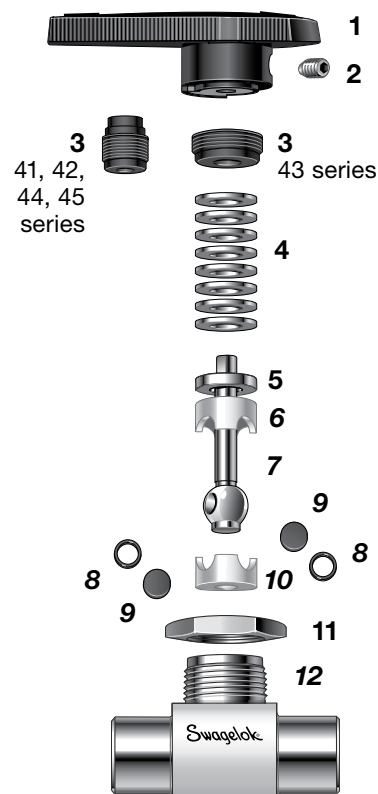
Wetted components listed in *italics*.

① 4-way, 5-way, 6-way, and 7-way valves contain stainless steel stem, rings, and discs.

② Bodies with VCO end connections have fluorocarbon FKM O-rings.

Materials of Construction

40T and 40E Series for Low-Temperature Service



| Component | Valve Body Materials | | |
|------------------------|---|-------------------|--|
| | Stainless Steel | Brass | Alloy 400 |
| | Material Grade/ASTM Specification | | |
| 1 Handle | Nylon with brass insert | | |
| 2 Set screw | S17400 SS/A564 | | |
| 3 Packing bolt | Powdered metal 300 series SS or 316 SS/A276, A479 | Brass CDA 360/B16 | Alloy 400/B164 |
| 4 Springs ^① | Molybdenum disulfide-coated S17700 SS/A693 | | |
| 5 Gland | Powdered metal 300 series SS | | |
| 6 Upper packing | 40T: PFA/D3307; 40E: UHMWPE/D4020 | | |
| 7 Ball stem | 316 SS/A276 and A479 | | Alloy 400/B164 |
| 8 Side rings | 40T: fluorocarbon-coated powdered metal 300 series SS/B783; | | Fluorocarbon-coated alloy 400 powdered metal |
| 9 Side discs | 40E: 300 series powdered metal SS/B783 | | |
| 10 Lower packing | 40T: PFA/D3307; 40E: UHMWPE/D4020 | | |
| 11 Panel nut | Powdered metal 300 series SS/B783 | Brass CDA 360/B16 | Powdered metal 300 series SS/B783 |
| 12 Body ^② | 316 SS/A276, A479 | Brass CDA 360/B16 | Alloy 400/B164 |
| Wetted lubricant | 40T: hydrocarbon- and silicone-based ^③ ; | | |
| Nonwetted lubricant | Molybdenum disulfide with hydrocarbon binder coating | | |

Wetted components listed in *italics*.

① 41 and 42 series—8 springs; 43 series—6 springs; 44 and 45 series—4 springs.

② 40T body with VCO fittings has fluorocarbon FKM O-rings; 40E body with VCO fittings has ethylene propylene O-rings.

③ 44T and 45T—hydrocarbon-based and silicone- and fluorinated-based.

Pressure-Temperature Ratings

The 40G series valve is designed for thermal cycling in both environmental and heated-process applications.

Ratings shown below apply to on-off (2-way) and switching (3-way) valves. Ratings for switching (5-way and 7-way) and crossover (4-way and 6-way) valves are shown on pages 385 and 386, respectively.

Temperature ratings are limited to 150°F (65°C) max with UHMWPE packing.

| Valve Series | 40G | | 40 | | | 40T and 40E | | |
|----------------------------|--|----------------|---|---------------|-----------------------|---|---------------|-----------------------|
| Packing Material | Modified PTFE UHMWPE ^① | | PTFE | | | Live-Loaded PFA (40T Series) Live-Loaded UHMWPE (40E Series) | | |
| Valve Size (Configuration) | 41G, 42G (Straight, Angle, 3-Way); 43G (Angle, 3-Way) | 43G (Straight) | 41, 42 (Straight, Angle, 3-Way); 43 (Angle, 3-Way); 44, 45 (Straight) | 43 (Straight) | 44, 45 (Angle, 3-Way) | 41, 42 (Straight, Angle, 3-Way); 43 (Angle, 3-Way); 44, 45 (Straight) | 43 (Straight) | 44, 45 (Angle, 3-Way) |
| Temperature °F (°C) | Working Pressure, psig (bar) | | | | | | | |
| -65 (-53) to 50 (10) | 2500 (172) | 3000 (206) | — | — | — | 2500 (172) | 3000 (206) | 1500 (103) |
| 50 (10) to 150 (65) | 2500 (172) | 3000 (206) | 2500 (172) | 3000 (206) | 1500 (103) | 2500 (172) | 3000 (206) | 1500 (103) |
| 200 (93) | 2500 (172) | 2800 (193) | — | — | — | — | — | — |
| 250 (121) | 2500 (172) | 2650 (182) | — | — | — | — | — | — |
| 300 (148) | 2500 (172) | 2500 (172) | — | — | — | — | — | — |

Pressure ratings for valves with Swagelok tube fitting ends may be lower due to the tubing pressure rating. See Swagelok *Tubing Data* (MS-01-107), page 224.

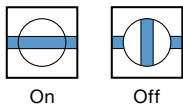
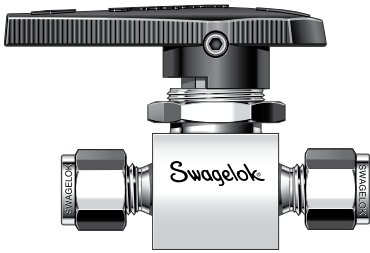
① Temperature ratings are limited to 150°F (65°C) max with UHMWPE packing.

On-Off (2-Way) Valves

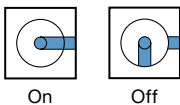
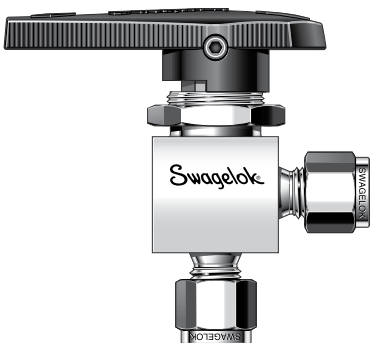
Flow Patterns

Straight and Angle Patterns for On-Off Service

Straight Pattern



Angle Pattern



Ordering Information

40G Series Valves

Select a 40G series ordering number from the **40G Series Complete Ordering Number** column, shaded blue.

Example: **SS-41GS1**

To order a valve with UHMWPE packing, insert **E** into the valve ordering number.

Example: **SS-41GES1**

40 Series Valves

Add a body material designator to a 40 series basic ordering number from the **40 Series Basic Ordering Number** column, shaded gray.

| Material | Valve Series | Designator |
|-----------|--------------------|------------|
| 316 SS | 44, 45 | SS |
| Alloy 400 | 41, 42, 43, 44, 45 | M |
| Brass | 41, 42, 43, 44, 45 | B |

Examples: **M-42S4**
SS-44S6

40T and 40E Series Valves

Insert a seat packing material designator.

| Material | Valve Series | Designator |
|----------|--------------------|------------|
| PFA | 41, 42, 43, 44, 45 | T |
| UHMWPE | 41, 42, 43 | E |

Examples: **M-42ES4**
SS-44TS6

Angle-Pattern Valves

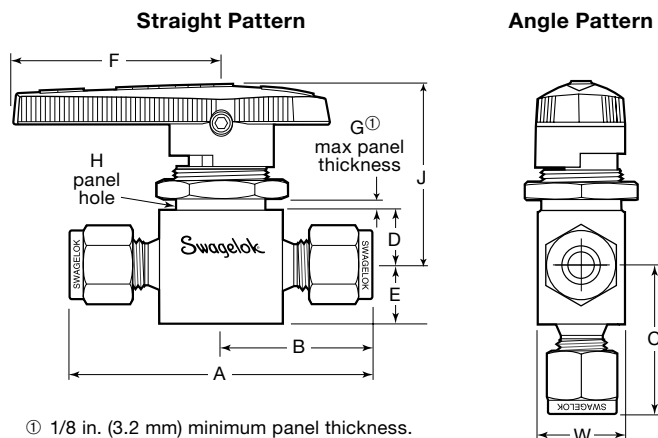
Angle-pattern valves have the same options and accessories as straight-pattern valves; the pressure-temperature ratings (page 380), flow coefficients, and dimensions are different.

To order an angle-pattern valve, add **-A** to ordering number of a valve with the C dimension listed.

Examples: **SS-43GS4-A**
SS-44S6-A

Dimensions

Dimensions are for reference only and are subject to change. Dimensions shown with Swagelok tube fitting nuts finger-tight.



① 1/8 in. (3.2 mm) minimum panel thickness.

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On-Off (2-Way) Valves

| End Connections | | C _v | | 40G Series Complete Ordering Number | 40 Series Basic Ordering Number | Orifice in. (mm) | Dimensions in. (mm) | | | | | | | | | |
|-----------------------------------|----------|----------------|-------|-------------------------------------|---------------------------------|------------------|---------------------|-------------|-------------|-------------|------------|--------------|-------------|--------------|-------------|-------------|
| Inlet/Outlet | Size | Straight | Angle | | | | A | B | C | D | E | F | G | H | J | W |
| Fractional Swagelok tube fittings | 1/16 in. | 0.10 | — | SS-41GS1 | -41S1 | 0.052 (1.32) | 1.68 (42.7) | 0.84 (21.3) | — | 0.34 (8.6) | 0.28 (7.1) | 1.12 (28.4) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 1/8 in. | 0.20 | 0.15 | SS-41GS2 | -41S2 | 0.093 (2.36) | 2.01 (51.1) | 1.01 (25.7) | 0.97 (24.6) | 0.34 (8.6) | 0.28 (7.1) | 1.12 (28.4) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 1/4 in. | 0.60 | 0.35 | SS-42GS4 | -42S4 | 0.125 (3.18) | 2.21 (56.1) | 1.10 (27.9) | 1.07 (27.2) | 0.34 (8.6) | 0.28 (7.1) | 1.12 (28.4) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | | 1.4 | 0.90 | SS-43GS4 | -43S4 | 0.187 (4.75) | 2.39 (60.7) | 1.20 (30.5) | 1.17 (29.7) | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 3/8 in. | 1.5 | 0.90 | SS-43GS6 | -43S6 | 0.187 (4.75) | 2.58 (65.5) | 1.29 (32.8) | | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | | 6.0 | 2.0 | — | -44S6 | 0.281 (7.14) | 3.05 (77.5) | 1.52 (38.6) | 1.43 (36.3) | 0.56 (14.2) | | 2.00 (50.8) | 3/8 (9.5) | 1 1/8 (28.6) | 2.07 (52.6) | 1.12 (28.4) |
| | 1/2 in. | 12 | 4.6 | — | -45S8 | 0.406 (10.3) | 3.92 (99.6) | 1.96 (49.8) | 1.74 (44.2) | 0.69 (17.5) | | 3.00 (76.2) | 3/8 (9.5) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| | 3/4 in. | 6.4 | 3.8 | — | -45S12 | 0.406 (10.3) | 3.92 (99.6) | 1.96 (49.8) | 1.74 (44.2) | 0.69 (17.5) | | 3.00 (76.2) | 3/8 (9.5) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Metric Swagelok tube fittings | 3 mm | 0.20 | 0.15 | SS-41GS3MM | -41S3MM | 0.093 (2.36) | 2.01 (51.1) | 1.01 (25.7) | 0.97 (24.6) | 0.34 (8.6) | 0.28 (7.1) | 1.12 (28.4) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 6 mm | 0.60 | 0.35 | SS-42GS6MM | -42S6MM | 0.125 (3.18) | 2.21 (56.1) | 1.10 (27.9) | 1.07 (27.2) | 0.34 (8.6) | 0.28 (7.1) | 1.12 (28.4) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | | 1.4 | 0.90 | SS-43GS6MM | -43S6MM | 0.187 (4.75) | 2.39 (60.7) | 1.20 (30.5) | 1.17 (29.7) | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 8 mm | 1.5 | 0.90 | SS-43GS8MM | -43S8MM | 0.187 (4.75) | 2.46 (62.5) | 1.23 (31.2) | 1.20 (30.5) | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 10 mm | 6.0 | 2.0 | — | -44S10MM | 0.281 (7.14) | 3.07 (78.0) | 1.53 (38.9) | 1.43 (36.3) | 0.56 (14.2) | | 2.00 (50.8) | 3/8 (9.5) | 1 1/8 (28.6) | 2.07 (52.6) | 1.12 (28.4) |
| | 12 mm | 12 | 4.6 | — | -45S12MM | 0.406 (10.3) | 3.92 (99.6) | 1.96 (49.8) | 1.74 (44.2) | 0.69 (17.5) | | 3.00 (76.2) | 3/8 (9.5) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Female NPT | 1/8 in. | 0.50 | 0.30 | SS-42GF2 | -42F2 | 0.125 (3.18) | 1.63 (41.4) | 0.81 (20.6) | | 0.34 (8.6) | 0.28 (7.1) | 1.12 (28.4) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | | 1.2 | 0.70 | SS-43GF2 | -43F2 | 0.187 (4.75) | 2.00 (50.8) | 1.00 (25.4) | | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 1/4 in. | 0.90 | 0.75 | SS-43GF4 | -43F4 | 0.187 (4.75) | 2.06 (52.3) | 1.03 (26.2) | | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | | 3.0 | 1.7 | — | -44F4 | 0.281 (7.14) | 2.50 (63.5) | 1.25 (31.8) | | 0.56 (14.2) | | 2.00 (50.8) | 3/8 (9.5) | 1 1/8 (28.6) | 2.07 (52.6) | 1.12 (28.4) |
| | 3/8 in. | 2.6 | 1.5 | — | -44F6 | 0.281 (7.14) | 2.50 (63.5) | 1.25 (31.8) | | 0.56 (14.2) | | 2.00 (50.8) | 3/8 (9.5) | 1 1/8 (28.6) | 2.07 (52.6) | 1.12 (28.4) |
| | 1/2 in. | 6.3 | 3.5 | — | -45F8 | 0.406 (10.3) | 3.12 (79.2) | 1.56 (39.6) | | 0.69 (17.5) | | 3.00 (76.2) | 3/8 (9.5) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Female ISO/BSP tapered | 1/4 in. | 0.90 | — | SS-43GF4RT | -43F4RT | 0.187 (4.75) | 2.06 (52.3) | 1.03 (26.2) | — | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 3/8 in. | 2.6 | | 0.281 (7.14) | 2.50 (63.5) | 1.25 (31.8) | 0.56 (14.2) | | | 2.00 (50.8) | 3/8 (9.5) | 1 1/8 (28.6) | 2.07 (52.6) | 1.12 (28.4) | | |
| | 1/2 in. | 6.3 | | 0.406 (10.3) | 3.12 (79.2) | 1.56 (39.6) | 0.69 (17.5) | | | 3.00 (76.2) | 3/8 (9.5) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) | | |
| Male NPT | 1/4 in. | 1.2 | 0.75 | SS-43GM4 | -43M4 | 0.187 (4.75) | 2.00 (50.8) | 1.00 (25.4) | 1.03 (26.2) | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| Male NPT/ Swagelok tube fitting | 1/4 in. | 1.6 | 0.75 | SS-43GM4-S4 | -43M4-S4 | 0.187 (4.75) | 2.20 (55.9) | 1.20 (30.5) | 1.03 (26.2) | 0.44 (11.2) | 0.38 (9.7) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| VCO fittings | 1/4 in. | 0.60 | 0.35 | SS-42GVCO4 | -42VCO4 | 0.125 (3.18) | 1.75 (44.4) | 0.88 (22.4) | 0.94 (23.9) | 0.44 (11.2) | 0.38 (9.7) | 1.12 (28.4) | 1/8 (3.2) | 19/32 (15.1) | 1.36 (34.5) | 0.78 (19.8) |
| | | 2.4 | 0.90 | SS-43GVCO4 | -43VCO4 | 0.187 (4.75) | 1.88 (47.8) | 0.94 (23.9) | | | | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | |
| Integral male VCR® fittings | 1/4 in. | 0.60 | 0.35 | SS-42GVCR4 | -42VCR4 | 0.125 (3.18) | 2.13 (54.1) | 1.06 (26.9) | 1.09 (27.7) | 0.44 (11.2) | 0.38 (9.7) | 1.12 (28.4) | 1/8 (3.2) | 19/32 (15.1) | 1.36 (34.5) | 0.78 (19.8) |
| | | 2.4 | 0.90 | SS-43GVCR4 | -43VCR4 | 0.187 (4.75) | | | | | | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | |
| | 1/2 in. | 6.0 | — | — | -44VCR8 ^① | 0.281 (7.14) | 2.88 (73.2) | 1.44 (36.6) | — | 0.56 (14.2) | | 2.00 (50.8) | 3/8 (9.5) | 1 1/8 (28.6) | 2.07 (52.6) | 1.50 (38.1) |
| | | 12 | | — | -45VCR8 ^① | 0.406 (10.3) | 3.12 (79.2) | 1.56 (39.6) | | 0.69 (17.5) | | 3.00 (76.2) | 3/8 (9.5) | 1 1/2 (38.1) | 2.43 (61.7) | |

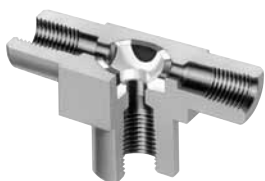
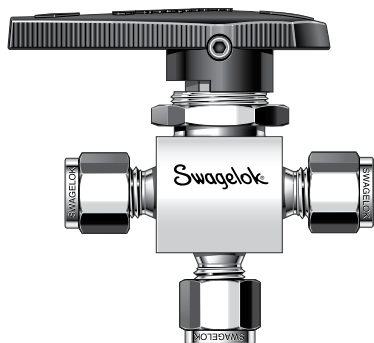
① Not recommended for panel mounting.

Switching (3-Way) Valves

Flow Pattern

On-Off Switching Service

Center-Off Position



On



Off



On

Ordering Information

40GX Series Valves

Select a 40GX series ordering number from the **40GX Series Complete Ordering Number** column, shaded *blue*.

Example: **SS-41GX^{S1}**

To order a valve with UHMWPE packing, insert **E** into the valve ordering number.

Example: SS-41GX^{ES1}

40X Series Valves

Add a body material designator to a 40X series basic ordering number from the **40X Series Basic Ordering Number** column, shaded *gray*.

| Material | Valve Series | Designator |
|-----------|-------------------------|------------|
| 316 SS | 44X, 45X | SS |
| Alloy 400 | 41X, 42X, 43X, 44X, 45X | M |
| Brass | 41X, 42X, 43X, 44X, 45X | B |

Examples: **M-42XS4**
SS-44XS6

40XT and 40XE Series Valves

Insert a seat packing material designator.

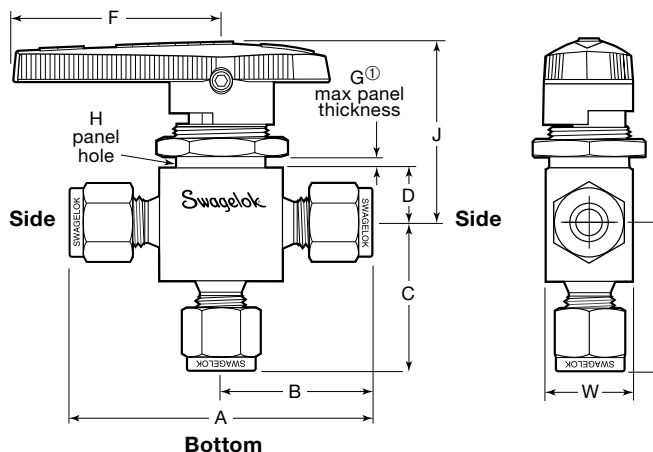
| Material | Valve Series | Designator |
|----------|--------------------|------------|
| PFA | 41, 42, 43, 44, 45 | T |
| UHMWPE | 41, 42, 43 | E |

Examples: **M-42XES4**
SS-44XTS6

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Dimensions

Dimensions are for reference only and are subject to change. Dimensions shown with Swagelok tube fitting nuts finger-tight.



① 1/8 in. (3.2 mm) minimum panel thickness.

Switching (3-Way) Valves

| End Connections | | C _v | 40GX Series Complete Ordering Number | 40X Series Basic Ordering Number | Orifice in. (mm) | Dimensions in. (mm) | | | | | | | | |
|-----------------------------------|----------|----------------|--------------------------------------|----------------------------------|------------------|---------------------|-------------|-------------|-------------|-------------|------------|--------------|-------------|-------------|
| Side/Bottom | Size | | | | | A | B | C | D | F | G | H | J | W |
| Fractional Swagelok tube fittings | 1/16 in. | 0.08 | SS-41GXS1 | -41XS1 | 0.052 (1.32) | 1.68 (42.7) | 0.84 (21.3) | 0.81 (20.6) | 0.34 (8.6) | 1.13 (28.7) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 1/8 in. | 0.15 | SS-41GXS2 | -41XS2 | 0.093 (2.36) | 2.01 (51.1) | 1.01 (25.7) | 0.97 (24.6) | 0.34 (8.6) | 1.13 (28.7) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 1/4 in. | 0.35 | SS-42GXS4 | -42XS4 | 0.125 (3.18) | 2.21 (56.1) | 1.10 (27.9) | 1.07 (27.2) | 0.34 (8.6) | 1.13 (28.7) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | | 0.90 | SS-43GXS4 | -43XS4 | 0.187 (4.75) | 2.39 (60.7) | 1.20 (30.5) | 1.17 (29.7) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 3/8 in. | 2.0 | — | -44XS6 | 0.281 (7.14) | 2.89 (73.4) | 1.45 (36.8) | 1.43 (36.3) | 0.56 (14.2) | 2.00 (50.8) | 3/8 (9.7) | 1 1/8 (28.7) | 2.07 (52.6) | 1.12 (28.4) |
| | 1/2 in. | 4.6 | — | -45XS8 | 0.406 (10.3) | 3.48 (88.4) | 1.74 (44.2) | | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| | 3/4 in. | 3.8 | — | -45XS12 | 0.406 (10.3) | 3.48 (88.4) | 1.74 (44.2) | | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Metric Swagelok tube fittings | 3 mm | 0.15 | SS-41GXS3MM | -41XS3MM | 0.093 (2.36) | 2.01 (51.1) | 1.01 (25.7) | 0.97 (24.6) | 0.34 (8.6) | 1.13 (28.7) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 6 mm | 0.35 | SS-42GXS6MM | -42XS6MM | 0.125 (3.18) | 2.21 (56.1) | 1.10 (27.9) | 1.07 (27.2) | 0.34 (8.6) | 1.13 (28.7) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | | 0.90 | SS-43GXS6MM | -43XS6MM | 0.187 (4.75) | 2.39 (60.7) | 1.20 (30.5) | 1.17 (29.7) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 8 mm | 0.80 | SS-43GXS8MM | -43XS8MM | 0.187 (4.75) | 2.46 (62.5) | 1.23 (31.2) | 1.20 (30.5) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 10 mm | 2.0 | — | -44XS10MM | 0.281 (7.14) | 2.89 (73.4) | 1.45 (36.8) | 1.43 (36.3) | 0.56 (14.2) | 2.00 (50.8) | 3/8 (9.7) | 1 1/8 (28.7) | 2.07 (52.6) | 1.12 (28.4) |
| | 12 mm | 4.6 | — | -45XS12MM | 0.406 (10.3) | 3.48 (88.4) | 1.74 (44.2) | | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Female NPT | 1/8 in. | 0.30 | SS-42GXF2 | -42XF2 | 0.125 (3.18) | 1.63 (41.4) | 0.81 (20.6) | | 0.34 (8.6) | 1.13 (28.7) | 1/4 (6.4) | 19/32 (15.1) | 1.36 (34.5) | 0.58 (14.7) |
| | 1/4 in. | 0.75 | SS-43GXF4 | -43XF4 | 0.187 (4.75) | 2.06 (52.3) | 1.03 (26.2) | | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | | 1.7 | — | -44XF4 | 0.281 (7.14) | 2.50 (63.5) | 1.25 (31.8) | | 0.56 (14.2) | 2.00 (50.8) | 3/8 (9.7) | 1 1/8 (28.7) | 2.07 (52.6) | 1.12 (28.4) |
| | 3/8 in. | 1.5 | — | -44XF6 | 0.281 (7.14) | 2.50 (63.5) | 1.25 (31.8) | | 0.56 (14.2) | 2.00 (50.8) | 3/8 (9.7) | 1 1/8 (28.7) | 2.07 (52.6) | 1.12 (28.4) |
| | 1/2 in. | 3.5 | — | -45XF8 | 0.406 (10.3) | 3.13 (79.5) | 1.56 (39.6) | | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Female ISO/BSP tapered | 1/4 in. | 0.75 | SS-43GXF4RT | -43XF4RT | 0.187 (4.75) | 2.06 (52.3) | 1.03 (26.2) | | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| | 3/8 in. | 1.5 | — | -44XF6RT | 0.281 (7.14) | 2.50 (63.5) | 1.25 (31.8) | | 0.56 (14.2) | 2.00 (50.8) | 3/8 (9.7) | 1 1/8 (28.7) | 2.07 (52.6) | 1.12 (28.4) |
| | 1/2 in. | 3.5 | — | -45XF8RT | 0.406 (10.3) | 3.13 (79.5) | 1.56 (39.6) | | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) | 1.50 (38.1) |
| Swagelok tube fittings/ Male NPT | 1/4 in. | 0.80 | SS-43GXS4-S4-M4 | -43XS4-S4-M4 | 0.187 (4.75) | 2.39 (60.7) | 1.20 (30.5) | 1.03 (26.2) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | 0.78 (19.8) |
| Integral male VCR fittings | 1/4 in. | 0.35 | SS-42GXVCR4 | -42XVCR4 | 0.125 (3.18) | 2.13 (54.1) | 1.06 (26.9) | 1.09 (27.7) | 0.44 (11.2) | 1.13 (28.7) | 1/8 (3.2) | 19/32 (15.1) | 1.36 (34.5) | 0.78 (19.8) |
| | | 0.90 | SS-43GXVCR4 | -43XVCR4 | 0.187 (4.75) | | | | | 1.53 (38.9) | 3/16 (4.8) | 25/32 (19.8) | 1.47 (37.3) | |

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BALL

Switching (5-Way and 7-Way) Valves (40 Series)

Features

- Capsule seat packing allows reliable switching.
- Flow can be switched from a single inlet to multiple outlets or from multiple inlets to a common outlet.
- 43Z and 43Z6 series valves have a spring-loaded detent for exact port positioning.
 - Detent handle components:
 - Handle: nylon with brass insert
 - Set screw: S17400 stainless steel
 - Pins, detent plate: nickel-plated steel
 - Springs: steel/ASTM A228

Pressure-Temperature Ratings

| Valve Series | Temperature °F (°C) | Working Pressure psig (bar) |
|--------------|---------------------------------------|-----------------------------|
| 43Z (5-way) | PTFE packing: 50 to 150 (10 to 65) | 2500 (172) |
| 45Z (5-way) | Live-loaded PFA or UHMWPE packing: | 1500 (103) |
| 43Z6 (7-way) | -65 to 150 (-53 to 65) | 500 (34.4) |

Pressure ratings for valves with Swagelok tube fitting ends may be lower due to the tubing pressure rating. See Swagelok *Tubing Data* (MS-01-107), page 224.

Ordering Information and Dimensions

Dimensions are for reference only and are subject to change. Dimensions shown with Swagelok tube fitting nuts finger-tight.

To order, add a body material designator to a 40 series basic ordering number.

40T and 40E Series Valves

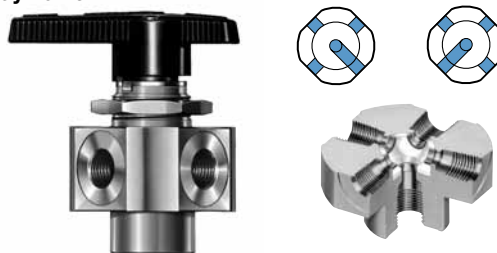
Insert a seat packing material designator.

| Material | Valve Series | Designator |
|----------|--------------|------------|
| PFA | 43, 45 | T |
| UHMWPE | 43 | E |

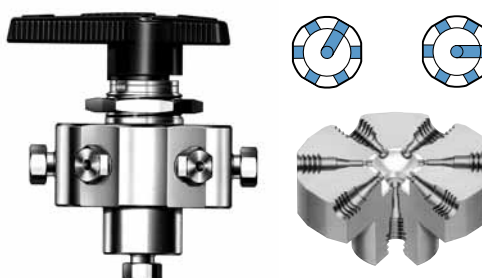
Example: SS-43ZTFS2

Example: SS-43ZFS2

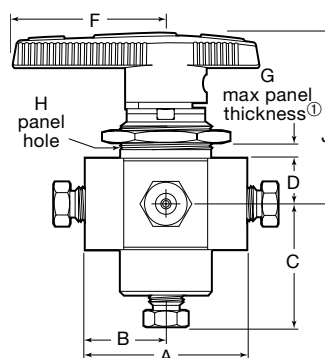
5-Way Valve



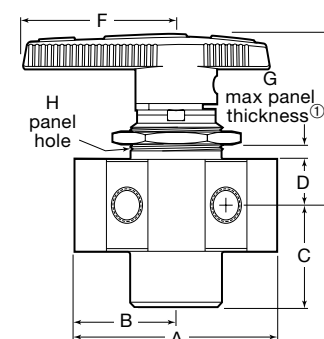
7-Way Valve



5-Way Valve



7-Way Valve



① 1/8 in. (3.2 mm) minimum panel thickness.

| End Connections | | 40 Series Basic Ordering Number | C _v | Orifice in. (mm) | Dimensions in. (mm) | | | | | | | |
|-------------------------------|----------|---------------------------------|----------------|------------------|---------------------|-------------|-------------|-------------|-------------|------------|--------------|-------------|
| Inlets/Outlets | Size | | | | A | B | C | D | F | G | H | J |
| 5-Way Valves | | | | | | | | | | | | |
| Female Swagelok tube fittings | 1/8 in. | -43ZFS2 ^① | 0.07 | 0.062 (1.57) | 1.94 (49.3) | 0.97 (24.6) | | 0.44 (11.2) | 1.53 (38.9) | 5/32 (4.1) | 29/32 (23.1) | 1.69 (42.9) |
| Female NPT | 1/8 in. | -43ZF2 ^① | 0.07 | 0.062 (1.57) | 1.55 (39.4) | 0.78 (19.8) | 0.88 (22.4) | 0.44 (11.2) | 1.53 (38.9) | 5/32 (4.1) | 29/32 (23.1) | 1.69 (42.9) |
| | 1/2 in. | -45ZF8-ND ^② | 3.5 | 0.406 (10.3) | 3.13 (79.5) | 1.56 (39.6) | | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) |
| 7-Way Valves | | | | | | | | | | | | |
| Female Swagelok tube fittings | 1/16 in. | -43Z6FS1 | 0.05 | 0.052 (1.32) | 1.94 (49.3) | 0.97 (24.6) | | 0.44 (11.2) | 1.53 (38.9) | 5/32 (4.1) | 29/32 (23.1) | 1.69 (42.9) |
| | 1/8 in. | -43Z6FS2 | 0.07 | 0.062 (1.57) | 1.94 (49.3) | 0.97 (24.6) | | 0.44 (11.2) | 1.53 (38.9) | 5/32 (4.1) | 29/32 (23.1) | 1.69 (42.9) |

① Cross-port flow may occur during switching. If cross-port flow is unacceptable, specify a 0.049 in. ball orifice. Example: SS-43ZF2-049

② Cross-port flow may occur during switching. If cross-port flow is unacceptable, specify a 0.093 in. ball orifice. Example: SS-45ZF8-ND-093

40G / 40 SERIES BALL

Crossover (4-Way and 6-Way) Valves (40 Series)

Features

- Capsule packing allows crossover of two or three streams.
- Machined stops provide positive port positioning.
 - Stop plate material: aluminum/ASTM B209 or B211.

Pressure-Temperature Ratings

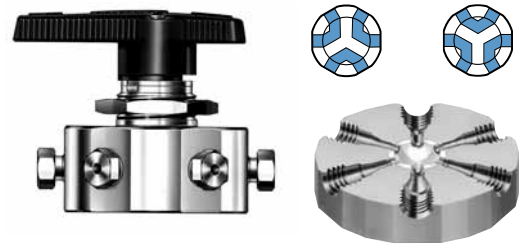
| Valve Series | Temperature °F (°C) | Working Pressure psig (bar) |
|--------------|--|-----------------------------|
| 43Y (4-way) | PTFE packing: 50 to 150 (10 to 65) | 2500 (172) |
| 45Y (4-way) | Live-loaded PFA or UHMWPE packing: -65 to 150 (-53 to 65) | 1500 (103) |
| 43Y6 (6-way) | | 500 (34.4) |

Pressure ratings for valves with Swagelok tube fitting ends may be lower due to the tubing pressure rating. See Swagelok *Tubing Data* (MS-01-107), page 224.

4-Way Valve



6-Way Valve



Ordering Information and Dimensions

Dimensions are for reference only and are subject to change. Dimensions shown with Swagelok tube fitting nuts finger-tight.

To order, add a body material designator to a 40 series basic ordering number.

40T and 40E Series Valves

Insert a seat packing material designator.

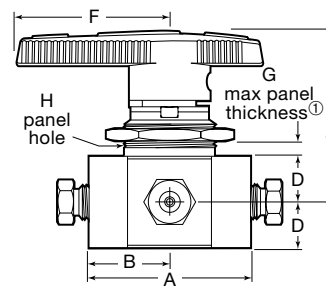
| Material | Designator |
|-----------|------------|
| 316 SS | SS |
| Alloy 400 | M |
| Brass | B |

| Material | Valve Series | Designator |
|----------|--------------|------------|
| PFA | 43, 45 | T |
| UHMWPE | 43 | E |

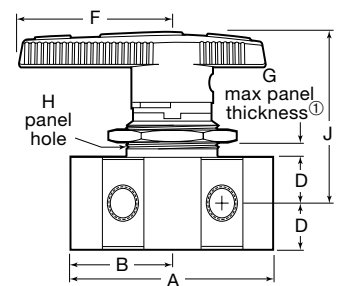
Example: SS-43YTFS1

Example: SS-43YFS1

4-Way Valve



6-Way Valve



① 1/8 in. (3.2 mm) minimum panel thickness.

| End Connections | | 40 Series Basic Ordering Number | C _v | Orifice in. (mm) | Dimensions in. (mm) | | | | | | |
|-------------------------------|----------|---------------------------------|----------------|------------------|---------------------|-------------|-------------|-------------|------------|--------------|-------------|
| Inlets/Outlets | Size | | | | A | B | D | F | G | H | J |
| 4-Way Valves | | | | | | | | | | | |
| Female Swagelok tube fittings | 1/16 in. | -43YFS1 ^① | 0.06 | 0.052 (1.32) | 1.55 (39.4) | 0.78 (19.8) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 29/32 (23.1) | 1.68 (42.7) |
| | 1/8 in. | -43YFS2 ^① | 0.08 | 0.062 (1.57) | 1.94 (49.3) | 0.97 (24.6) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 29/32 (23.1) | 1.68 (42.7) |
| Female NPT | 1/8 in. | -43YF2 ^① | 0.08 | 0.062 (1.57) | 1.55 (39.4) | 0.78 (19.8) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 29/32 (23.1) | 1.69 (42.9) |
| | 1/2 in. | -45YF8 ^② | 1.6 | 0.281 (7.14) | 3.13 (79.5) | 1.56 (39.6) | 0.69 (17.5) | 3.00 (76.2) | 3/8 (9.7) | 1 1/2 (38.1) | 2.43 (61.7) |
| 6-Way Valves | | | | | | | | | | | |
| Female Swagelok tube fittings | 1/16 in. | -43Y6FS1 | 0.06 | 0.052 (1.32) | 1.94 (49.3) | 0.97 (24.6) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 29/32 (23.1) | 1.68 (42.7) |
| | 1/8 in. | -43Y6FS2 | 0.08 | 0.062 (1.57) | 1.94 (49.3) | 0.97 (24.6) | 0.44 (11.2) | 1.53 (38.9) | 3/16 (4.8) | 29/32 (23.1) | 1.68 (42.7) |

① Cross-port flow may occur during switching. If cross-port flow is unacceptable, specify a 0.049 in. ball orifice. Example: SS-43YFS2-049

② Cross-port flow may occur during switching. If cross-port flow is unacceptable, specify a 0.093 in. ball orifice. Example: SS-45YF8-093

Flow Data at 70°F (20°C)

| Flow Coefficient (C _v) | Pressure Drop to Atmosphere (Δp), psi (bar) | | | | | |
|------------------------------------|---|--------------|--------------|---|-----------|-----------|
| | 10 (0.68) | 50 (3.4) | 100 (6.8) | 10 (0.68) | 50 (3.4) | 100 (6.8) |
| | Air Flow std ft ³ /min (std L/min) | | | Water Flow U. S. gal/min (std L/min) | | |
| 0.05 | 0.6 (16) | 1.5 (42) | 2.6 (73) | 0.1 (0.3) | 0.3 (1.1) | 0.5 (1.8) |
| 0.06 | 0.7 (19) | 1.8 (50) | 3.2 (90) | 0.2 (0.7) | 0.4 (1.5) | 0.6 (2.2) |
| 0.07 | 0.8 (22) | 2.1 (59) | 3.7 (100) | 0.2 (0.7) | 0.5 (1.8) | 0.7 (2.6) |
| 0.08 | 0.9 (25) | 2.4 (67) | 4.3 (120) | 0.3 (1.1) | 0.6 (2.2) | 0.8 (3.0) |
| 0.10 | 1.1 (31) | 3.0 (84) | 5.3 (150) | 0.3 (1.1) | 0.7 (2.6) | 1.0 (3.7) |
| 0.15 | 1.7 (48) | 4.5 (120) | 8.0 (220) | 0.4 (1.5) | 1.0 (3.7) | 1.5 (5.6) |
| 0.20 | 2.3 (65) | 6.0 (160) | 11 (310) | 0.6 (2.2) | 1.4 (5.2) | 2.0 (7.5) |
| 0.30 | 3.4 (96) | 9.0 (250) | 16 (450) | 0.9 (3.4) | 2.1 (7.9) | 3.0 (11) |
| 0.35 | 4.0 (110) | 10 (280) | 19 (530) | 1.1 (4.1) | 2.4 (9.0) | 3.5 (13) |
| 0.50 | 5.6 (150) | 15 (420) | 27 (760) | 1.6 (6.0) | 3.5 (13) | 5.0 (18) |
| 0.60 | 6.8 (190) | 18 (500) | 32 (900) | 1.9 (7.1) | 4.2 (15) | 6.0 (22) |
| 0.70 | 7.9 (220) | 21 (590) | 37 (1000) | 2.2 (8.3) | 4.9 (18) | 7.0 (26) |
| 0.75 | 8.5 (240) | 22 (620) | 40 (1100) | 2.3 (8.7) | 5.3 (20) | 7.5 (28) |
| 0.80 | 9.0 (250) | 24 (670) | 42 (1100) | 2.5 (9.4) | 5.6 (21) | 8.0 (30) |
| 0.90 | 10 (280) | 27 (760) | 48 (1300) | 2.8 (10) | 6.4 (24) | 9.0 (34) |
| 1.2 | 14 (390) | 36 (1000) | 64 (1800) | 3.8 (14) | 8.5 (32) | 12 (45) |
| 1.4 | 16 (450) | 42 (1100) | 74 (2000) | 4.4 (16) | 9.9 (37) | 14 (52) |
| 1.5 | 17 (480) | 45 (1200) | 80 (2200) | 4.7 (17) | 11 (41) | 15 (56) |
| 1.6 | 18 (500) | 48 (1300) | 85 (2400) | 5.0 (18) | 11 (41) | 16 (60) |
| 1.7 | 19 (530) | 51 (1400) | 90 (2500) | 5.3 (20) | 12 (45) | 17 (64) |
| 2.0 | 22 (620) | 60 (1600) | 100 (2800) | 6.3 (23) | 14 (52) | 20 (75) |
| 2.4 | 27 (760) | 72 (2000) | 120 (3300) | 7.6 (28) | 17 (64) | 24 (90) |
| 2.6 | 29 (820) | 78 (2200) | 140 (3900) | 8.2 (31) | 18 (68) | 26 (98) |
| 3.0 | 34 (960) | 90 (2500) | 160 (4500) | 9.5 (35) | 21 (79) | 30 (110) |
| 3.5 | 39 (1100) | 100 (2800) | 180 (5000) | 11 (41) | 25 (94) | 35 (130) |
| 3.8 | 43 (1200) | 110 (3100) | 200 (5600) | 12 (45) | 27 (100) | 38 (140) |
| 4.6 | 52 (1400) | 140 (3900) | 240 (6700) | 15 (56) | 33 (120) | 46 (170) |
| 6.0 | 68 (1900) | 180 (5000) | 320 (9000) | 19 (71) | 42 (150) | 60 (220) |
| 6.3 | 71 (2000) | 190 (5300) | 330 (9300) | 20 (75) | 45 (170) | 63 (230) |
| 6.4 | 72 (2000) | 190 (5300) | 340 (9600) | 20 (75) | 45 (170) | 64 (240) |
| 12 | 130 (3600) | 360 (10 000) | 640 (18 000) | 38 (140) | 85 (320) | 120 (450) |

Testing

Every 40G series and 40 series ball valve is factory tested with nitrogen at 1000 psig (69 bar) or at its maximum rated pressure if less than 1000 psig (69 bar). Seat tests have a maximum allowable leak rate of 0.1 std cm³/min.

Cleaning and Packaging

All 40G series and 40 series valves are cleaned in accordance with Swagelok *Standard Cleaning and Packaging (SC-10)* (MS-06-62), page 1174.

Special cleaning and packaging in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* (MS-06-63), page 1175, to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C, is available as an option. See **Process Options**, page 398.

Handle Options

Factory-Assembled Handles

Nylon Directional

Black is standard. For other colors, add a handle color designator to the valve ordering number.

Examples:
SS-43GS4-**BL**
B-43S4-**BL**

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

Nylon Oval

Add **-K** to the valve ordering number.

Examples:
SS-43GS4-**K**
B-43S4-**K**



Metal

Ideal for continuous elevated ambient temperatures

Stainless Steel Directional (40G Series)

Add **-SHD** to the valve ordering number.

Example:
SS-43GS4-**SHD**



316 Stainless Steel Bar (40 Series)

Add **-SH** to the valve ordering number.

Examples:
SS-44S6-**SH**
B-43S4-**SH**



Aluminum Bar (40 Series)

Add **-BKB** to the valve ordering number.

Examples:
SS-44S6-**BKB**
B-43S4-**BKB**



No Handle

Add **-NH** to the valve ordering number.

Example: SS-43GS4-**NH**
B-43S4-**NH**

See page 396 for 40G series valves with no handle and no handle stop, typically specified for valves to be field assembled to pneumatic actuators.

Handle Kits for Field Assembly

Kits include handle and set screw.

| Valve Series ^① | Nylon Directional ^② | Nylon Oval ^③ | Stainless Steel Directional | Stainless Steel Bar | Aluminum Bar |
|---|--------------------------------|-------------------------|-----------------------------|---------------------|--------------|
| 41G, 41GX ^④ , 42G, 42GX ^④ | NY-5K-42G-BK | NY-5K-42GK-BK | SS-5K-42GPM | — | — |
| 43G, 43GX ^④ | NY-5K-43G-BK | NY-5K-43GK-BK | SS-5K-43GPM | — | — |
| 41, 41X ^⑤ , 42, 42X ^⑤ | BZ-5K-42-BK | — | — | SS-5K-42B | A-5K-42B-BK |
| 43, 43X ^⑤ , 43Y | BZ-5K-43-BK | — | — | SS-5K-43B | A-5K-43B-BK |
| 43Z | BZ-5K-43Z-BK | — | — | — | — |
| 44, 44X ^⑤ | BZ-5K-44-BK | — | — | SS-5K-44B | A-5K-44B-BK |
| 45, 45X ^⑤ , 45Y | BZ-5K-45-BK | — | — | SS-5K-45B | A-5K-45B-BK |

① **X** designates switching (3-way) valve; **Y** designates crossover (4-way) valve; **Z** designates switching (5-way) valve.

② Ordering number specifies a black handle. For another color, replace **-BK** with a handle color designator from the table above.
Example: BZ-5K-42-**BL**

③ Nylon oval handles are only available factory assembled on 40 series valves.

④ Handle kits for 40GX series 3-way valves with **L** or **H** flow paths also require a powdered metal 300 series SS stop insert, which can be ordered separately. Use ordering numbers: **SS-5SI-42G** for 41GX and 42GX series valves; and **SS-5SI-43G** for 43GX series valves.

⑤ To order handle kits for 40X series 3-way valves with **L** or **H** flow paths, contact your authorized Swagelok sales and service representative.

Locking Brackets (41G/41, 42G/42, and 43G/43 Series)

- Allows lockout of 2-way, straight-pattern valves with directional handles in the open or closed position with a standard lock.
- Additional small-diameter hole can be used to tether locking mechanism to bracket or attach ID tag.
- Available on 43G/43 series valves with Swagelok end connection sizes up to 3/8 in. and 10 mm.
- Brackets cannot be used on valves with integral VCO and VCR fitting end connections or with panel mounting.

- To order the locking bracket factory-assembled on a valve, add **-LH** to the valve ordering number.
Example: SS-42GS4-**LH**
- To order the locking bracket for field assembly, use kit ordering numbers: **SS-51K-41G-LH** for 41G/41 and 42G/42 series valves; **SS-51K-43G-LH** for 43G/43 series valves



Handle Options

Latch-Lock Handles (43G Series; 43, 44, 45 Series)

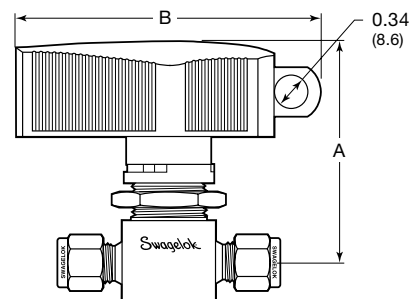
- Lock on-off valves open and closed or closed only
- Lock switching valves at each port, (including center-off position on 3-way model)
- Lock crossover valves in both positions
- Confirm handle position with positive detent
- Assist compliance with lockout/tagout programs
- Fit padlocks with 3/16 to 5/16 in. (4.8 to 7.9 mm) shackle diameters.



43G/43 series directional handle shown; 44 and 45 series handles are oval.

Dimensions

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



Materials of Construction

| Component | Material |
|---|------------------------------|
| Handle | Reinforced nylon |
| Locking mechanism | 304 SS |
| Detent base, handle base, handle pin stop | Powdered metal 300 series SS |
| Spring | S17700 SS |
| Set screw | S17400 SS |
| Lubricant | Hydrocarbon-based |

| Valve Series | Type | Dimensions in. (mm) | |
|---------------------|---|---------------------|----------------|
| | | A | B |
| 43G 43GX | On-off (2-way) Switching (3-way) | 2.27 (57.7) | 3.02 (76.7) |
| 43 43X 43Z | On-off (2-way) Switching (3-way) Switching (5-way) | | |
| 43Y 43Y6 43Z6 | Crossover (4-way) Crossover (6-way) Switching (7-way) | 2.30 (58.4) | 3.02 (76.7) |
| 44 44X | On-off (2-way) Switching (3-way) | 2.63 (66.9) | 3.96 (101) |
| 45 45X 45Y | On-off (2-way) Switching (3-way) Crossover (4-way) | 2.85 (72.4) | 3.96 (101) |

⚠ Caution:
These handles are designed to prevent unintentional valve operation. They are not tamper resistant and can be removed, even when locked.

Ordering Information

Factory Assembled

1. Select a 43G, 43, 44, or 45 series valve ordering number.
Example: **SS-43GS4**
2. To order a valve with a black latch-lock handle, add a handle designator.
Example: **SS-43GS4-LL**
3. To order a handle color other than black, add a handle color designator to the valve ordering number, keeping the handle and color designators in *alphabetical* order.
Examples: **SS-43GS4-BL-LL**
SS-43GS4-LL-RD

Kits for Field Assembly

1. To order a black handle kit, select a handle kit basic ordering number.
Example: **NY-5K-43GLL-BK**
2. For another handle color, replace **BK** with a handle color designator from the table at right.
Example: **NY-5K-43GLL-BL**

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

| Valve Series | Type | Factory Assembly Handle Designators | | Field Assembly Handle Kit Basic Ordering Numbers | |
|--------------|-------------------|-------------------------------------|----------------|--|-----------------|
| | | Open/Closed | Closed Only | Open/Closed | Closed Only |
| 43G | On-off (2-way) | -LL | -LLC | NY-5K-43GLL-BK | NY-5K-43GLLC-BK |
| 43GX | Switching (3-way) | | — | NY-5K-43GXLL-BK | — |
| 43 | On-off (2-way) | -LL | -LLC | NY-5K-43LL-BK | NY-5K-43LLC-BK |
| 43X | Switching (3-way) | | — | NY-5K-43XLL-BK | — |
| 43Y | Crossover (4-way) | | — | NY-5K-43YLL-BK | — |
| 43Y6 | Crossover (6-way) | | — | NY-5K-43Y6LL-BK | — |
| 43Z | Switching (5-way) | | — | NY-5K-43ZLL-BK | — |
| 43Z6 | Switching (7-way) | | — | NY-5K-43Z6LL-BK | — |
| 44 | On-off (2-way) | | -LLC | NY-5K-44LL-BK | NY-5K-44LLC-BK |
| 44X | Switching (3-way) | | — | NY-5K-44XLL-BK | — |
| 45 | On-off (2-way) | | -LLC | NY-5K-45LL-BK | NY-5K-45LLC-BK |
| 45X | Switching (3-way) | | — | NY-5K-45XLL-BK | — |
| 45Y | Crossover (4-way) | — | NY-5K-45YLL-BK | — | |

40G / 40
SERIES
BALL

Vent Port and Stem Extension Options

Vented Valves

Pressure rating for vented valves is 500 psig (34.4 bar).

2-Way, Straight-Pattern Valves

When the valve is closed, the downstream port vents to atmosphere through a vent hole in the side of the valve body.

2-Way, Angle-Pattern and 3-Way Valves

When the valve is closed, the bottom port vents to atmosphere through a vent hole in the side of the valve body.

Ordering Information

To order a vented valve, insert **V** into the valve ordering number.

Example: SS-43GVS4
B-43VS4

Warning: Cross-vent flow may occur in vented valves.

To eliminate cross-vent flow, specify a smaller ball orifice. Add a designator from the table below to the valve ordering number.

| Valve Series | Orifice in. (mm) | Designator |
|--|------------------|------------|
| 41G, 41GX, 41, 41X, 42G, 42GX, 42, 42X | 0.040 (1.02) | -040 |
| 43G, 43GX, 43, 43X, 44, 44X, 45, 45X | 0.049 (1.24) | -049 |
| 45, 45X | 0.093 (2.36) | -093 |

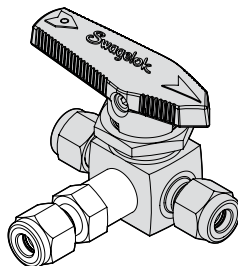
Examples: SS-41GVS1-040
B-42VS4-040

Welded Vent Port Connections

Stainless steel vented valves are available with a Swagelok tube fitting or a tube stub welded to the vent port. See the table below.

40G Series Ordering Information

To order a 40G series vented valve with a welded vent port connection, add the connection designator to the vented valve ordering number.



Swagelok Tube Fitting Connection Welded to Vent Port

| Vent Port Connection | Size | Designator |
|----------------------------------|-------------------------|---------------------|
| Fractional Swagelok tube fitting | 1/8 in. | -WVS2 |
| | 1/4 in. | -WVS4 |
| | 3/8 in. | -WVS6 ^① |
| Metric Swagelok tube fitting | 3 mm | -WVS3M |
| | 6 mm | -WVS6M |
| | 8 mm | -WVS8M ^① |
| Fractional tube stub | 1/4 × 0.049, 2 in. long | -WV4T49-2 |
| Metric tube stub | 6 × 1.0, 50 mm long | -WV6MT10-50M |

^① Available for 43G series valves only.

Example: SS-43GVS4-WVS4

40 Series Ordering Information

To order a 40 series vented valve with welded vent port connection, contact your authorized Swagelok representative.

Stem Extensions (Manual Valves)

Standard lengths are 2, 4, and 6 in.

Factory Assembled

To order a factory-assembled stem extension, add the stem extension designator to the valve ordering number

| Stem Extension Length, in. (mm) | Stem Extension Designator |
|---------------------------------|---------------------------|
| 2 (50.8) | -SE2 |
| 4 (102) | -SE4 |
| 6 (152) | -SE6 |

Examples: SS-43GS4-SE2
SS-44S6-SE4

Kits for Field Assembly

To order a stem extension kit for field assembly, add a dash and the stem extension length (2, 4, 6) in inches to the kit basic ordering number.

| Valve Series | Stem Extension Kit Basic Ordering Number |
|--------------|--|
| 41G, 42G | MS-SE-42G |
| 43G | MS-SE-43G |
| 41, 42 | MS-SE-42 |
| 43 | MS-SE-43 |
| 44 | MS-SE-44 |
| 45 | MS-SE-45 |

Examples: MS-SE-42G-2"
MS-SE-44-4"

Accessories

Directional Name Plates

- Indicate the direction of flow.
- Available for all 40G series and 40 series valves.
- Matte surface accepts ink or labels.

To order, add **-WN1** (blank nameplate) or **-WN2** (marked nameplate) to the valve ordering number.

Examples: SS-43GS4-WN1
B-42VS4-WN2

Directional name plate kits are also available. Contact your authorized Swagelok representative.



Pneumatic Actuators



Swagelok rack and pinion pneumatic actuators are compact, lightweight, and easily mountable. The actuators are available in spring-return and double-acting modes. Straight, angle-pattern, 4-way, and 3-way valves with **H** and **L** flow paths require 90° actuation; all other 3-way valves require 180° actuation.

For technical data, including materials of construction, air displacement, and weight, see the *Swagelok Ball Valve Actuation Options* catalog (MS-02-343), page 468.

⚠ Caution: Actuated assemblies must be properly aligned and supported. Improper alignment or inadequate support of the actuated assembly may result in leakage or premature valve failure.

Pressure-Temperature Ratings

| Actuator Service | Actuator Service Designator | Temperature Range °F (°C) | Maximum Actuator Pressure, psig (bar) | |
|------------------|-----------------------------|---------------------------|---------------------------------------|------------------------|
| | | | At 100°F (37°C) | At Maximum Temperature |
| Standard | — | -20 to 200 (-28 to 93) | 200 (13.7) | 165 (11.3) |
| High temperature | HT | 0 to 400 (-17 to 204) | | 100 (6.8) |
| Low temperature | LT | -40 to 200 (-40 to 93) | | 165 (11.3) |
| Nonfluorocarbon | NF | -20 to 200 (-28 to 93) | | 165 (11.3) |

Actuator Pressure at Maximum System Pressure

Based on valve performance using pressurized air or nitrogen.

40G Series and 40 Series

| Valve Series ^① | Actuator Model | Actuator Model Designator | Actuation Modes | | | |
|---------------------------|----------------|---------------------------|---------------------------------------|----------|---------------|-----------|
| | | | Spring Return | | Double Acting | |
| | | | Single | Dual | Single | Dual |
| | | | Minimum Actuator Pressure, psig (bar) | | | |
| 41G, 42G, 41, 42 | 31 (90°) | -31 | 60 (4.2) | 70 (4.9) | 25 (1.8) | 35 (2.5) |
| 41GX, 42GX, 41X, 42X | 51 (180°) | -51 | 60 (4.2) | 70 (4.9) | 25 (1.8) | 35 (2.5) |
| 43G, 43, 43Y | 31 (90°) | -31 | 80 (5.6) | — | 50 (3.5) | 80 (5.6) |
| | 33 (90°) | -33 | 65 (4.5) | 75 (5.2) | 20 (1.4) | 35 (2.5) |
| 43GX, 43X | 51 (180°) | -51 | 70 (4.9) | — | 50 (3.5) | 80 (5.6) |
| | 53 (180°) | -53 | 65 (4.5) | 70 (4.9) | 20 (1.4) | 35 (2.5) |
| 44 | 33 (90°) | -33 | 70 (4.9) | 90 (6.3) | 25 (1.8) | 50 (3.5) |
| 44X | 53 (180°) | -53 | 70 (4.9) | 80 (5.6) | 25 (1.8) | 50 (3.5) |
| 45, 45Y | 33 (90°) | -33 | 90 (6.3) | — | 60 (4.2) | 100 (6.9) |
| 45X | 53 (180°) | -53 | 85 (5.9) | — | 60 (4.2) | 100 (6.9) |

40G / 40 SERIES BALL

40T and 40E Series for Low-Temperature Service

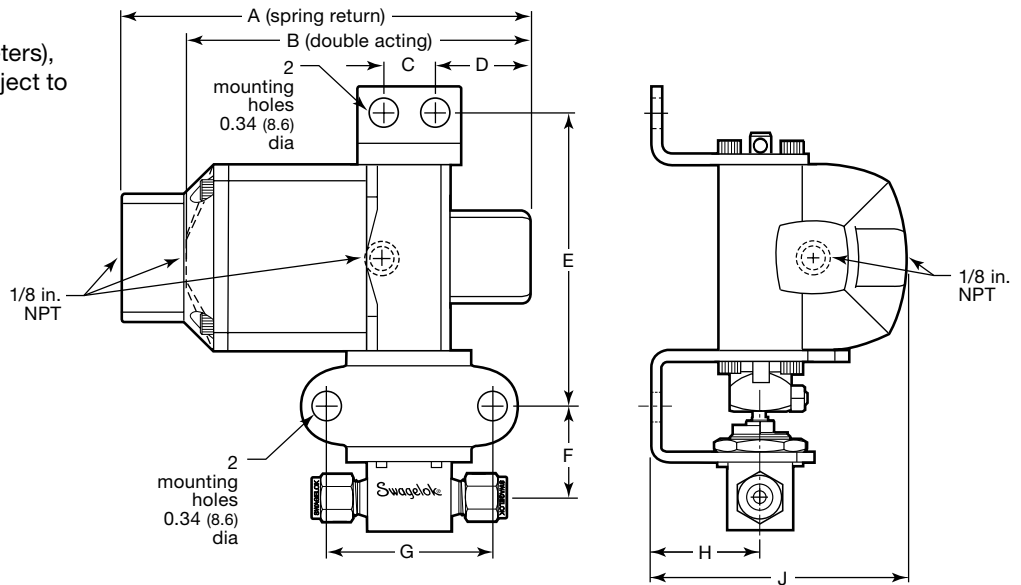
| Valve Series ^① | Actuator Model | Actuator Model Designator | Actuation Modes | | | |
|---------------------------|----------------|---------------------------|---------------------------------------|----------|---------------|-----------|
| | | | Spring Return | | Double Acting | |
| | | | Single | Dual | Single | Dual |
| | | | Minimum Actuator Pressure, psig (bar) | | | |
| 41, 42 | 31 (90°) | -31 | 65 (4.5) | 80 (5.6) | 25 (1.8) | 45 (3.2) |
| 41X, 42X | 51 (180°) | -51 | 65 (4.5) | — | 25 (1.8) | 45 (3.2) |
| 43, 43Y | 31 (90°) | -31 | — | — | 60 (4.2) | 100 (6.9) |
| | 33 (90°) | -33 | 70 (4.9) | 85 (5.9) | 25 (1.8) | 40 (2.8) |
| 43X | 51 (180°) | -51 | — | — | 60 (4.2) | 100 (6.9) |
| | 53 (180°) | -53 | 65 (4.5) | 75 (5.2) | 25 (1.8) | 40 (2.8) |
| 44 | 33 (90°) | -33 | 80 (5.6) | — | 40 (2.8) | 75 (5.2) |
| 44X | 53 (180°) | -53 | 75 (5.2) | — | 40 (2.8) | 75 (5.2) |
| 45, 45Y | 33 (90°) | -33 | — | — | 65 (4.5) | — |
| 45X | 53 (180°) | -53 | — | — | 65 (4.5) | — |

① X designates switching (3-way) valve; Y designates crossover (4-way) valve.

Pneumatic Actuators

Dimensions

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



| Valve Series ^① | Actuator Model | Dimensions, in. (mm) | | | | | | | | |
|--|----------------|----------------------|-------|--------|--------|--------|--------|--------|--------|--------|
| | | A | B | C | D | E | F | G | H | J |
| 41G, 42G, 41, 42, 41GX, 42GX, 41X, 42X | 31 (90°) | 4.91 | 4.09 | 0.63 | 1.15 | 3.55 | 1.02 | 2.00 | 1.31 | 3.04 |
| | 51 (180°) | (125) | (104) | (16.0) | (29.2) | (90.2) | (25.9) | (50.8) | (33.3) | (77.2) |
| 43G, 43, 43GX, 43X, 43Y | 31 (90°) | 4.91 | 4.09 | 0.63 | 1.15 | 3.55 | 1.11 | 2.00 | 1.31 | 3.04 |
| | 51 (180°) | (125) | (104) | (16.0) | (29.2) | (90.2) | (28.2) | (50.8) | (33.3) | (77.2) |
| 44, 44X | 33 (90°) | 7.86 | 5.89 | 0.88 | 1.73 | 4.61 | 1.17 | 2.00 | 1.75 | 4.07 |
| | 53 (180°) | (200) | (150) | (22.4) | (43.9) | (117) | (29.7) | (50.8) | (44.4) | (103) |
| 45, 45X, 45Y | 33 (90°) | 7.86 | 5.89 | 0.88 | 1.73 | 4.88 | 1.56 | 2.00 | 1.75 | 4.07 |
| | 53 (180°) | (200) | (150) | (22.4) | (43.9) | (124) | (39.6) | (50.8) | (44.4) | (103) |

① X designates switching (3-way) valve; Y designates crossover (4-way) valve.

Ordering Information

Factory-Assembled Valves with Actuators

Typical Ordering Number

A
B
C
D
SS - 43GS4 -31 D HT

A Valve Ordering Number

B Actuator Model

Based on valve series, select actuator designator. See **Actuator Pressure at Maximum System Pressure** table, page 391.

- 31 = 90° actuation
- 33 = 90° actuation
- 51 = 180° actuation
- 53 = 180° actuation

C Actuation Mode

- C = Spring return, normally closed
- D = Double acting
- O = Spring return, normally open
- S = Spring return, 3-way and 4-way valves

D Actuator Service

- HT = High temperature
- LT = Low temperature
- NF = Nonfluorocarbon
- None = Standard

For dual-mounted assemblies (two valves mounted to one actuator), add **DM** to the ordering number.

Example: SS-43GS4-31DDM

Pneumatic Actuators

Ordering Information

Kits for Field Assembly

Order one actuator kit and one mounting bracket kit for each valve.

Actuator Kit Typical Ordering Number

A B C
MS-1 31 - DA -HT

A Actuator Model

Based on valve series, select actuator model. See **Dimensions** table, page 392.

- 31 = 90° actuation
- 33 = 90° actuation
- 51 = 180° actuation
- 53 = 180° actuation

B Actuation Mode

- DA = Double acting
- SR = Spring return

C Actuator Service

- HT = High temperature
- LT = Low temperature
- NF = Nonfluorocarbon
- None = Standard

Mounting Bracket Kits

Mounting bracket kits contain:

- 316 stainless steel mounting bracket
- 420 stainless steel actuator roll pin
- Coupling
 - 40G series—304 stainless steel
 - 40 series—carbon steel
- Coupling pin
 - 40G series—S17400 stainless steel
 - 40 series—carbon steel
- Lock nut
 - 40G series—18-8 stainless steel
 - 40 series—carbon steel
- Four 18-8 stainless steel socket head cap screws (kit SS-MS-41G for 41G, 42G, 41GX, and 42GX series *only*)
- instructions.

| Valve Series ^① | Actuator Model | Mounting Bracket Kit Ordering Number |
|---------------------------|----------------|--------------------------------------|
| 41G, 42G | 31 (90°) | SS-MB-41G ^② |
| 41GX, 42GX | 51 (180°) | SS-MB-41G ^② |
| 43G | 31 (90°) | SS-MB-43G |
| | 33 (90°) | SS-MB-43G-133 |
| 43GX | 51 (180°) | SS-MB-43G |
| | 53 (180°) | SS-MB-43G-133 |
| 41, 42 | 31 (90°) | MS-MB-41 ^② |
| 41X, 42X | 51 (180°) | MS-MB-41 ^② |
| 43 | 31 (90°) | MS-MB-43 |
| | 33 (90°) | MS-MB-43-133 |
| 43X | 51 (180°) | MS-MB-43 |
| | 53 (180°) | MS-MB-43-133 |
| 43Y | 31 (90°) | MS-MB-43Y |
| | 33 (90°) | MS-MB-43Y-133 |
| 44 | 33 (90°) | MS-MB-44 ^③ |
| 44X | 53 (180°) | MS-MB-44 ^③ |
| 45 | 33 (90°) | MS-MB-45 |
| 45X | 53 (180°) | MS-MB-45 |
| 45Y | 33 (90°) | MS-MB-45Y |

- ① X designates switching (3-way) valve; Y designates crossover (4-way) valve.
- ② 42G series and 42 series valves with VCO or VCR end connections mounted to a Swagelok pneumatic actuator are only available factory assembled.
- ③ 44 series valves with VCR end connections require kit **MS-MB-44-VCR**.

Coupling Kits

Coupling kits enable replacement of 41, 42, or 43 series valves mounted to Swagelok pneumatic actuators with equivalent 41G, 42G, or 43G series valves. Coupling kits contain:

- 304 stainless steel coupling
- S17400 stainless steel coupling pin
- 18-8 stainless steel lock nut
- instructions.

| Valve Series ^① | Actuator Model | Coupling Kit Ordering Number |
|---------------------------|----------------|------------------------------|
| 41G, 42G | 31 (90°) | 304-5K-41G-131 |
| 41GX, 42GX | 51 (180°) | 304-5K-41G-131 |
| 43G | 31 (90°) | 304-5K-43G-131 |
| | 33 (90°) | 304-5K-43G-133 |
| 43GX | 51 (180°) | 304-5K-43G-131 |
| | 53 (180°) | 304-5K-43G-133 |

- ① X designates switching (3-way) valve; Y designates crossover (4-way) valve.

40G / 40 SERIES BALL

ISO 5211-Compliant Pneumatic Actuators



These Swagelok rack and pinion pneumatic actuators are ISO 5211 compliant and are suitable for general applications. They are available in spring-return and double-acting modes. Straight, angle-pattern, and 3-way valves with **H** and **L** flow paths require 90° actuation; all other 3-way valves require 180° actuation.

For technical data, including actuator materials of construction and weight, see the *Swagelok Ball Valve Actuation Options* catalog (MS-02-343), page 468.

For additional information on selecting and sizing ISO 5211-compliant actuators, see the *Actuated Ball Valve Selection Guide—ISO 5211-Compliant Actuator Mounting Bracket Kits* (MS-02-136), page 484.

Certifications

Factory-assembled valve assemblies with ISO 5211-compliant actuators are available with ATEX conformity on request at the time of order quotation. ATEX certification is not available for field assemblies.

⚠ Caution: Actuated assemblies must be properly aligned and supported. Improper alignment or inadequate support of the actuated assembly may result in leakage or premature valve failure.

Pressure-Temperature Ratings

Maximum actuator pressure is 116 psig (8.0 bar). See **Minimum Actuator Pressure** table below for minimum actuator pressures.

| Actuator Service | Actuator Service Designator | Temperature Range °F (°C) |
|------------------|-----------------------------|---------------------------|
| Standard | — | -40 to 176 (-40 to 80) |
| High temperature | HT | 5 to 302 (-15 to 150) |

Minimum Actuator Pressure

40G Series and 40 Series

| Valve Series ^① | Actuator Model | Actuator Model Designators | | | Actuation Modes | |
|---------------------------|----------------|----------------------------|-----------------|---------------|-----------------|---------------|
| | | Spring Return | | Double Acting | Spring Return | Double Acting |
| | | Normally Open | Normally Closed | | | |
| 41G, 42G, 41, 42 | A10 (90°) | -A10O4 | -A10C4 | -A10D | 50 (3.5) | 36 (2.5) |
| | A15 (90°) | -A15O3 | -A15C3 | -A15D | 36 (2.5) | 36 (2.5) |
| 41GX, 42GX, 41X, 42X | A15 (180°) | — | — | -A15XD | — | 36 (2.5) |
| 43G, 43 | A10 (90°) | — | — | -A10D | — | 43 (3.0) |
| | A15 (90°) | -A15O3 | -A15C3 | -A15D | 43 (3.0) | 36 (2.5) |
| 43GX, 43X | A15 (180°) | ② | ② | -A15XD | — | 36 (2.5) |
| 44 | A10 (90°) | — | — | -A10D | — | 50 (3.5) |
| | A15 (90°) | -A15O4 | -A15C4 | -A15D | 50 (3.5) | 36 (2.5) |
| 44X | A15 (180°) | ② | ② | -A15XD | — | 36 (2.5) |
| 45 | A30 (90°) | -A30O4 | -A30C4 | -A30D | 65 (4.5) | 36 (2.5) |
| 45X | A30 (180°) | ③ | ③ | -A30XD | — | 36 (2.5) |

40T and 40E Series for Low-Temperature Service

| Valve Series ^① | Packing Material | Actuator Model | Actuator Model Designators | | | Actuation Modes | |
|---------------------------|------------------|----------------|----------------------------|-----------------|---------------|-----------------|---------------|
| | | | Spring Return | | Double Acting | Spring Return | Double Acting |
| | | | Normally Open | Normally Closed | | | |
| 41, 42 | PFA, UHMWPE | A10 (90°) | -A10O4 | -A10C4 | -A10D | 50 (3.5) | 36 (2.5) |
| | | A15 (90°) | -A15O3 | -A15C3 | -A15D | 36 (2.5) | 36 (2.5) |
| 41X, 42X | PFA, UHMWPE | A15 (180°) | ② | ② | -A15XD | — | 36 (2.5) |
| 43 | PFA | A10 (90°) | — | — | -A10D | — | 43 (3.0) |
| | | A15 (90°) | -A15O3 | -A15C3 | -A15D | 43 (3.0) | 36 (2.5) |
| | UHMWPE | A10 (90°) | — | — | -A10D | — | 43 (3.0) |
| | | A15 (90°) | -A15O3 | -A15C3 | -A15D | 36 (2.5) | 36 (2.5) |
| 43X | PFA, UHMWPE | A15 (180°) | ② | ② | -A15XD | — | 36 (2.5) |
| 44 | PFA | A30 (90°) | -A30O3 | -A30C3 | -A30D | 50 (3.5) | 36 (2.5) |
| 44X | PFA | A15 (180°) | ② | ② | -A15XD | — | 43 (3.0) |
| 45 | PFA | A60 (90°) | -A60O4 | -A60C4 | -A30D | 50 (3.5) | 36 (2.5) |
| 45X | PFA | A30 (180°) | ③ | ③ | -A30XD | — | 36 (2.5) |

① X designates switching (3-way) valve.

② 3-way valves with **H** and **L** flow paths: **-A15S3**

③ 3-way valves with **H** and **L** flow paths: **-A30S4**

ISO 5211-Compliant Pneumatic Actuators

Ordering Information

Factory-Assembled Valves with Actuators

Typical Ordering Number

A B C
SS-43GS4 -A15D HT

A Valve Ordering Number

B Actuator Model

Based on valve series, actuation mode, and packing material, select actuator designator. See **Minimum Actuator Pressure** table, page 394.

C Actuator Service

HT = High temperature
None = Standard

Kits for Field Assembly

Order one actuator kit and one mounting bracket kit for each valve.

Actuator Kit Typical Ordering Number

A B C D
MS - A15 - DA - DIN -HT

A Actuator Model

Based on valve series and packing material, select actuator designator. See **Minimum Actuator Pressure** table, page 394.

- A10** = A10
- A15** = A15
- A30** = A30
- A60** = A60

B Actuation Mode

- DA** = Double acting (2-way valves)
- XDA** = Double acting (3-way valves)
- 3** = Spring return (41G, 42G, 43G, 41, 42, 43 series 2-way valves with A15 and A30 actuators)
- 4** = Spring return (41G, 41 series 2-way valves with A10 actuator; 44, 45 series 2-way valves)

C Coupling Drive Type

DIN

D Actuator Service

-HT = High temperature
None = Standard

For field assembly to ISO 5211-compliant actuators, 40G series and 40 series valves must contain a two-flat, K-style stem. K-style stems are standard for all 40G series valves and for many 44 and 45 series valves, but are optional for 41, 42, and 43 series valves. For more information, contact your Swagelok sales and service representative.

To order a valve with a two-flat, K-style stem and without a handle, if they are not standard, add **-K-NH** to the valve ordering number.

Example: B-43S4-**K-NH**

Mounting Bracket Kits

Swagelok ISO 5211 mounting bracket kits contain:

- 316 stainless steel mounting bracket
- Four A4 stainless steel socket head cap screws (A4 is approximately equivalent to 316 SS)
- Coupling
 - 40G series—powdered metal 300 series stainless steel
 - 40 series—316 stainless steel
- A4 stainless steel set screw
- Instructions

| Valve Series ^① | Mounting Bracket Kit Ordering Number |
|---------------------------|--------------------------------------|
| 41G, 41GX, 42G, 42GX | SS-MB-41G-F04-11DIN-M ^② |
| 43G, 43GX | SS-MB-43G-F04-11DIN-M |
| 41, 41X, 42, 42X | SS-MB-41-F04-11DIN-M ^② |
| 43, 43X | SS-MB-43-F04-11DIN-M |
| 44, 44X | SS-MB-44-F04-11DIN-M |
| 45, 45X | SS-MB-45-F05-14DIN-M |

^① X designates switching (3-way) valve.

^② 42G series and 42 series valves with VCO or VCR end connections mounted to a Swagelok ISO 5211-compliant pneumatic actuator are only available factory assembled.

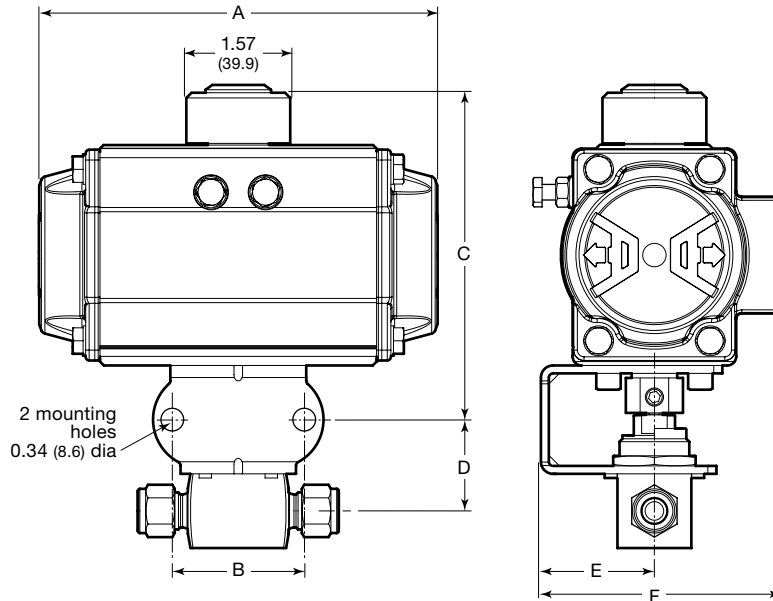
Couplings and Set Screws

Replacement of 41, 42, or 43 series valves mounted to ISO 5211-compliant pneumatic actuators with equivalent 41G, 42G, or 43G series valves requires new couplings and set screws. To order, contact your authorized Swagelok representative.

ISO 5211-Compliant Pneumatic Actuators

Dimensions

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



| Valve Series ^① | Actuator Model | Dimensions, in. (mm) | | | | | |
|---------------------------|----------------|----------------------|-------------|------------|-------------|-------------|-------------|
| | | A | B | C | D | E | F |
| 41G, 42G, 41, 42 | A10 (90°) | 4.65 (118) | 2.00 (50.8) | 4.06 (103) | 1.02 (25.9) | 1.44 (36.6) | 2.84 (72.1) |
| | A15 (90°) | 5.33 (135) | 2.00 (50.8) | 4.18 (106) | 1.02 (25.9) | 1.44 (36.6) | 3.09 (78.5) |
| 41GX, 42GX, 41X, 42X | A15 (180°) | 7.55 (192) | 2.00 (50.8) | 4.18 (106) | 1.02 (25.9) | 1.44 (36.6) | 3.09 (78.5) |
| 43G, 43 | A10 (90°) | 4.65 (118) | 2.00 (50.8) | 4.05 (103) | 1.10 (27.9) | 1.44 (36.6) | 2.84 (72.1) |
| | A15 (90°) | 5.33 (135) | 2.00 (50.8) | 4.16 (106) | 1.10 (27.9) | 1.44 (36.6) | 3.09 (78.5) |
| 43GX, 43X | A15 (180°) | 7.55 (192) | 2.00 (50.8) | 4.16 (106) | 1.10 (27.9) | 1.44 (36.6) | 3.09 (78.5) |
| 44 | A10 (90°) | 4.65 (118) | 2.00 (50.8) | 4.21 (107) | 1.38 (35.1) | 1.44 (36.6) | 2.84 (72.1) |
| | A15 (90°) | 5.33 (135) | 2.00 (50.8) | 4.32 (110) | 1.38 (35.1) | 1.44 (36.6) | 3.09 (78.5) |
| 44X | A15 (180°) | 7.55 (192) | 2.00 (50.8) | 4.32 (110) | 1.38 (35.1) | 1.44 (36.6) | 3.09 (78.5) |
| 45 | A30 (90°) | 6.04 (153) | 2.19 (55.6) | 5.05 (128) | 1.61 (40.9) | 1.72 (43.7) | 3.63 (92.2) |
| | A60 (90°) | 8.01 (203) | 2.19 (55.6) | 5.73 (146) | 1.61 (40.9) | 1.72 (43.7) | 3.71 (94.2) |
| 45X | A30 (180°) | 8.50 (216) | 2.19 (55.6) | 5.05 (128) | 1.61 (40.9) | 1.72 (43.7) | 3.63 (92.2) |

① X designates switching (3-way) valve.

Options for ISO 5211-Compliant and Swagelok Pneumatic Actuators

Swagelok offers a range of accessories to enhance instrumentation and process ball valve performance and control, including solenoid valves, limit switches, and position sensors. Factory assemblies and kits for field assembly are available.

For more information, see the *Swagelok Ball Valve Actuation Options* catalog (MS-02-343), page 468.



■ Valve with No Handle Stop and No Handle (40G Series)

provides increased accessibility to packing bolt.

To order, add **-NHS** to the valve ordering number.

Example: SS-43GS4-**NHS**

For more information on actuator options, contact your authorized Swagelok representative.

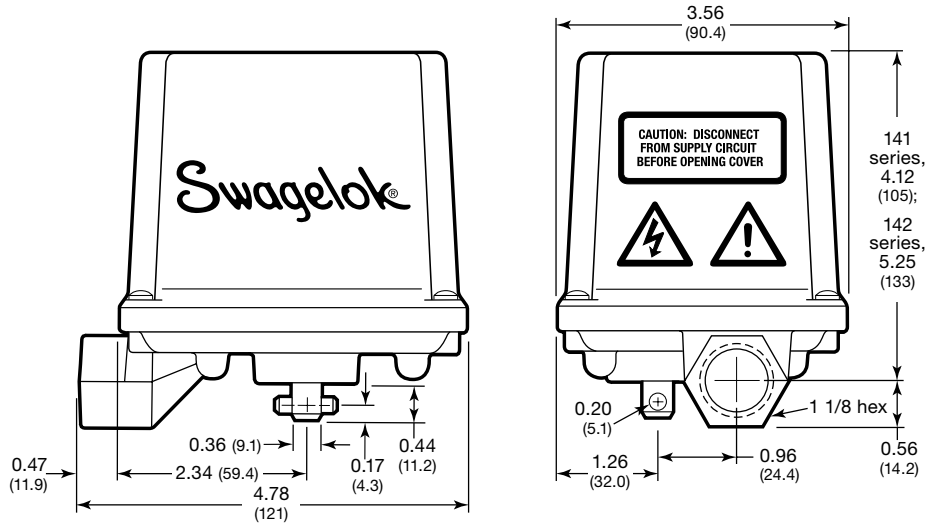
Electric Actuators



Swagelok electric actuators can be used to control the position of Swagelok instrumentation ball valves; alternating- and direct-current models are available. An electrical signal is used to change valve position from remote locations. Integral limit switches provide an output signal of the valve position, even between positions. The drive shaft of these actuators rotates in one direction.

Dimensions

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



See the Swagelok *Electric Actuators* catalog, MS-01-35, for features, testing, materials of construction, technical data, and dimensions.

Electric actuators are not available on angle-pattern valves and vented valves.

⚠ DO NOT USE THESE ACTUATORS ON VENTED BALL VALVES. THE DRIVE SHAFT OF THESE ACTUATORS ROTATES IN ONE DIRECTION.

⚠ Not CE marked.

Ordering Information

Factory-Assembled Valve and Actuator

1. Choose the actuator series that corresponds with the selected valve series.

| Valve Series ^① | Actuator Series |
|---|-----------------|
| 41G, 41GX, 42G, 42GX, 41, 41X, 42, 42X | 141 |
| 43G, 43GX, 43, 43X, 44, 44X | 142 |

^① X designates switching (3-way) valve.

Example: A **41G** series valve requires a **141** series actuator.

2. See the **Actuator Specifications** table in the Swagelok *Electric Actuators* catalog, MS-01-35. Based on the actuator series, select the preferred voltage/frequency/conduit connection for the required actuator.

Example: **120 V (ac)/60 Hz/1/2 in. NPT**

3. Identify the valve flow path.

Example: **2-way**

4. Add the actuator designator to the valve ordering number.

Example: SS-41GS2-**41AC**

Actuator Kits for Field Assembly

Order one actuator kit and one mounting bracket kit for each valve.

1. Identify the valve series.
2. Follow steps 1 through 3 in the **Factory-Assembled Valve and Actuator** ordering information.
3. Replace the dash in the actuator designator with **MS-1**.
Example: **MS-141AC**
4. Select the mounting bracket kit ordering number from the table below. Kits include mounting brackets, cap screws, coupling, and instructions.

| Valve Series ^① | Mounting Bracket Kit Ordering Number |
|---------------------------|--------------------------------------|
| 41G, 41GX, 42G, 42GX | SS-MB-41G ^② |
| 43G, 43GX | SS-MB-43G |
| 41, 41X, 42, 42X | MS-MB-41 ^② |
| 43, 43X | MS-MB-43 |
| 44, 44X | MS-MB-44-131 |

^① X designates switching (3-way) valve.

^② 42G series and 42 series valves with VCO or VCR end connections mounted to a Swagelok electric actuator are only available factory assembled.

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Process Options

Production Tests

To specify an optional production test in place of the standard testing, add a designator from the table at right to the valve ordering number.

Examples: SS-43GS4-**PT**
B-43S4-**PT**

| Test Designator | Production Test Description |
|-----------------|---|
| -PT | Valves are tested with nitrogen at a customer-specified pressure. Test pressure must not exceed the rated pressure of the valve. Maximum allowable leak rate depends on test pressure. |
| -W20 | 40G series—valves are hydrostatically tested with deionized water at 1.5 times the rated pressure of the valve. No visible leakage is permitted. 40 series—valves are hydrostatically tested with deionized water at the rated pressure of the valve. No visible leakage is permitted. |
| -W31 | Valves are helium leak tested at a pressure of 1×10^{-4} Torr. The maximum allowable leak rate is 4×10^{-9} std cm ³ /s. |

Special Cleaning and Packaging (SC-11)

40G series and 40 series valves are available with optional cleaning and packaging in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* (MS-06-63), page 1175, to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C.

40G Series

Special cleaning of 40G series valves changes the low-temperature rating from -65°F (-53°C) to -30°F (-34°C).

40 Series

Special cleaning of 40 series valves does not affect the temperature rating.

Ordering Information

To order, add **-SC11** to the valve ordering number.

Examples: SS-43GS4-**SC11**
B-43S4-**SC11**

Oxygen Service Hazards

For more information about hazards and risks of oxygen-enriched systems, see the Swagelok *Oxygen System Safety* technical report (MS-06-13), page 1184.

Valves Assembled Without Lubrication

40G series and 40 series ball valves assembled without lubrication are cleaned and packaged in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* (MS-06-63), page 1175,

40G Series

40G series valves assembled without lubrication have a pressure rating of 500 psig (34.4 bar).

40 Series

40 series valves assembled without lubrication have a pressure rating of 200 psig (13.7 bar). Brass valves are assembled with stainless steel rings, discs, and ball stem.

Ordering Information

To order, add **-1466** to the valve ordering number.

Examples: SS-43GS4-**1466**
B-43S4-**1466**

⚠ 44 and 45 series valves assembled without lubrication have a significantly higher actuation torque than valves assembled with lubrication.

Service Options

Sour Gas Service

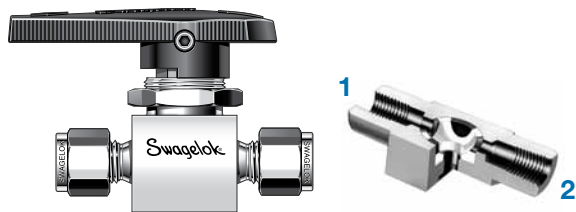
40G series and 40 series valves for sour gas service are available. Materials are selected in accordance with NACE MR0175/ISO 15156.

To order, add **-SG** to the valve ordering number.

Examples: SS-42GF2-**SG**
SS-44F4-**SG**

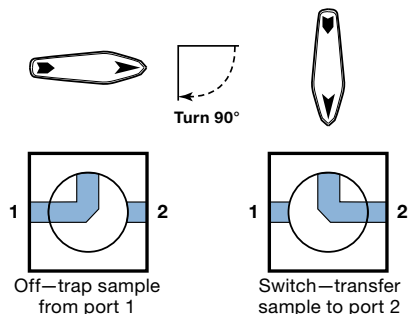
Flow Path Options

Two-Port Paths

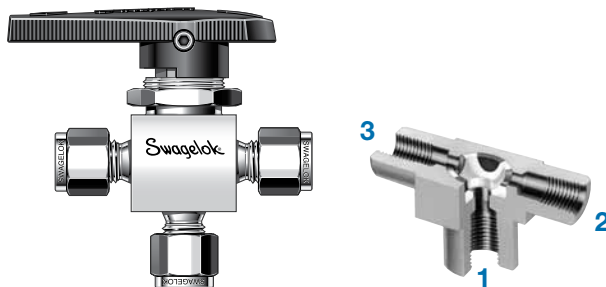


L Flow Path

Angle porting can transfer a sample from port 1 to port 2.

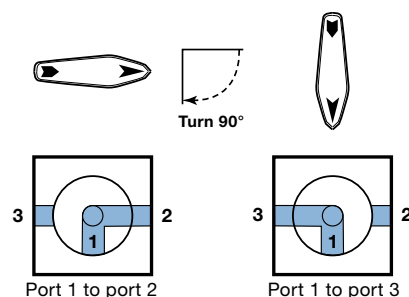


Three-Port Paths



L Flow Path

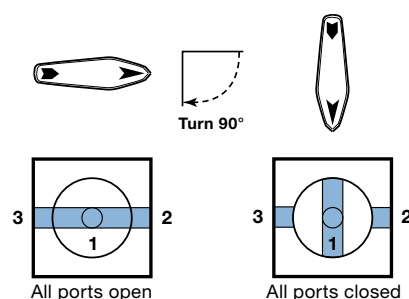
Angle porting allows switching of port 1 to port 2 or port 1 to port 3 when the handle is rotated 90°. THERE IS NO OFF POSITION.



| Valve Series | Orifice in. (mm) | Approx Ball Volume in. ³ (cm ³) | Pressure Rating psig (bar) | Flow Path Designator |
|--------------|------------------|--|----------------------------|----------------------|
| 41G, 41 | 0.040 (1.02) | 0.0004 (0.007) | 2500 (172) | L |
| 42G, 42 | 0.047 (1.19) | 0.0005 (0.008) | | |
| 43G | 0.062 (1.57) | 0.0012 (0.020) | | |
| 43 | 0.062 (1.57) | 0.0013 (0.021) | 1500 (103) | |
| 44 | 0.125 (3.18) | 0.0073 (0.120) | | |
| 45 | 0.281 (7.14) | 0.0473 (0.775) | | |

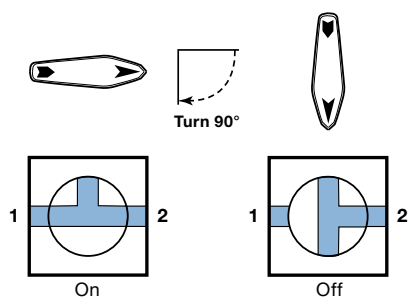
H Flow Path

Tee porting with a leg to the bottom port (port 1) allows ports 1, 2, and 3 to be open or closed at the same time.

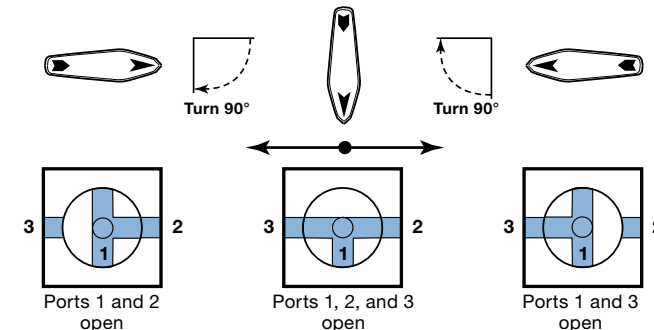


HL Flow Path

Tee porting is used for inline, on-off service when fluid must not be trapped in the stem cavity. System fluid can be evacuated through port 2 when the valve is in the off position.



HL Flow Path



Tee porting with a leg to the bottom port (port 1) enables selection of ports 1 and 2; 1 and 3; or 1, 2, and 3. THERE IS NO OFF POSITION.

| Valve Series | Orifice in. (mm) | Pressure Rating psig (bar) | Flow Path Designator |
|--------------|------------------|----------------------------|----------------------|
| 41G, 41 | 0.093 (2.36) | 2500 (172) | HL |
| 42G, 42 | 0.125 (3.18) | | |
| 43G, 43 | 0.187 (4.75) | | |
| 44 | 0.281 (7.14) | 1500 (103) | |
| 45 | 0.406 (10.3) | | |

| Valve Series | Orifice in. (mm) | Pressure Rating psig (bar) | Flow Path Designator |
|--------------|------------------|----------------------------|---|
| 41GX, 41X | 0.093 (2.36) | 2500 (172) | L = Angle H = Tee (all ports open or closed) |
| 42GX, 42X | 0.125 (3.18) | | |
| 43GX, 43X | 0.187 (4.75) | | |
| 44X | 0.281 (7.14) | 1500 (103) | HL = Tee (no off position) |
| 45X | 0.406 (10.3) | | |

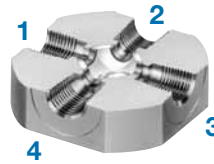
Warning: Cross-port flow may occur in two- and three-port valves with L and HL flow paths and orifices larger than 0.049 in. (1.24 mm).

To eliminate cross-port flow, specify a smaller orifice. See **Ordering Information**, page 402.

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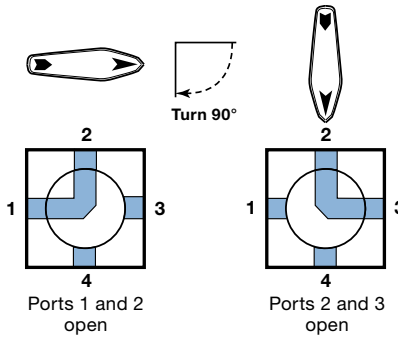
Flow Path Options (40 Series)

Four-Port Paths

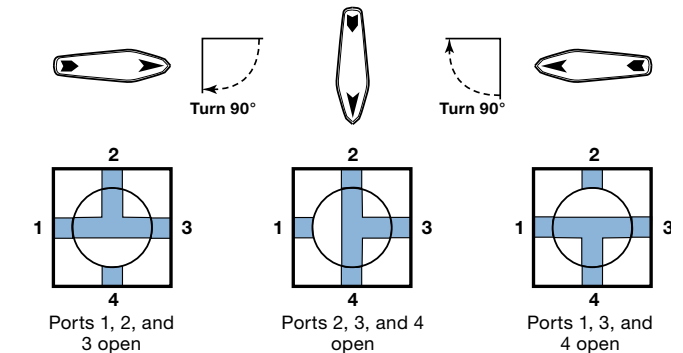


L Flow Path

Angle porting provided with four ports and 360° handle rotation; two adjacent ports are connected and the other two are closed.

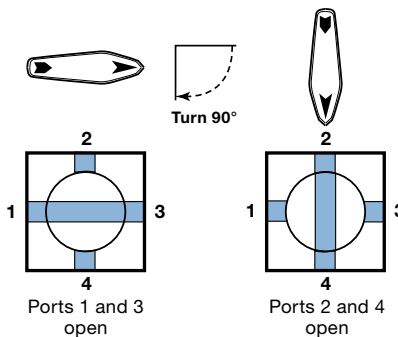


HL Flow Path



H Flow Path

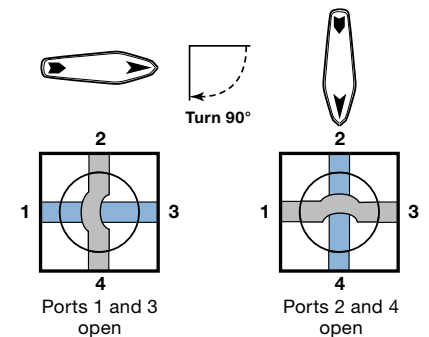
Straight-pattern porting can switch two streams on and off alternately or transfer a sample from ports 1 and 3 to ports 2 and 4.



Tee porting provided with four ports and 360° rotation of the handle; three adjacent ports can be connected at the same time and the remaining port is off.

HH Flow Path

Crossover ports allow continuous flow through ports 1 and 3 and continuous flow through ports 2 and 4.



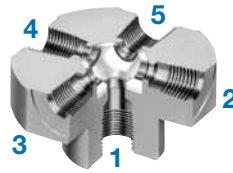
| Valve Series | Orifice in. (mm) | Pressure Rating psig (bar) | Flow Path Designator |
|--------------|--|-------------------------------|----------------------------|
| 43Y | 0.062 (1.57) | 2500 (172) | L = Angle H = Straight |
| 45Y | L, H, HL: 0.281 (7.14) HH: 0.161 (4.09) | 1500 (103) | HL = Tee HH = Crossover |

Warning: Cross-port flow may occur in four-port valves.

To eliminate cross-port flow, specify a smaller orifice. See **Ordering Information**, page 402.

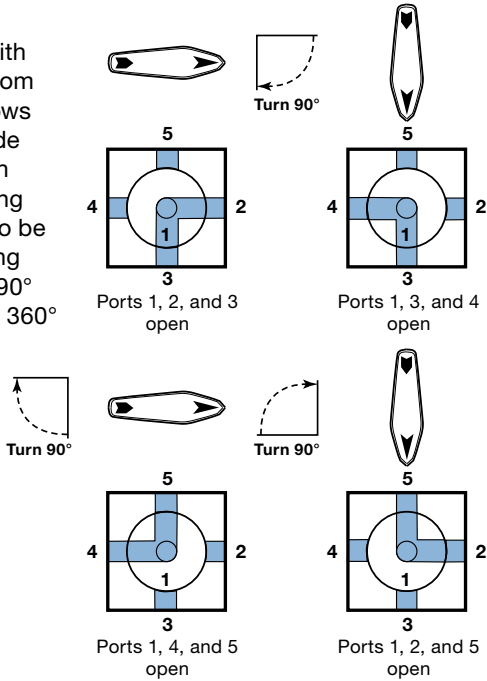
Flow Path Options (40 Series)

Five-Port Paths



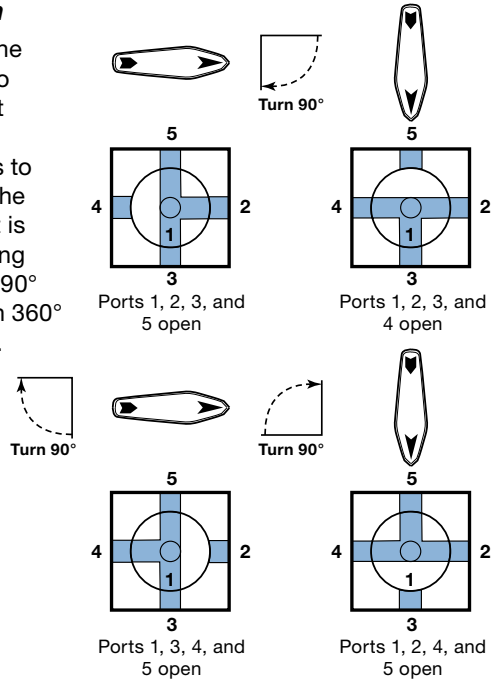
L Flow Path

Angle porting with a leg to the bottom port (port 1) allows two adjacent side ports to be open and the remaining two side ports to be closed. Switching can be done in 90° increments with 360° handle rotation.



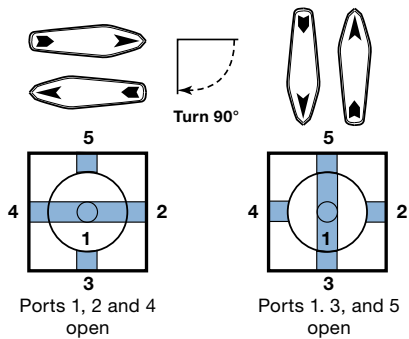
HL Flow Path

Tee porting in the ball with a leg to the bottom port (port 1) permits three side ports to be open while the fourth side port is closed. Switching can be done in 90° increments with 360° handle rotation.



H Flow Path

Tee porting in the ball with a leg to the bottom port (port 1) allows selection of ports 2 and 4 or 3 and 5 with 360° handle rotation.



| Valve Series | Orifice in. (mm) | Pressure Rating psig (bar) | Flow Path Designator |
|--------------|---------------------|-------------------------------|---|
| 43Z | 0.062 (1.57) | 2500 (172) | L = Angle |
| 45Z | 0.281 (7.14) | 1500 (103) | H = Tee (2 ports close) HL = Tee (1 port closes) |

Warning: Cross-port flow may occur in five-port valves.

To eliminate cross-port flow, specify a smaller orifice. See **Ordering Information**, page 402.

40G / 40
SERIES
BALL

Flow Path Options

Ordering Information

40G Series

Two- and three-port flow paths are available. Insert a flow path designator into a 40G series ordering number as shown.

Examples: SS-41GLS2 for a two-port 41G series valve with **L** flow path
 SS-43GXHLS4 for a three-port 43G series valve with **HL** flow path

40 Series

Two-and three-port paths are available for brass and alloy 400 valves. Four-and five-port paths are available for stainless steel, brass, and alloy 400 valves.

Add a material designator and insert a flow path designator into a 40 series basic ordering number as shown.

Examples: **B**-41LS2 for a brass two-port 41 series valve with **L** flow path
SS-44XHS6 for a stainless steel three-port 44 series valve with **H** flow path

| Material | Valve Series | Designator |
|-----------|--|------------|
| 316 SS | 43Y, 43Z, 44, 44X, 45, 45X, 45Y, 45Z | SS |
| Alloy 400 | 41, 41X, 42, 42X, 43, 43X, 43Y, 43Z, 44, 44X, 45, 45X, 45Y, 45Z | M |
| Brass | 41, 41X, 42, 42X, 43, 43X, 43Y, 43Z, 44, 44X, 45, 45X, 45Y, 45Z | B |

Warning: Cross-port flow may occur in some sizes and flow paths.

To eliminate cross-port flow, specify an orifice of:

- 0.049 in. for 41G, 42G, 43G, 41, 42, and 43 series valves whose standard orifice is larger than 0.049 in. (1.24 mm).
 Examples: SS-43GHLS4-**049**
 B-43XLS4-**049**
- 0.093 in. for 44 and 45 series valves whose standard orifice is larger than 0.093 in. (2.36 mm).
 Examples: SS-44LS6-**093**
 SS-45YHS8-**093**

Ordering Multiple Options and Accessories

Swagelok 40G series and 40 series instrumentation ball valves are available with a wide variety of options and accessories that enable valve configurations customized to meet specific system requirements. Just insert or add designators as shown.

Typical Ordering Number

1 **2** **3** **4** **5** **6** **7**
SS - 43G E V L S4 -LL-RD

1 Body Material

B = Brass (40 series only)
M = Alloy 400 (40 series only)
SS = 316 stainless steel (40G series, 44 series, 45 series)

2 Valve Series

On-Off (2-Way) (page 381)
 41G, 42G, 43G,
 41, 42, 43, 44, 45

Switching (3-Way) (page 383)
 41GX, 42GX, 43GX,
 41X, 42X, 43X, 44X, 45X

Switching (5-Way) (page 385)
 43Z, 45Z

Switching (7-Way) (page 385)
 43Z6

Crossover (4-Way) (page 386)
 43Y, 45Y

Crossover (6-Way) (page 386)
 43Y6

3 Packing Material

40G Series
E = UHMWPE
None = modified PTFE

40 Series
None = PTFE

40T and 40E Series
E = Live-loaded UHMWPE (41, 42, 43 series sizes only)
T = Live-loaded PFA (all sizes)

4 Optional Vent Port

V = Vent port (page 390)

5 Optional Flow Path

H, L, HH, HL (page 399)

6 End Connections, Size

Swagelok Tube Fittings

Fractional, in.

S1 = 1/16
S2 = 1/8
S4 = 1/4
S6 = 3/8
S8 = 1/2
S12 = 3/4

Metric, mm

S3MM = 3
S6MM = 6
S8MM = 8
S10MM = 10
S12MM = 12

Female NPT

F2 = 1/8 in.
F4 = 1/4 in.
F6 = 3/8 in.
F8 = 1/2 in.

Female ISO/BSP Tapered

F4RT = 1/4 in.
F6RT = 3/8 in.
F8RT = 1/2 in.

Male NPT

M4 = 1/4 in.

Male NPT to

Swagelok Tube Fitting

M4-S4 = 1/4 in.

VCO Fittings

VCO4 = 1/4 in.

Integral Male VCR Fittings

VCR4 = 1/4 in.
VCR8 = 1/2 in.

7 Options and Accessories

Add multiple designators in *alphanumeric* order. Not all options available for all valves. See pages cited below.

-A = Angle-pattern body (page 381)

-BL, -GR, -OG, -RD, -YW = Nylon directional handle colors (page 388)

-K, -SHD, -SH, -BKB, -NH, -NHS, -LH, -LL, -LLC = Handle options (pages 388 and 396)

-WVS2, -WVS4, . . . -WVS8M = Swagelok tube fitting vent port connections (page 390)

-WV4T49-2, -WV6MT10-50M = Tube stub vent port connections (page 390)

-SE2, -SE4, -SE6 = Stem extensions (page 390)

-WN1, -WN2 = Directional name plates (page 390)

-PT, -W20, -W31 = Production tests (page 398)

-SC11 = Special cleaning and packaging (page 398)

-1466 = No lubrication/special cleaning and packaging (page 398)

Caution: Do not mix or interchange parts with those of other manufacturers.

About this document

Thank you for downloading this electronic catalog, which is part of General Product catalog Swagelok published in print. This type of electronic catalog is updated as new information arises or revisions, which may be more current than the printed version.

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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.

Warranty Information

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

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AutoCAD—TM Autodesk, Inc.
CSA—TM Canadian Standards Association
DeviceNet—TM ODVA
Kalrez, Krytox—TM DuPont
Elgiloy—TM Elgiloy Specialty Metals
FM—TM FM Global
Grafoil—TM GrafTech International Holdings, Inc.
MAC—TM MAC Valves Inc.
Microsoft, Windows—TM Microsoft Corp.
NACE—TM NACE International
picofast—TM HansTurck KG
Pillar—TM Nippon Pillar Packing Company, Ltd.
15-7 PH, 17-7 PH—TM AK Steel Corp.
Sandvik—TM SandvikAB
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SolidWorks—TM SolidWorks Corporation