Actuated Ball Valve Selection Guide

ISO 5211-Compliant Actuator Mounting Bracket Kits

40G, 40, 60, 83, H83, SK, and FKB Series Valves
AFS Ball Valves

- Calculate valve operating torque

- Choose actuators and related components

- Select mounting bracket kits

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Contents

Introduction

This guide enables the user to:

- determine the operating torque for Swagelok® 40G, 40, 60, 83, H83, SK, and FKB series valves and AFS ball valves in a variety of operating conditions
- select and size actuators, based on valve operating torque
- choose Swagelok ISO 5211 dimensionally compliant mounting bracket kits, based on calculated operating torque values and actuator manufacturers' literature.

40G Series Valves

Swagelok 43G series valve with ISO 5211-compliant actuator.

Operating Torque

Operating torque for a Swagelok 40G series ball valve is influenced by:

- packing material
- system pressure
- system temperature
- system media.

The tables and calculations on page 3 can be used for 2- and 3-way stainless steel 40G series valves.

Valve Operating Torque

Start (break) torque is the torque required to begin actuation of a valve. The actuator start torque must be greater than the valve start torque.

End (run) torque is the torque required to complete the actuation. The actuator end torque must be greater than the valve end torque.

Factors that Affect Operating Torque

Frequency of Use

Operating torque typically increases as the time interval between cycles increases.

For applications in which valves are cycled less frequently than noted in the **Calculating Operating Torque** instructions, contact your authorized Swagelok sales and service representative.

Cycle Wear

Contacting surfaces—valve ball, seat, and body, for example—gradually wear as valves are actuated repeatedly, resulting in increased friction and operating torque. Actuation speed may influence the rate of valve wear as well.

For applications in which valves are actuated rapidly or repeatedly—more often than once per hour—contact your authorized Swagelok representative.

Seat or Packing Material

In some ball valve designs, friction between ball and seat or packing affects operating torque, which varies with material and lubricant.

System Pressure

Higher pressures cause greater contact forces and friction, resulting in higher operating torque.

System Temperature

The values given in the tables that follow were generated at room temperature. Lower or higher temperatures, depending on the valve design, can cause increased operating torque.

System Media

The values given in the tables that follow were generated with clean, dry nitrogen gas. Different system fluids have varying viscosities, bringing about different levels of friction and affecting operating torque. Some lightweight oils may reduce operating torque. Dirty, abrasive, or highly viscous fluids may increase operating torque.

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40G Series Valves

Calculating Operating Torque

1. Select the base start and base end torque at system pressure from Table 1.
2. Select the temperature factor from Table 2.
3. Select the media factor from Table 3.
4. Calculate the start and end operating torque:
   Base torque (Table 1)
   × temperature factor (Table 2)
   × media factor (Table 3).

Example: A 43G valve with modified PTFE packing is operated with nitrogen at 2500 psig and 70°F (20°C).

1. According to Table 1, the base start torque is 37 in.·lb and the base end torque is 11 in.·lb.
2. According to Table 2, the temperature factor is 1.0.
3. According to Table 3, the media factor is 1.0.
4. Start torque = 37 in.·lb × 1.0 × 1.0 = 37 in.·lb

   End torque = 11 in.·lb × 1.0 × 1.0 = 11 in.·lb

Ordering Information

1. Select the desired 40G series valve and packing material. Using the **Calculating Operating Torque** instructions at left, calculate the valve start and end torque.
2. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature to specify ISO 5211 mounting dimensions, including flange and coupling sizes.
3. Select a mounting bracket kit ordering number based on valve series, flange size, and coupling size.

Table 1—Base Start and End Torque

Use linear interpolation to obtain torque values for system pressures not listed.

Valve Series	System Pressure, psig (bar, MPa)							
	0 to 1000 (68.9, 6.89)		1500 (103, 10.3)		2500 (172, 17.2)		3000 (206, 20.6)	
	Base Torque, in.·lb (N·m, cm·kg)							
	Start	End	Start	End	Start	End	Start	End
41G/42G 41GE/42GE 41G-1466/42G-1466	13 (1.5, 15) 10 (1.2, 12) 13 (1.5, 15)	7 (0.8, 8.1) 7 (0.8, 8.1) 7 (0.8, 8.1)	15 (1.7, 18) 11 (1.3, 13) —	7 (0.8, 8.1) 7 (0.8, 8.1) —	15 (1.7, 18) 12 (1.4, 14) —	8 (0.9, 9.3) 8 (0.9, 9.3) —	— 	—
43G 43GE 43G-1466	32 (3.7, 37) 23 (2.6, 27) 28 (3.2, 33)	9 (1.1, 11) 10 (1.2, 12) 16 (1.9, 19)	33 (3.8, 39) 25 (2.9, 29) —	10 (1.2, 12) 11 (1.3, 13) —	37 (4.2, 43) 27 (3.1, 32) —	11 (1.3, 13) 12 (1.4, 14) —	40 (4.6, 47) 30 (3.4, 35) —	11 (1.3, 13) 13 (1.5, 15) —

Table 2—Temperature Factors

Use linear interpolation to obtain factors for system temperatures not listed.

Valve Series	Temperature, °F (°C)	
	−65 (−53)	50 to 300 (10 to 148)
41G/42G 41GE/42GE 41G-1466/42G-1466	1.0 1.5 1.0	1.0 1.0 1.0
43G 43GE 43G-1466	1.0 1.5 1.0	1.0 1.0 1.0

Table 3—Media Factors

Medium-Weight Oil	Clean Water	Nitrogen Gas
0.85	1.0	1.0

> ### *40G Series Valve Designators*
> **None**—standard, modified PTFE packing
> **E**—UHMWPE packing
> **-1466**—modified PTFE packing, assembled without lubricant and cleaned and packaged in accordance with Swagelok *Special Cleaning and Packaging (SC-11),* MS-06-63

See *Mounting Instructions, ISO 5211 Dimensionally Compliant Bracket, Coupling, and Actuator,* MS-INS-4080-NAMUR.

Mounting Bracket Kit Ordering Numbers

Valve Series	ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
41G/42G	F03	9 mm ISO	Metric	SS-MB-41G-F03-9ISO-M
		9 mm ISO	Fractional	SS-MB-41G-F03-9ISO-F
		9 mm DIN	Metric	SS-MB-41G-F03-9DIN-M
		9 mm DIN	Fractional	SS-MB-41G-F03-9DIN-F
	F04	9 mm ISO	Metric	SS-MB-41G-F04-9ISO-M
		9 mm ISO	Fractional	SS-MB-41G-F04-9ISO-F
		9 mm DIN	Metric	SS-MB-41G-F04-9DIN-M
		9 mm DIN	Fractional	SS-MB-41G-F04-9DIN-F
		11 mm ISO	Metric	SS-MB-41G-F04-11ISO-M
		11 mm ISO	Fractional	SS-MB-41G-F04-11ISO-F
		11 mm DIN	Metric	SS-MB-41G-F04-11DIN-M
		11 mm DIN	Fractional	SS-MB-41G-F04-11DIN-F
43G	F03	9 mm ISO	Metric	SS-MB-43G-F03-9ISO-M
		9 mm ISO	Fractional	SS-MB-43G-F03-9ISO-F
		9 mm DIN	Metric	SS-MB-43G-F03-9DIN-M
		9 mm DIN	Fractional	SS-MB-43G-F03-9DIN-F
	F04	9 mm ISO	Metric	SS-MB-43G-F04-9ISO-M
		9 mm ISO	Fractional	SS-MB-43G-F04-9ISO-F
		9 mm DIN	Metric	SS-MB-43G-F04-9DIN-M
		9 mm DIN	Fractional	SS-MB-43G-F04-9DIN-F
		11 mm ISO	Metric	SS-MB-43G-F04-11ISO-M
		11 mm ISO	Fractional	SS-MB-43G-F04-11ISO-F
		11 mm DIN	Metric	SS-MB-43G-F04-11DIN-M
		11 mm DIN	Fractional	SS-MB-43G-F04-11DIN-F
	F05	11 mm ISO	Metric	SS-MB-43G-F05-11ISO-M
		11 mm ISO	Fractional	SS-MB-43G-F05-11ISO-F
		11 mm DIN	Metric	SS-MB-43G-F05-11DIN-M
		11 mm DIN	Fractional	SS-MB-43G-F05-11DIN-F
		14 mm ISO	Metric	SS-MB-43G-F05-14ISO-M
		14 mm ISO	Fractional	SS-MB-43G-F05-14ISO-F
		14 mm DIN	Metric	SS-MB-43G-F05-14DIN-M
		14 mm DIN	Fractional	SS-MB-43G-F05-14DIN-F

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40 Series Valves

Operating Torque

Operating torque for a Swagelok 40 series ball valve is influenced by:

- cycle frequency
- packing material
- system pressure
- system temperature
- system media.

The tables and calculations on this page can be used for 2- and 3-way 40 series valves in stainless steel, brass, and alloy 400 materials.

Calculating Operating Torque

If the valve will be cycled at least once per 3 days, but not more than once per hour:

1. Select the base start and base end torque at system pressure from Table 4.
2. Select the temperature factor from Table 5.
3. Select the media factor from Table 6.
4. Calculate the start and end operating torque:
   Base torque (Table 4)
   × temperature factor (Table 5)
   × media factor (Table 6).

Example: A 43 series valve with PTFE packing is operated with nitrogen at 1500 psig and 70°F (20°C) and cycled every 3 days.

1. According to Table 4, the base start torque is 33 in.·lb and the base end torque is 10 in.·lb.
2. According to Table 5, the temperature factor is 1.0.
3. According to Table 6, the media factor is 1.0.
4. Start torque = 33 in.·lb × 1.0 × 1.0 = 33 in.·lb

   End torque = 10 in.·lb × 1.0 × 1.0 = 10 in.·lb.

If the valve will be cycled less frequently than once per 3 days or more frequently than once per hour, contact your authorized Swagelok representative.

Table 4—Base Start and End Torque

Use linear interpolation to obtain torque values for system pressures not listed.

Valve Series	System Pressure, psig (bar, MPa)			
	0 to 1000 (68.9, 6.89)		1500 (103, 10.3)	
	Base Torque, in.·lb (N·m, cm·kg)			
	Start	End	Start	End
41/42	13 (1.5, 15)	7 (0.8, 8.1)	15 (1.7, 18)	7 (0.8, 8.1)
41T/42T	13 (1.5, 15)	7 (0.8, 8.1)	15 (1.7, 18)	7 (0.8, 8.1)
41E/42E	10 (1.2, 12)	7 (0.8, 8.1)	11 (1.3, 13)	7 (0.8, 8.1)
41-1466/42-1466	13 (1.5, 15)	7 (0.8, 8.1)	—	—
43	32 (3.7, 37)	9 (1.1, 11)	33 (3.8, 39)	10 (1.2, 12)
43T	36 (4.1, 42)	15 (1.7, 18)	38 (4.3, 44)	16 (1.9, 19)
43E	23 (2.6, 27)	10 (1.2, 12)	25 (2.9, 29)	11 (1.3, 13)
43-1466	28 (3.2, 33)	16 (1.9, 19)	—	—
44	37 (4.2, 43)	20 (2.3, 24)	40 (4.6, 47)	22 (2.5, 26)
44T	48 (5.5, 56)	22 (2.5, 26)	52 (5.9, 60)	23 (2.6, 27)
44E	70 (8.0, 81)	33 (3.8, 39)	75 (8.5, 87)	35 (4.0, 41)
44-1466	60 (6.8, 70)	40 (4.6, 47)	—	—
45	80 (9.1, 93)	30 (3.4, 35)	85 (9.7, 98)	32 (3.7, 37)
45T	80 (9.1, 93)	35 (4.0, 41)	85 (9.7, 98)	37 (4.2, 43)
45E	130 (14.7, 150)	46 (5.2, 53)	135 (15.3, 156)	50 (5.7, 58)
45-1466	135 (15.3, 156)	95 (10.8, 110)	—	—

Valve Series	System Pressure, psig (Bar, MPa)			
	2500 (172, 17.2)		3000 (206, 20.6)	
	Base Torque, in.·lb (N·m, cm·kg)			
	Start	End	Start	End
41/42	15 (1.7, 18)	8 (0.9, 9.3)		
41T/42T	15 (1.7, 18)	8 (0.9, 9.3)	—	—
41E/42E	12 (1.4, 14)	8 (0.9, 9.3)		
41-1466/42-1466	—	—		
43	37 (4.2, 43)	11 (1.3, 13)	40 (4.6, 47)	11 (1.3, 13)
43T	42 (4.8, 49)	18 (2.1, 21)	45 (5.1, 52)	20 (2.3, 24)
43E	27 (3.1, 32)	12 (1.4, 14)	30 (3.4, 35)	13 (1.5, 15)
43-1466	—	—	—	—
44	44 (5.0, 51)	25 (2.9, 29)		
44T	57 (6.5, 66)	26 (3.0, 30)	—	—
44E	83 (9.4, 96)	40 (4.6, 47)		
44-1466	—	—		
45	95 (10.8, 110)	35 (4.0, 41)		
45T	95 (10.8, 110)	42 (4.8, 49)	—	—
45E	150 (17.0, 173)	55 (6.3, 64)		
45-1466	—	—		

Table 5—Temperature Factors

Use linear interpolation to obtain factors for temperatures from –65 to 50°F (–53 to 10°C).

| Valve Series | Temperature, °F (°C) | |
	(–65) (–53)	50 to 150 (10 to 65)
41/42	1.0	1.0
41T/42T	1.0	1.0
41E/42E	1.5	1.0
41-1466/42-1466	1.0	1.0
43	1.0	1.0
43T	1.0	1.0
43E	1.5	1.0
43-1466	1.0	1.0
44	1.0	1.0
44T	1.35	1.0
44E	1.5	1.0
44-1466	1.0	1.0
45	1.0	1.0
45T	1.35	1.0
45E	1.5	1.0
45-1466	1.0	1.0

Table 6—Media Factors

Medium-Weight Oil	Clean Water	Nitrogen Gas
0.85	1.0	1.0

40 Series Valve Designators

None—standard, PTFE packing

T—low-temperature, PFA packing

E—low-temperature, UHMWPE packing

-1466—PTFE packing, assembled without lubricant and cleaned and packaged in accordance with Swagelok *Special Cleaning and Packaging (SC-11),* MS-06-63

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40 Series Valves

Ordering Information

1. Select the desired 40 series valve and packing material. Using the **Calculating Operating Torque** instructions at left, calculate the valve start and end torque.

2. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature to specify ISO 5211 mounting dimensions, including flange and coupling sizes.

3. Select a Swagelok 40 series bracket kit ordering number. Bracket kits can be used with stainless steel, brass, and alloy 400 valves with two-flat, K-style stems. K-style stems are optional for 41, 42, and 43 series valves and standard for many 44 and 45 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**

See *Mounting Instructions, ISO 5211 Dimensionally Compliant Bracket, Coupling, and Actuator,* MS-INS-4080-NAMUR.

Swagelok 45 series valve with El-O-Matic® actuator and Westlock® limit switch.

Mounting Bracket Kit Ordering Numbers

Valve Series	ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
41/42	F03	9 mm ISO	Metric	SS-MB-41-F03-9ISO-M
		9 mm ISO	Fractional	SS-MB-41-F03-9ISO-F
		9 mm DIN	Metric	SS-MB-41-F03-9DIN-M
		9 mm DIN	Fractional	SS-MB-41-F03-9DIN-F
	F04	9 mm ISO	Metric	SS-MB-41-F04-9ISO-M
		9 mm ISO	Fractional	SS-MB-41-F04-9ISO-F
		9 mm DIN	Metric	SS-MB-41-F04-9DIN-M
		9 mm DIN	Fractional	SS-MB-41-F04-9DIN-F
		11 mm ISO	Metric	SS-MB-41-F04-11ISO-M
		11 mm ISO	Fractional	SS-MB-41-F04-11ISO-F
		11 mm DIN	Metric	SS-MB-41-F04-11DIN-M
		11 mm DIN	Fractional	SS-MB-41-F04-11DIN-F
43	F03	9 mm ISO	Metric	SS-MB-43-F03-9ISO-M
		9 mm ISO	Fractional	SS-MB-43-F03-9ISO-F
		9 mm DIN	Metric	SS-MB-43-F03-9DIN-M
		9 mm DIN	Fractional	SS-MB-43-F03-9DIN-F
	F04	9 mm ISO	Metric	SS-MB-43-F04-9ISO-M
		9 mm ISO	Fractional	SS-MB-43-F04-9ISO-F
		9 mm DIN	Metric	SS-MB-43-F04-9DIN-M
		9 mm DIN	Fractional	SS-MB-43-F04-9DIN-F
		11 mm ISO	Metric	SS-MB-43-F04-11ISO-M
		11 mm ISO	Fractional	SS-MB-43-F04-11ISO-F
		11 mm DIN	Metric	SS-MB-43-F04-11DIN-M
		11 mm DIN	Fractional	SS-MB-43-F04-11DIN-F
	F05	11 mm ISO	Metric	SS-MB-43-F05-11ISO-M
		11 mm ISO	Fractional	SS-MB-43-F05-11ISO-F
		11 mm DIN	Metric	SS-MB-43-F05-11DIN-M
		11 mm DIN	Fractional	SS-MB-43-F05-11DIN-F
		14 mm ISO	Metric	SS-MB-43-F05-14ISO-M
		14 mm ISO	Fractional	SS-MB-43-F05-14ISO-F
		14 mm DIN	Metric	SS-MB-43-F05-14DIN-M
		14 mm DIN	Fractional	SS-MB-43-F05-14DIN-F

Valve Series	ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
44	F03	9 mm ISO	Metric	SS-MB-44-F03-9ISO-M
		9 mm ISO	Fractional	SS-MB-44-F03-9ISO-F
		9 mm DIN	Metric	SS-MB-44-F03-9DIN-M
		9 mm DIN	Fractional	SS-MB-44-F03-9DIN-F
	F04	11 mm ISO	Metric	SS-MB-44-F04-11ISO-M
		11 mm ISO	Fractional	SS-MB-44-F04-11ISO-F
		11 mm DIN	Metric	SS-MB-44-F04-11DIN-M
		11 mm DIN	Fractional	SS-MB-44-F04-11DIN-F
	F05	11 mm ISO	Metric	SS-MB-44-F05-11ISO-M
		11 mm ISO	Fractional	SS-MB-44-F05-11ISO-F
		11 mm DIN	Metric	SS-MB-44-F05-11DIN-M
		11 mm DIN	Fractional	SS-MB-44-F05-11DIN-F
		14 mm ISO	Metric	SS-MB-44-F05-14ISO-M
		14 mm ISO	Fractional	SS-MB-44-F05-14ISO-F
		14 mm DIN	Metric	SS-MB-44-F05-14DIN-M
		14 mm DIN	Fractional	SS-MB-44-F05-14DIN-F
45	F05	11 mm ISO	Metric	SS-MB-45-F05-11ISO-M
		11 mm ISO	Fractional	SS-MB-45-F05-11ISO-F
		11 mm DIN	Metric	SS-MB-45-F05-11DIN-M
		11 mm DIN	Fractional	SS-MB-45-F05-11DIN-F
		14 mm ISO	Metric	SS-MB-45-F05-14ISO-M
		14 mm ISO	Fractional	SS-MB-45-F05-14ISO-F
		14 mm DIN	Metric	SS-MB-45-F05-14DIN-M
		14 mm DIN	Fractional	SS-MB-45-F05-14DIN-F
		17 mm ISO	Metric	SS-MB-45-F05-17ISO-M
		17 mm ISO	Fractional	SS-MB-45-F05-17ISO-F
		17 mm DIN	Metric	SS-MB-45-F05-17DIN-M
		17 mm DIN	Fractional	SS-MB-45-F05-17DIN-F
	F07	17 mm ISO	Metric	SS-MB-45-F07-17ISO-M
		17 mm ISO	Fractional	SS-MB-45-F07-17ISO-F
		17 mm DIN	Metric	SS-MB-45-F07-17DIN-M
		17 mm DIN	Fractional	SS-MB-45-F07-17DIN-F

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60 Series Valves

Operating Torque

Operating torque for a Swagelok 60 series valve is influenced by:

- cycle frequency
- seat material
- system pressure
- system temperature
- system media.

The tables and calculations on this page can be used for 2- and 3-way 60 series valves in stainless steel, carbon steel, and brass materials.

Calculating Operating Torque

If the valve will be cycled at least once per day, but not more than once per hour:

1. Select the base start and base end torque at system pressure from Table 7.

2. Select the temperature factor from Table 8.

3. Select the media factor from Table 9.

4. Calculate the start and end operating torque:
   Base torque (Table 7)
   × temperature factor (Table 8)
   × media factor (Table 9).

Example: A 63 series valve with reinforced PTFE seat is operated with nitrogen at 1500 psig and 70°F (20°C) and cycled once per day.

1. According to Table 7, the base start torque is 62 in.·lb and the base end torque is 37 in.·lb.

2. According to Table 8, the temperature factor is 1.0.

3. According to Table 9, the media factor is 1.0.

4. Start torque = 62 in.·lb × 1.0 × 1.0 = 62 in.·lb

   End torque = 37 in.·lb × 1.0 × 1.0 = 37 in.·lb.

If the valve will be cycled less frequently than once per day or more frequently than once per hour, contact your authorized Swagelok representative.

Table 7—Base Start and End Torque

Use linear interpolation to obtain torque values for system pressures not listed.

Valve Series	System Pressure, psig (bar, MPa)					
	0		1000 (68.9, 6.89)		1500 (103, 10.3)	
	Base Torque, in.·lb (N·m, cm·kg)					
	Start	End	Start	End	Start	End
62T 62P	18 (2.1, 21) 25 (2.9, 29)	16 (1.9, 19) 16 (1.9, 19)	22 (2.5, 26) 25 (2.9, 29)	20 (2.3, 24) 16 (1.9, 19)	25 (2.9, 29) 30 (3.4, 35)	22 (2.5, 26) 20 (2.3, 24)
63T 63P	52 (5.9, 60) 50 (5.7, 58)	28 (3.2, 33) 40 (4.6, 47)	58 (6.6, 67) 50 (5.7, 58)	35 (4.0, 41) 40 (4.6, 47)	62 (7.1, 72) 65 (7.4, 75)	37 (4.2, 43) 50 (5.7, 58)
65T 65P	125 (14.2, 144) 90 (10.2, 104)	60 (6.8, 70) 75 (8.5, 87)	160 (18.1, 185) 90 (10.2, 104)	100 (11.3, 116) 75 (8.5, 87)	180 (20.4, 208) 150 (17.0, 173)	120 (13.6, 139) 125 (14.2, 144)
67T 67P	250 (28.3, 288) 190 (21.5, 219)	120 (13.6, 139) 160 (18.1, 185)	290 (32.8, 335) 190 (21.5, 219)	140 (15.9, 162) 160 (18.1, 185)	310 (35.1, 358) 275 (31.1, 317)	145 (16.4, 168) 230 (26.0, 265)
68T 68P	290 (32.8, 335) 280 (31.7, 323)	135 (15.3, 156) 230 (26.0, 265)	370 (41.9, 427) 280 (31.7, 323)	200 (22.6, 231) 230 (26.0, 265)	500 (56.5, 576) 360 (40.7, 415)	235 (26.6, 271) 295 (33.4, 340)

Valve Series	System Pressure, psig (bar, MPa)					
	2200 (151, 15.1)		2500 (172, 17.2)		3000 (206, 20.6)	
	Base Torque, in.·lb (N·m, cm·kg)					
	Start	End	Start	End	Start	End
62T 62P	26 (3.0, 30) 37 (4.2, 43)	23 (2.6, 27) 23 (2.6, 27)	— 40 (4.6, 47)	— 25 (2.9, 29)	— 45 (5.1, 52)	— 30 (3.4, 35)
63T 63P	67 (7.6, 78) 100 (11.3, 116)	42 (4.8, 49) 75 (8.5, 85)	— 110 (12.5, 127)	— 85 (9.7, 98)	— —	— —
65T 65P	205 (23.2, 237) 230 (26.0, 265)	150 (17.0, 173) 190 (21.5, 219)	— 260 (29.4, 300)	— 215 (24.3, 248)	— —	— —
67T 67P	335 (37.9, 386) 405 (45.8, 467)	160 (18.1, 185) 340 (38.5, 392)	— —	— —	— —	— —
68T 68P	500 (56.5, 576) 485 (54.9, 559)	280 (31.7, 323) 400 (45.2, 461)	— —	— —	— —	— —

Table 8—Temperature Factors

Use linear interpolation to obtain factors for temperatures from 100 to 450°F (37 to 232°C).

Valve Series	Temperature, °F (°C)	
	–20 to 100 (–28 to 37)	450 (232)
62T 62P	1.0 1.0	1.9 1.0
63T 63P	1.0 1.0	3.0 1.0
65T 65P	1.0 1.0	2.3 1.2
67T 67P	1.0 1.0	2.0 1.0
68T 68P	1.0 1.0	2.8 1.0

Table 9—Media Factors

Seat Material	Medium-Weight Oil	Clean Water	Nitrogen Gas
PTFE PEEK	0.9 1.0	1.0 1.0	1.0 1.0

60 Series Valve Designators

T—reinforced PTFE seat and packing

P—PEEK seat and packing

Swagelok

60 Series Valves

Ordering Information

1. Select the desired 4-bolt 60 series valve and seat material. Using the **Calculating Operating Torque** instructions at left, calculate the valve start and end operating torque.

   For 60 series valves with encased 8-bolt construction, contact your authorized Swagelok representative.

2. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature to specify ISO 5211 mounting dimensions, including flange and coupling sizes.

3. Select a Swagelok 60 series bracket kit ordering number. Bracket kits can be used with stainless steel, carbon steel, and alloy 400 valves.

   To order bracket kits for brass valves, insert **-B** into the bracket kit ordering number.

   Example: SS-MB-62-**B**-F03-9ISO-M

See *Mounting Instructions, ISO 5211 Dimensionally Compliant Bracket, Coupling, and Actuator to 4-Bolt 60 Series Valves,* MS-INS-4B60NM.

Swagelok 63 series valve with ISO 5211-compliant actuator, ASCO® solenoid, and Pepperl+Fuchs proximity sensor.

Mounting Bracket Kit Ordering Numbers

Valve Series	ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
62	F03	9 mm ISO 9 mm ISO 9 mm DIN 9 mm DIN	Metric Fractional Metric Fractional	SS-MB-62-F03-9ISO-M SS-MB-62-F03-9ISO-F SS-MB-62-F03-9DIN-M SS-MB-62-F03-9DIN-F
		11 mm ISO 11 mm ISO 11 mm DIN 11 mm DIN	Metric Fractional Metric Fractional	SS-MB-62-F03-11ISO-M SS-MB-62-F03-11ISO-F SS-MB-62-F03-11DIN-M SS-MB-62-F03-11DIN-F
		14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-62-F03-14ISO-M SS-MB-62-F03-14ISO-F SS-MB-62-F03-14DIN-M SS-MB-62-F03-14DIN-F
	F04	9 mm ISO 9 mm ISO 9 mm DIN 9 mm DIN	Metric Fractional Metric Fractional	SS-MB-62-F04-9ISO-M SS-MB-62-F04-9ISO-F SS-MB-62-F04-9DIN-M SS-MB-62-F04-9DIN-F
		11 mm ISO 11 mm ISO 11 mm DIN 11 mm DIN	Metric Fractional Metric Fractional	SS-MB-62-F04-11ISO-M SS-MB-62-F04-11ISO-F SS-MB-62-F04-11DIN-M SS-MB-62-F04-11DIN-F
		14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-62-F04-14ISO-M SS-MB-62-F04-14ISO-F SS-MB-62-F04-14DIN-M SS-MB-62-F04-14DIN-F
63	F05	11 mm ISO 11 mm ISO 11 mm DIN 11 mm DIN	Metric Fractional Metric Fractional	SS-MB-63-F05-11ISO-M SS-MB-63-F05-11ISO-F SS-MB-63-F05-11DIN-M SS-MB-63-F05-11DIN-F
		14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-63-F05-14ISO-M SS-MB-63-F05-14ISO-F SS-MB-63-F05-14DIN-M SS-MB-63-F05-14DIN-F
		17 mm ISO 17 mm ISO 17 mm DIN 17 mm DIN	Metric Fractional Metric Fractional	SS-MB-63-F05-17ISO-M SS-MB-63-F05-17ISO-F SS-MB-63-F05-17DIN-M SS-MB-63-F05-17DIN-F

Valve Series	ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
65	F05	14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-65-F05-14ISO-M SS-MB-65-F05-14ISO-F SS-MB-65-F05-14DIN-M SS-MB-65-F05-14DIN-F
		17 mm ISO 17 mm ISO 17 mm DIN 17 mm DIN	Metric Fractional Metric Fractional	SS-MB-65-F05-17ISO-M SS-MB-65-F05-17ISO-F SS-MB-65-F05-17DIN-M SS-MB-65-F05-17DIN-F
	F07	14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-65-F07-14ISO-M SS-MB-65-F07-14ISO-F SS-MB-65-F07-14DIN-M SS-MB-65-F07-14DIN-F
		17 mm ISO 17 mm ISO 17 mm DIN 17 mm DIN	Metric Fractional Metric Fractional	SS-MB-65-F07-17ISO-M SS-MB-65-F07-17ISO-F SS-MB-65-F07-17DIN-M SS-MB-65-F07-17DIN-F
67	F07	14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-67-F07-14ISO-M SS-MB-67-F07-14ISO-F SS-MB-67-F07-14DIN-M SS-MB-67-F07-14DIN-F
		17 mm ISO 17 mm ISO 17 mm DIN 17 mm DIN	Metric Fractional Metric Fractional	SS-MB-67-F07-17ISO-M SS-MB-67-F07-17ISO-F SS-MB-67-F07-17DIN-M SS-MB-67-F07-17DIN-F
68	F07	14 mm ISO 14 mm ISO 14 mm DIN 14 mm DIN	Metric Fractional Metric Fractional	SS-MB-68-F07-14ISO-M SS-MB-68-F07-14ISO-F SS-MB-68-F07-14DIN-M SS-MB-68-F07-14DIN-F
		17 mm ISO 17 mm ISO 17 mm DIN 17 mm DIN	Metric Fractional Metric Fractional	SS-MB-68-F07-17ISO-M SS-MB-68-F07-17ISO-F SS-MB-68-F07-17DIN-M SS-MB-68-F07-17DIN-F

Swagelok

83 and H83 Series Valves

Operating Torque

Operating torque for a Swagelok 83 or H83 series valve is influenced by:

- system pressure
- cycle frequency
- system media.

The tables and calculations on this page can be used for 83 and H83 series valves of stainless steel and alloy 400 with any seat material.

Calculating Operating Torque

If the valve will be cycled no more than once per hour:

1. Select the base start and base end torque at system pressure from Table 10.
2. Select the media factor from Table 11.
3. Calculate the start and end operating torque:
   Base torque (Table 10)
   × media factor (Table 11).

Example: An 83 series 3-way valve is operated with medium-weight oil at 1500 psig and cycled once per day.

1. According to Table 10, the base start torque is 25 in.·lb and the base end torque is 15 in.·lb.
2. According to Table 11, the media factor is 0.9.
3. Start torque = 25 in.·lb × 0.9 = 22.5 in.·lb

   End torque = 15 in.·lb × 0.9 = 13.5 in.·lb.

If the valve will be cycled more frequently than once per hour, contact your authorized Swagelok representative.

Table 10—Base Start and End Torque

Use linear interpolation to obtain torque values for system pressures not listed.

Valve Series	System Pressure, psig (bar, MPa)									
	0		1500 (103, 10.3)		3000 (206, 20.6)		6000 (413, 41.3)		10 000 (689, 68.9)	
	Base Torque, in.·lb (N·m, cm·kg)									
	Start	End	Start	End	Start	End	Start	End	Start	End
83 2-way	15 (1.7, 18)	15 (1.7, 18)	15 (1.7, 18)	15 (1.7, 18)	17 (2.0, 20)	17 (2.0, 20)	20 (2.3, 24)	20 (2.3, 24)	—	—
83 3-way	25 (2.9, 29)	15 (1.7, 18)	25 (2.9, 29)	15 (1.7, 18)	27 (3.1, 32)	17 (2.0, 20)	30 (3.4, 35)	20 (2.3, 24)	—	—
All H83	25 (2.9, 29)	15 (1.7, 18)	25 (2.9, 29)	15 (1.7, 18)	27 (3.1, 32)	17 (2.0, 20)	30 (3.4, 35)	20 (2.3, 24)	35 (4.0, 41)	20 (2.3, 24)

Ordering Information

Swagelok 83 series valve with ISO 5211-compliant actuator.

1. Select the desired 83 or H83 series valve. Using the **Calculating Operating Torque** instructions above, calculate the valve start and end operating torque.
2. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature to specify ISO 5211 mounting dimensions, including flange and coupling sizes.
3. Select a Swagelok 83 series bracket kit ordering number. Bracket kits can be used with stainless steel and alloy 400 valves.

See *Mounting Instructions, ISO 5211 Dimensionally Compliant Bracket, Coupling, and Actuator,* MS-INS-4080-NAMUR.

Table 11—Media Factors

Medium-Weight Oil	Clean Water	Nitrogen Gas
0.9	1.0	1.0

Mounting Bracket Kit Ordering Numbers

ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
F03	9 mm ISO	Metric	SS-MB-83-F03-9ISO-M
	9 mm ISO	Fractional	SS-MB-83-F03-9ISO-F
	9 mm DIN	Metric	SS-MB-83-F03-9DIN-M
	9 mm DIN	Fractional	SS-MB-83-F03-9DIN-F
F04	9 mm ISO	Metric	SS-MB-83-F04-9ISO-M
	9 mm ISO	Fractional	SS-MB-83-F04-9ISO-F
	9 mm DIN	Metric	SS-MB-83-F04-9DIN-M
	9 mm DIN	Fractional	SS-MB-83-F04-9DIN-F
	11 mm ISO	Metric	SS-MB-83-F04-11ISO-M
	11 mm ISO	Fractional	SS-MB-83-F04-11ISO-F
	11 mm DIN	Metric	SS-MB-83-F04-11DIN-M
	11 mm DIN	Fractional	SS-MB-83-F04-11DIN-F
F05	11 mm ISO	Metric	SS-MB-83-F05-11ISO-M
	11 mm ISO	Fractional	SS-MB-83-F05-11ISO-F
	11 mm DIN	Metric	SS-MB-83-F05-11DIN-M
	11 mm DIN	Fractional	SS-MB-83-F05-11DIN-F
	14 mm ISO	Metric	SS-MB-83-F05-14ISO-M
	14 mm ISO	Fractional	SS-MB-83-F05-14ISO-F
	14 mm DIN	Metric	SS-MB-83-F05-14DIN-M
	14 mm DIN	Fractional	SS-MB-83-F05-14DIN-F

Swagelok

AFS Ball Valves

Operating Torque

Operating torque for a Swagelok AFS ball valve is influenced by:

- system pressure
- system temperature.

Calculating Operating Torque

If the valve will be cycled at least once per day, but not more than once per hour:

1. Select the base start and base end torque at system pressure from Table 12.

2. Select the temperature factor from Table 13.

3. Calculate the start and end operating torque:
   Base torque (Table 12)
   $\times$ temperature factor (Table 13).

Example: AFS valve is operated with nitrogen at 4500 psig and 70°F (20°C).

1. According to Table 12, the base start torque is 61 in.·lb and the base end torque is 36 in.·lb.

2. According to Table 13, the temperature factor is 1.0.

3. Start torque = 61 in.·lb $\times$ 1.0
   = 61 in.·lb

   End torque = 36 in.·lb $\times$ 1.0
   = 36 in.·lb.

If the valve will be cycled less frequently than once per day or more frequently than once per hour, contact your authorized Swagelok representative.

Table 12—Base Start and End Torque

Torque values based on the valve's remaining closed for one day at pressure. Use linear interpolation to obtain torque values for system pressures not listed.

Valve Torque	System Pressure, psig (bar, MPa)			
	0	1000 (68.9, 6.89)	4500 (310, 31.0)	6000 (413, 41.3)
	Base Torque, in.·lb (N·m, cm·kg)			
Start	13 (1.5, 15)	23 (2.6, 27)	61 (6.9, 71)	76 (8.6, 88)
End	12 (1.4, 14)	18 (2.1, 21)	36 (4.1, 42)	41 (4.7, 48)

Table 13—Temperature Factors

Temperature factors based 6000 psig (413 bar) system pressure and on the valve's remaining closed for one day at pressure. Use linear interpolation to obtain factors for system temperatures not listed.

Temperature, °F (°C)			
–40 (–40)	70 (20)	185 (85)	250 (121)
2.9	1.0	1.0	1.0

Ordering Information

Swagelok AFS ball valve with ISO 5211-compliant actuator.

1. Select the desired AFS valve. Using the **Calculating Operating Torque** instructions at right, calculate the valve start and end torque.

2. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature to specify ISO 5211 mounting dimensions, including flange and coupling sizes.

3. Select a mounting bracket kit ordering number.

See *Mounting Instructions, ISO 5211 Dimensionally Compliant Bracket, Coupling, and Actuator,* MS-INS-4080-NAMUR.

Mounting Bracket Kit Ordering Numbers

ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
F05	11 mm ISO	Metric	SS-MB-45-F05-11ISO-M
	11 mm ISO	Fractional	SS-MB-45-F05-11ISO-F
	11 mm DIN	Metric	SS-MB-45-F05-11DIN-M
	11 mm DIN	Fractional	SS-MB-45-F05-11DIN-F
	14 mm ISO	Metric	SS-MB-45-F05-14ISO-M
	14 mm ISO	Fractional	SS-MB-45-F05-14ISO-F
	14 mm DIN	Metric	SS-MB-45-F05-14DIN-M
	14 mm DIN	Fractional	SS-MB-45-F05-14DIN-F
	17 mm ISO	Metric	SS-MB-45-F05-17ISO-M
	17 mm ISO	Fractional	SS-MB-45-F05-17ISO-F
	17 mm DIN	Metric	SS-MB-45-F05-17DIN-M
	17 mm DIN	Fractional	SS-MB-45-F05-17DIN-F
F07	17 mm ISO	Metric	SS-MB-45-F07-17ISO-M
	17 mm ISO	Fractional	SS-MB-45-F07-17ISO-F
	17 mm DIN	Metric	SS-MB-45-F07-17DIN-M
	17 mm DIN	Fractional	SS-MB-45-F07-17DIN-F

Swagelok

SK Series Valves

Operating Torque

Operating torque for a Swagelok SK series valve is influenced by:

■ cycle frequency
■ system pressure
■ system temperature.

Calculating Operating Torque

1. Determine the base start and base end torque at system pressure from Table 14.

2. Determine the temperature factor from Table 15.

3. Calculate the start and end operating torque:
   Base torque (Table 14)
   $\times$ temperature factor (Table 15).

Example: SK series valve is operated with nitrogen at 3000 psig and 70°F (20°C).

1. According to Table 14, the base start torque is 21 in.·lb and the base end torque is 10 in.·lb.

2. According to Table 15, the temperature factor is 1.0.

3. Start torque = 21 in.·lb $\times$ 1.0 = 21 in.·lb

   End torque = 10 in.·lb $\times$ 1.0 = 10 in.·lb.

If the valve will be cycled less frequently than once per day or more frequently than once per hour, contact your authorized Swagelok representative.

Table 14—Base Start and End Torque

Use linear interpolation to obtain torque values for system pressures not listed.

Valve Torque	System Pressure, psig (bar, MPa)		
	0	3000 (206, 20.6)	6000 (413, 41.3)
	Base Torque, in.·lb (N·m, cm·kg)		
Start	14 (1.6, 17)	21 (2.4, 25)	26 (3.0, 30)
End	10 (1.2, 12)	10 (1.2. 12)	10 (1.2. 12)

Table 15—Temperature Factors

Use linear interpolation to obtain factors for system temperatures not listed.

Temperature, °F (°C)				
−40 (−40)	0 (−17)	70 (20)	250 (121)	302 (150)
2.0	2.0	1.0	1.0	1.0

Ordering Information

Swagelok SK series valve with ISO 5211-compliant actuator.

1. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature to specify ISO 5211 mounting dimensions, including flange and coupling sizes.

2. Select a mounting bracket kit ordering number.

See *Mounting Instructions, ISO 5211 Dimensionally Compliant Bracket, Coupling, and Actuator,* MS-INS-4080-NAMUR.

Mounting Bracket Kit Ordering Numbers

ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
F04	11 mm ISO	Metric	SS-MB-4SK-F04-11ISO-M
	11 mm ISO	Fractional	SS-MB-4SK-F04-11ISO-F
	11 mm DIN	Metric	SS-MB-4SK-F04-11DIN-M
	11 mm DIN	Fractional	SS-MB-4SK-F04-11DIN-F

Swagelok

FKB Series Valves

Operating Torque

Operating torque for a Swagelok FKB series valve is influenced by:

- system pressure
- system temperature.

Calculating Operating Torque

If the valve will be cycled at least once per day, but not more than once per hour:

1. Select the base start and base end torque at system pressure from Table 16.

2. Select the temperature factor from Table 17.

3. Calculate the start and end operating torque:
   Base torque (Table 16)
   × temperature factor (Table 17).

Example: 8FKB valve is operated with nitrogen at 7500 psig and 70°F (20°C).

1. According to Table 16, the base start torque is 256 in.·lb and the base end torque is 63 in.·lb.

2. According to Table 17, the temperature factor is 1.0.

3. Start torque = 256 in.·lb × 1.0
   = 256 in.·lb

   End torque = 63 in.·lb × 1.0
   = 63 in.·lb.

If the valve will be cycled less frequently than once per day or more frequently than once per hour, contact your authorized Swagelok representative.

Table 16—Base Start and End Torque

Torque values based on the valve's remaining closed for one day at pressure. Use linear interpolation to obtain torque values for system pressures not listed.

Valve Series	System Pressure, psig (bar, MPa)									
	0		3750 (258, 25.83)		7500 (516, 51.6)		11 250 (775, 77.5)		15 000 (1034, 103)	
	Base Torque, in.·lb (N·m, cm·kg)									
	Start	End	Start	End	Start	End	Start	End	Start	End
6FKB	30 (3.4, 35)	30 (3.4, 35)	51 (5.8, 59)	33 (3.8, 39)	71 (8.1, 82)	35 (4.0, 41)	85 (9.7, 98)	47 (5.4, 55)	102 (12, 118)	49 (5.6, 57)
8FKB	84 (9.5, 97)	71 (8.1, 82)	166 (19, 192)	72 (8.2, 83)	256 (29, 295)	63 (7.2, 73)	322 (37, 371)	64 (7.3, 74)	375 (43, 432)	76 (8.6, 88)
12FKB	288 (33, 332)	184 (21, 212)	308 (35, 355)	140 (16, 162)	396 (45, 257)	145 (17, 168)	443 (51, 511)	121 (14, 140)	543 (62, 626)	116 (14, 134)

Ordering Information

Swagelok 6FKB series valve with ISO 5211-compliant actuator.

1. Select the desired FKB series valve. Using the **Calculating Operating Torque** instructions aboovew, calculate the valve start and end torque.

2. Choose an actuator based on the valve start and end torque. See the actuator manufacturer's literature for ISO 5211 mounting dimensions, including flange and coupling sizes.

3. Select a mounting bracket kit ordering number.

See *Medium-Pressure Ball Valve, Mounting Instructions for FKB Series Medium-Pressure Ball Valves to ISO 5211-Compliant Actuators,* MS-CRD-0124.

Table 13—Temperature Factors

Temperature factors based 6000 psig (413 bar) system pressure and on the valve's remaining closed for one day at pressure. Use linear interpolation to obtain factors for system temperatures not listed.

Valve Series	Temperature, °F (°C)		
	0 (0)	70 (20)	250 (121)
6FKB	1.5	1.0	1.0
8FKB	1.2	1.0	1.0
12FKB	1.0	1.0	0.6

Mounting Bracket Kit Ordering Numbers

Valve Series	ISO 5211 Flange Size	Coupling Size	Cap Screw Type	Bracket Kit Ordering Number
6FKB	F05	14 mm DIN	Metric	SS-MB-6FKB-F05-14DIN-M
8FKB	F07	17 mm DIN	Metric	SS-MB-8FKB-F07-17DIN-M
12FKB	F07	17 mm DIN	Metric	SS-MB-12FKB-F07-17DIN-M

Swagelok

Mounting Bracket Kits

Kits for Swagelok 40G, 40, 83, H83, SK, and FKB series and AFS ball valves contain:

- 316 stainless steel mounting bracket that meets ISO 5211 dimensional specifications
- four (eight for FKB series valves) 316 stainless steel socket head cap screws for fractional sizes, or A4 stainless steel for metric sizes (A4 is approximately equivalent to AISI 316.)
- Coupling
  - 40G, SK, and FKB series—powdered metal 300 series stainless steel
  - 40, 83, and H83 series and AFS ball valves—316 stainless steel
- A4 stainless steel set screw (316 stainless steel for FKB series valves)
- instructions.

Kits for Swagelok 60 series valves contain:

- 316 stainless steel mounting bracket that meets ISO 5211 dimensional specifications
- four 316 stainless steel socket head cap screws for fractional sizes, or A4 stainless steel for metric sizes (A4 is approximately equivalent to AISI 316.)
- 316 stainless steel coupling
- 316 stainless steel wall mounting bracket
- two 316 stainless steel lock washers
- 302 stainless steel upper and lower grounding springs
- 316 stainless steel lock tab
- two 316 stainless steel hex nuts and bolts
- lubricant and MSDS
- instructions.

Actuated Ball Valve Assemblies

In addition to bracket kits, Swagelok can provide complete actuated ball valve assemblies—including valves, actuators, sensors, and solenoids—with interfaces that meet ISO 5211, NAMUR, and VDI/VDE 3845 standards.

Assemblies are based on:

- maximum valve pressure
- ambient temperature (50 to 100°F [10 to 37°C])
- a design margin of 20 % for calculated operating torque

Contact your authorized Swagelok representative for assemblies built for other system conditions.

See the Swagelok *Actuation Options for Swagelok Ball Valves* catalog, MS-02-343, for more information.

Swagelok-Stocked Components		
Actuators	*Sensors*	*Solenoids*
Swagelok	Pepperl+Fuchs (proximity sensors)	ASCO
	Westlock (limit switches)	

Additional components and manufacturers available on request.

⚠ **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.**

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.

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

Warranty Information

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