

Swagelok® Alternative Fuel Service (AFS) Ball Valves

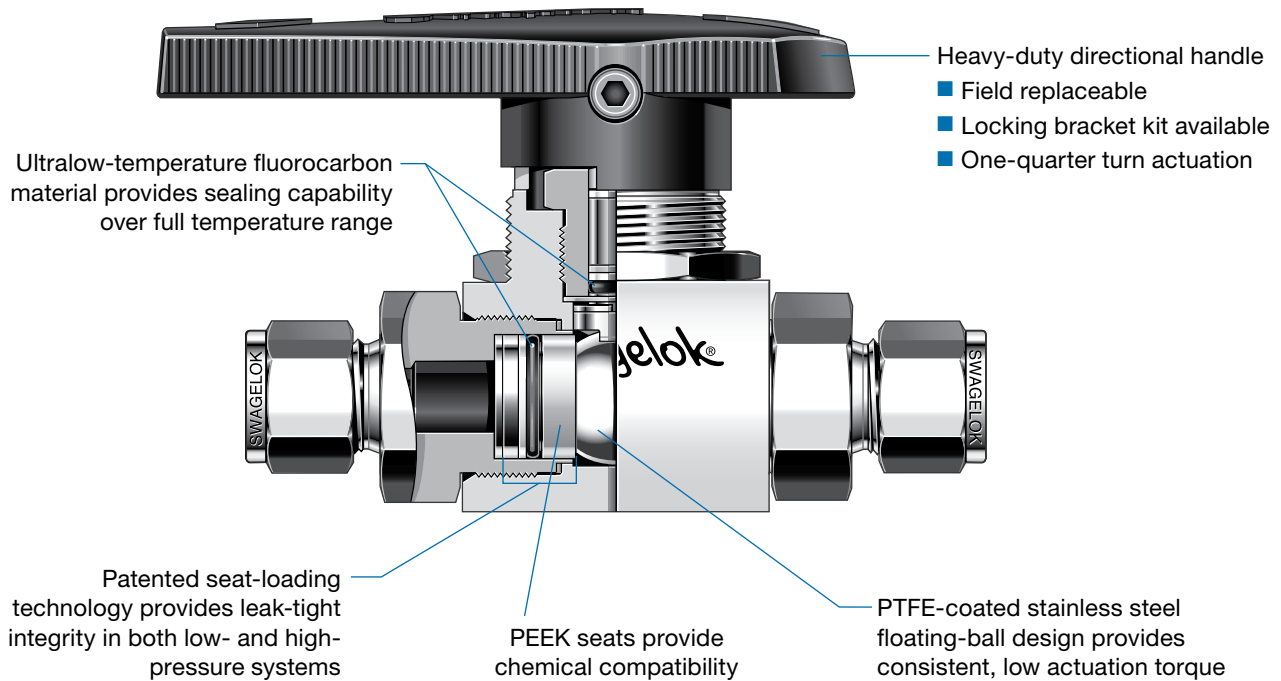
For High-Pressure, High-Flow Applications



Swagelok AFS Ball Valves

- Working pressures up to 6000 psig (413 bar)
- Flow coefficients (C_v) from 4.0 to 13.8
- Fractional and metric Swagelok tube fittings; ISO and NPT pipe end connections available
- 316 stainless steel body and end connections
- Manual and pneumatic actuation

Swagelok Alternative Fuel Service (AFS) Ball Valves



Features

- High flow— C_v from 4.0 to 13.8
- All wetted components are compatible with hydrogen and compressed natural gas (CNG)
- Maximum pressure rating: 6000 psig (413 bar)
- Temperature rating: -40 to 250°F (-40 to 121°C)
- Low operating torque
- No packing adjustment required
- Field repairable with seal kit

Pressure-Temperature Ratings

End Connections	Swagelok Tube Fittings			Female Pipe	
	3/8, 1/2 in., 12 mm	3/4 in., 16 mm	1 in.	3/8, 1/2 in.	3/4 in.
Temperature, °F (°C)	Working Pressure, psig (bar)				
-40 (-40) to 200 (93)	6000 (413)	5800 (400)	4700 (323)	6000 (413)	5532 (381)
250 (121)	6000 (413)	5742 (395)	4653 (320)	6000 (413)	5532 (381)

Ratings are based on ASME Code for Pressure Piping B31.3, Process Piping. To determine working pressure ratings in accordance with ASME B31.1, Power Piping, for 316 stainless steel, multiply pressure by:

- 0.86 for temperatures from 100 to 200°F (37 to 93°C).
- 0.82 for temperatures up to 250°F (121°C).

Important Information About Swagelok AFS Ball Valves

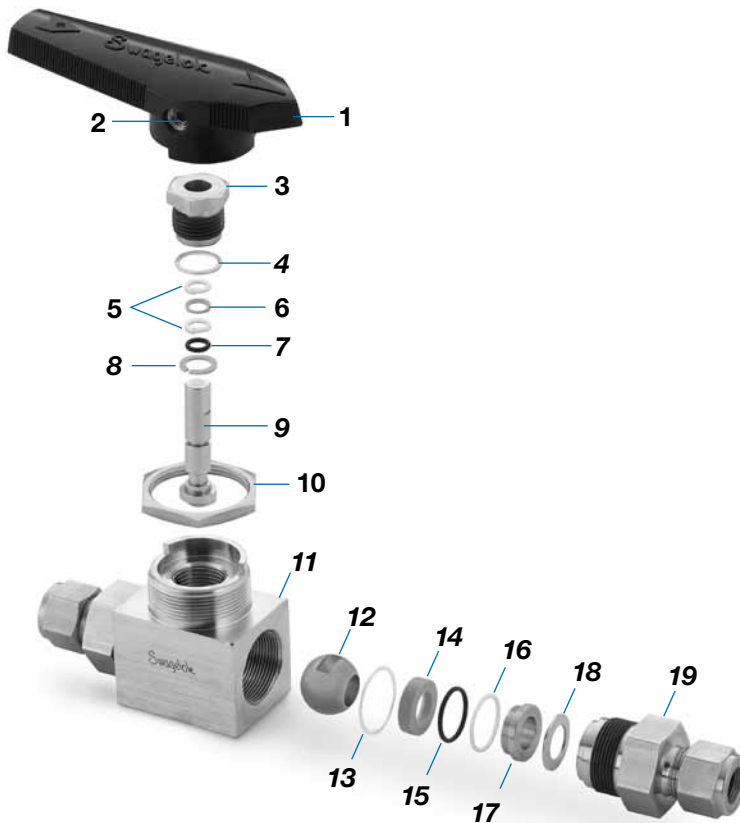
- ⚠ Swagelok AFS ball valves are designed to be used in the fully open or fully closed position.
- ⚠ Valves that have not been cycled for a period of time may have a higher initial actuation torque.

Certifications

- ANSI / AGA NGV 3.1 / CGA 12.3-M95,
Classification: Manual valve
Pressure: 4500 psig (310 bar)
Temperature: -40 to 250°F (-40 to 121°C)
- ANSI / IAS NGV 4.6 / CSA 12.56-M99,
Classification: Class A
Pressure: 4500 psig (310 bar)
Temperature: -40 to 185°F (-40 to 85°C)
- ECE R110 Manual Service Valve Type Approval
Classification: Class 0
Pressure: 3770 psig (260 bar)
Temperature: -40 to 248°F (-40 to 120°C)
- Certifications do not include attachments to the valve, such as actuators or a different handle mechanism.

Materials of Construction

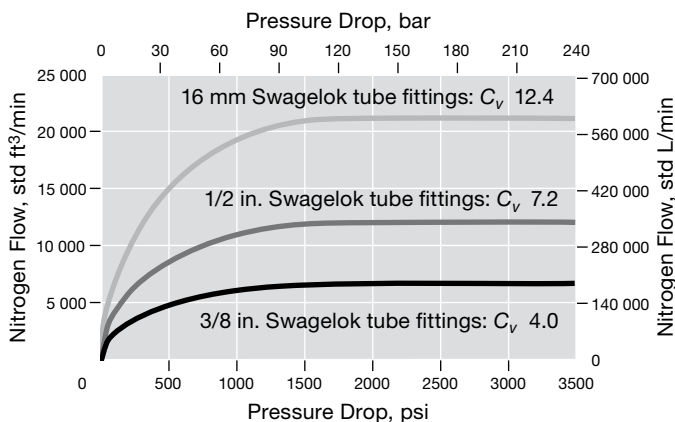
Component	Material Grade/ ASTM Specification
1 Handle	Nylon with brass insert
2 Set screw	S17400 SS
3 Packing bolt	316 SS / A479
4 Packing bolt gasket	Silver-plated 316 SS / A240
5 Guide ring (2)	PTFE / D1710
6 Stem backup ring	PEEK
7 Stem O-ring	Ultralow-temperature fluorocarbon / D2000
8 Thrust washer	PEEK
9 Stem	316 SS / A276
10 Panel nut	316 SS / B783
11 Body	316 SS / A479
12 Ball	PTFE-coated 316 SS / A276
13 End screw gasket (2)	Silver-plated 316 SS / A240
14 Seat (2)	PEEK
15 Seat O-ring (2)	Ultralow-temperature fluorocarbon / D2000
16 Seat backup ring (2)	PTFE / D1710
17 Seat gland (2)	316 SS / A479
18 Seat spring (2)	316 SS / A240
19 End screw (2)	316 SS / A479
Lubricant	PTFE-based



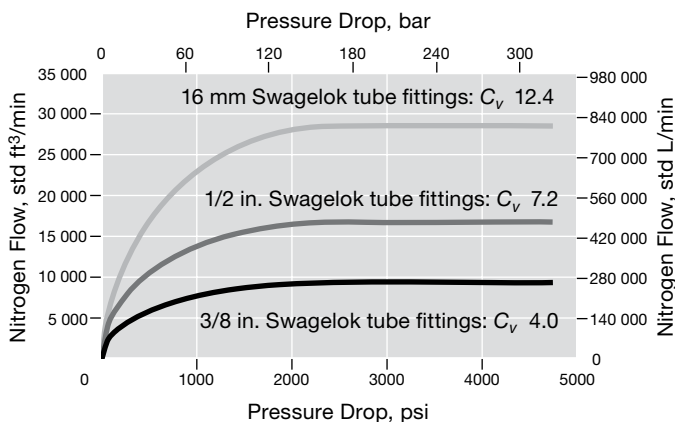
Wetted components listed in *italics*.

Flow Data at 70°F (20°C)

Inlet Pressure 3600 psig (248 bar)



Inlet Pressure 5000 psig (344 bar)



Testing

Every Swagelok AFS ball valve is factory tested in both directions with nitrogen at 1000 psig (69 bar). Seats have a maximum allowable leak rate of 0.1 std cm³/min. Shell testing is performed to a requirement of no detectable leakage with a liquid leak detector.

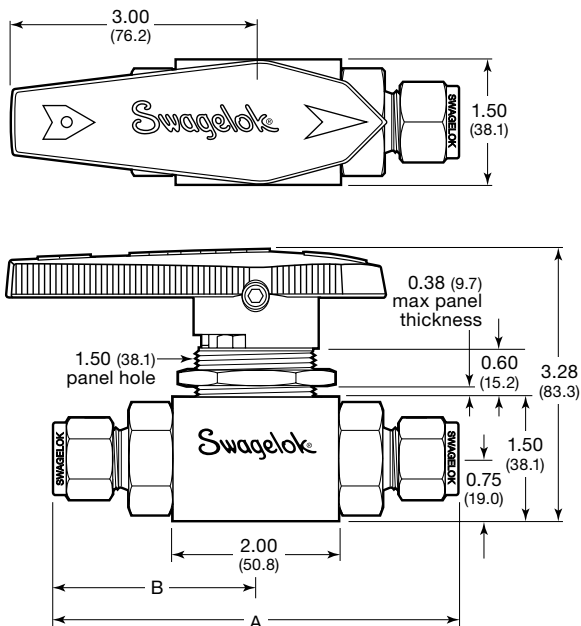
Cleaning and Packaging

All Swagelok AFS ball valves are cleaned and packaged in accordance with Swagelok *Standard Cleaning and Packaging (SC-10)*, MS-06-62.

Ordering Information and Dimensions

Select an ordering number.

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



End Connections ^①		Ordering Number	C _v	Orifice in. (mm)	Dimensions in. (mm)	
Type	Size				A	B
Fractional Swagelok tube fitting	3/8 in.	SS-AFSS6	4.0	0.281 (7.1)	4.57 (116)	2.29 (58.2)
	1/2 in.	SS-AFSS8	7.2	0.406 (10.3)	4.80 (122)	2.40 (61.0)
	3/4 in.	SS-AFSS12	7.1	0.472 (12.0)	4.80 (122)	2.40 (61.0)
	1 in.	SS-AFSS16 ^②	6.5	0.472 (12.0)	5.10 (130)	2.55 (64.8)
Metric Swagelok tube fitting	12 mm	SS-AFSS12MM	5.2	0.406 (10.3)	4.40 (112)	2.20 (55.9)
	16 mm	SS-AFSS16MM	12.4	0.472 (12.0)	4.80 (122)	2.40 (61.0)
Female NPT	3/8 in.	SS-AFSF6	11.0	0.472 (12.0)	4.00 (102)	2.00 (50.8)
	1/2 in.	SS-AFSF8	13.8		4.00 (102)	2.00 (50.8)
	3/4 in.	SS-AFSF12 ^②	7.8	4.12 (105)	2.06 (52.3)	
Female ISO tapered ^③	1/2 in.	SS-AFSF8RT	13.8	0.472 (12.0)	4.00 (102)	2.00 (50.8)

Dimensions shown with Swagelok tube fitting nuts finger-tight.

① Valves can be ordered with two different end connections. Contact your authorized Swagelok sales and service representative.

② Not available with AGA, IAS, and ECE R110 certifications; not recommended for panel mounting; not available with pneumatic actuator.

③ Thread type ISO/BSP (tapered), based on DIN 3852, Swagelok RT fittings. See specifications ISO 7/1, BS EN ISO 10226-1, and JIS B0203.

Options and Accessories

Handle Options

Black nylon directional handles are standard.

- To order a directional handle of another color, add a handle color designator to the valve ordering number.

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

Example: SS-AFSS6-RD

- To order a nylon oval handle, add **-K** to the valve ordering number.



Example: SS-AFSS6-K

- To order a black aluminum directional handle, add **-AHD** to the valve ordering number.

Example: SS-AFSS6-AHD

Handle Kits

The replacement handle kit includes a handle with set screw and instructions.

- Black nylon directional handle kit ordering number: **NY-5K-AFS-BK**

To order a nylon directional handle kit in a color other than black, replace **-BK** in the kit ordering number with a handle color designator.

Example: NY-5K-AFS-RD

- Nylon oval handle kit ordering number: **NY-5K-AFSK-BK**
- Black aluminum directional handle kit ordering number: **A-5K-AFS-BK**

Stem Seal Material Option

Ultralow-temperature fluorocarbon FKM is standard. Ultralow-temperature nitrile (Buna C) is available as an option to enhance valve cycle life. Valves with ultralow-temperature nitrile have a temperature rating of -40 to 200°F (-40 to 93°C) **and are not certified to AGA, IAS, or ECE R110.**

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

Example: SS-AFSS6-BCS

Locking Brackets



- Designed to lock valve in the open and closed position
- Accommodates shackle diameters up to 0.344 in. (8.7 mm)
- To order the locking bracket factory-assembled on a valve, add **-LH** to the valve ordering number.

Example: SS-AFSS6-LH

To order the locking bracket for field assembly, use kit ordering number: **SS-51K-AFS-LH**

Swagelok Pneumatic Actuators



The Swagelok rack and pinion pneumatic actuator is compact, lightweight, easily mountable, and can be operated with standard shop air. The actuators are available in spring-return and double-acting modes. For technical data, including materials of construction, air displacement, and weight, see the Swagelok *Rack and Pinion Pneumatic Actuators for Swagelok Ball Valves* catalog, MS-06-87.

⚠ Actuated assemblies must be properly aligned and supported. Improper alignment or inadequate support of the actuated assembly may result in shorter valve life.

Actuator Service Ratings

Actuator Service	Temperature °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	0 to 400 (-17 to 204)		100 (6.8)
Low temperature ^①	-40 to 200 (-40 to 93)		165 (11.3)

^① Maximum working pressure for valves mounted to low-temperature service actuators is 4500 psig (310 bar).

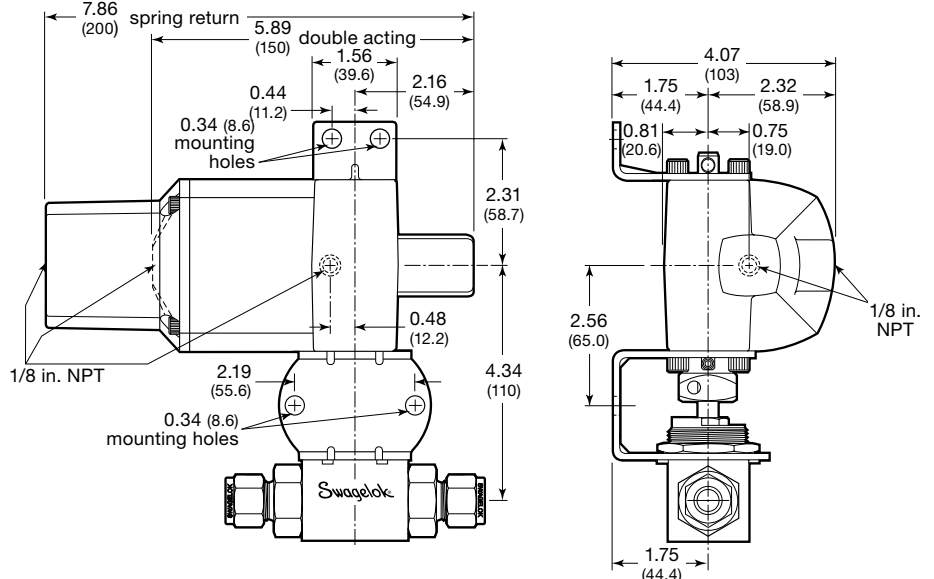
Actuator Pressure at Maximum System Pressure

Required pressures based on valve performance using pressurized air or nitrogen.

Actuator Model	Actuation Modes			
	Spring Return		Double Acting	
	Single	Dual	Single	Dual
	Minimum Actuator Pressure, psig (bar) at 100°F (37°C)			
133	80 (5.6)	—	40 (2.8)	80 (5.6)

Dimensions

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



Ordering Information

Factory-Assembled Actuators

Typical Ordering Number

SS - AFSS6 - 33 D HT

Valve Ordering Number

Actuator Model

Actuation Mode

- D** = Double acting
- C** = Normally closed spring return
- O** = Normally open spring return

Actuator Service

- None** = Standard
- HT** = High temperature
- LT** = Low temperature^①

^① Maximum working pressure for valves mounted to low-temperature service actuators is 4500 psig (310 bar).

Actuators for Field Assembly

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

Mounting bracket kit ordering number:
MS-MB-AFS-133

Actuator Mode	Actuator Service	Kit Ordering Number
Spring return	Standard	MS-133-SR
	High temperature	MS-133-SR-HT
	Low temperature ^①	MS-133-SR-LT
Double acting	Standard	MS-133-DA
	High temperature	MS-133-DA-HT
	Low temperature ^①	MS-133-DA-LT

^① Maximum working pressure for valves mounted to low-temperature service actuators is 4500 psig (310 bar).

For dual-mounted assemblies (two valves mounted to one actuator), add **DM** to the ordering number. Example: SS-AFSS6-33DHTDM

ISO 5211-Compliant Pneumatic Actuators



Swagelok ISO 5211-compliant rack and pinion pneumatic actuators are available in spring-return and double-acting modes.

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

For technical data, including actuator materials of construction and weight, see the *ISO 5211-Compliant Actuators for Swagelok Ball Valves*, MS-02-337.

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.

Actuator Service Ratings

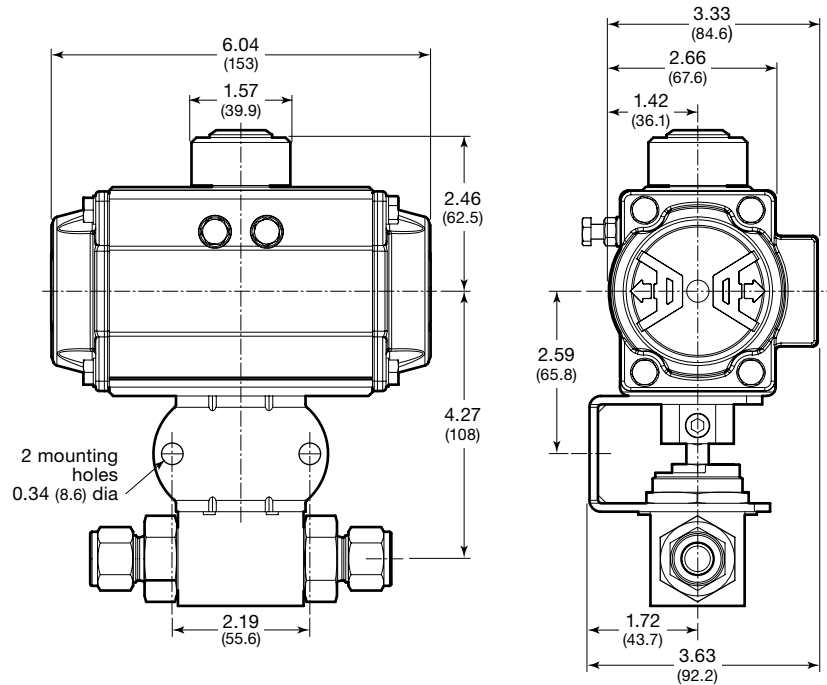
Actuator Service	Temperature Range °F (°C)	Maximum Actuator Pressure, psig (bar)
Standard	-40 to 176 (-40 to 80)	116 (7.9)
High temperature	5 to 302 (-15 to 150)	

Minimum Actuator Pressure

Actuator Model	Actuation Modes	
	Spring Return	Double Acting
	Minimum Actuator Pressure, psig (bar)	
A30	55 (3.8)	40 (2.8)

Dimensions

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



Ordering Information

Factory-Assembled Actuators

Typical Ordering Number

SS - AFSS6 - A30 D HT

Valve Ordering Number

Actuator Model

Actuator Service

None = Standard

HT = High temperature

Actuation Mode

D = Double acting

C4 = Normally closed spring return

O4 = Normally open spring return

Actuators for Field Assembly

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

Mounting bracket kit ordering number:

SS-MB-45-F05-14DIN-M

Actuator Mode	Actuator Service	Kit Ordering Number
Spring return	Standard	MS-A30-4-DIN
	High temperature	MS-A30-4-DIN-HT
Double acting	Standard	MS-A30-DA-DIN
	High temperature	MS-A30-DA-DIN-HT

⚠ Actuated assemblies must be properly aligned and supported. Improper alignment or inadequate support of the actuated assembly may result in shorter valve life.

ISO 5211-Compliant Actuator Mounting Bracket Kits

Mounting Bracket Kits

Swagelok mounting bracket kits 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 (316 SS is similar to A4.)
- 316 stainless steel coupling
- A4 stainless steel set screw
- Instructions.

Ordering Information

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.

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

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 1, below.
2. Select the temperature factor from Table 2, below.
3. Calculate the start and end operating torque:
Base torque × temperature factor

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

1. According to Table 1, the base start torque is 61 in.·lb and the base end torque is 36 in.·lb.
2. According to Table 2, the temperature factor is 1.0.
3. Start torque = 61 in.·lb × 1.0 = 61 in.·lb
End torque = 36 in.·lb × 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 1—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 Operating Torque	System Pressure, psig (bar)			
	0	1000 (68.9)	4500 (310)	6000 (413)
	Base Torque, in.·lb (N·m)			
Start	13 (1.5)	23 (2.6)	61 (6.9)	76 (8.6)
End	12 (1.4)	18 (2.1)	36 (4.1)	41 (4.7)

Table 2—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

Options for Pneumatic Actuators

For Field Assembly or Factory Assembly

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

■ Solenoid Valves

attach to the actuator to create an electropneumatically actuated ball valve assembly. For more information, see the Swagelok *Solenoid Valves for Electropneumatically Actuated Ball Valves* catalog, MS-02-41.

■ Position Indicators

provide visual status of a valve.

■ Limit Switches

indicate actuator position by means of an electrical signal. They meet a variety of NEMA ratings such as NEMA 4 (weatherproof) and NEMA 7 (explosion proof). For more information, see the Swagelok *Limit Switches* catalog, MS-06-39.

Maintenance Kits

Kit components are of the same materials and grades listed in **Materials of Construction**, page 3.

Seat Seal Kits

The seat seal kit contains two seats, seat O-rings, seat backup rings, seat springs, end screw gaskets, lubricant with Material Safety Data Sheet (MSDS), and instructions.

Kit ordering number: **SS-9K-AFS**

Stem and Seat Seal Kits

The stem and seat seal kit contains a stem O-ring, two guide rings, stem backup ring, thrust washer, packing bolt gasket, two seats, seat O-rings, seat backup rings, seat springs, end screw gaskets, lubricant with Material Safety Data Sheet (MSDS), and instructions.

Kit ordering number: **SS-91K-AFS**

To order a kit with a stem O-ring of optional ultralow-temperature nitrile (Buna C) material, use kit ordering number: **SS-91K-AFS-BCS**

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.