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# Bellows-Sealed Valves




## BN Series

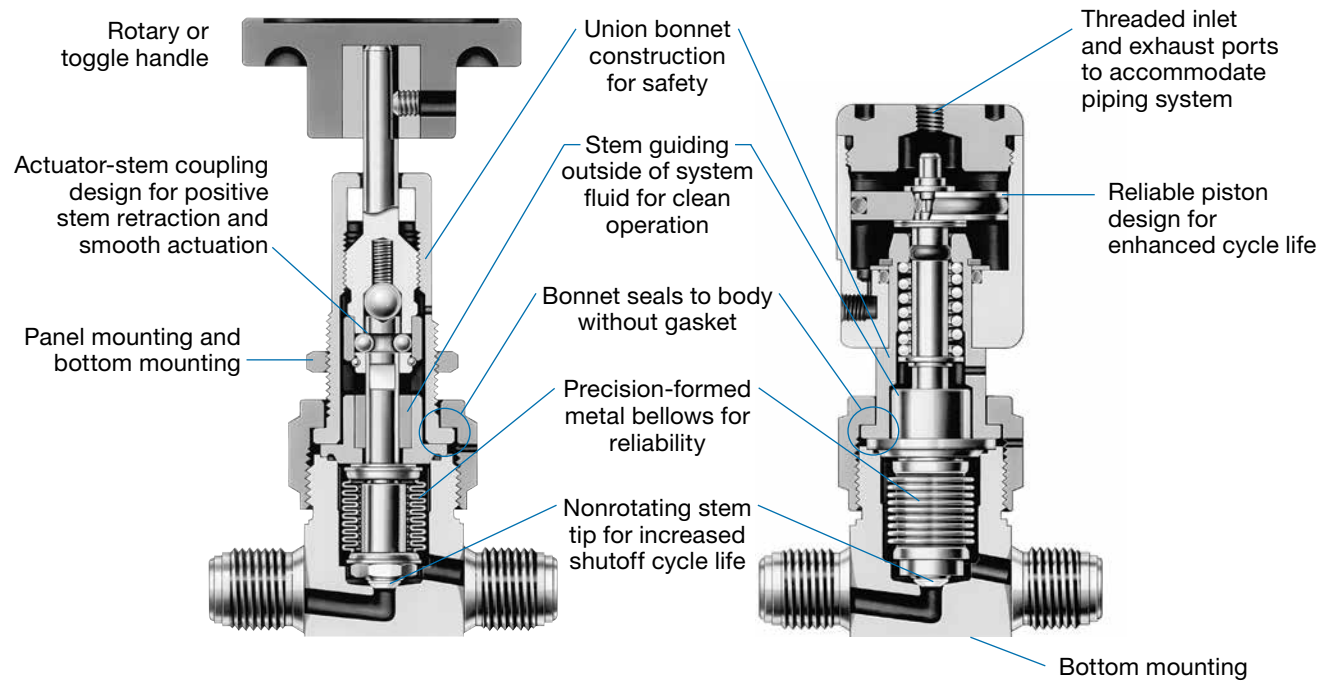
- Packless valves with all-metal seal to atmosphere
- Working pressures up to 500 psig (34.4 bar)
- Temperatures up to 200°F (93°C)
- 1/4 to 1/2 in. and 6 to 12 mm end connections

Swagelok

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## Features




### Valve

- 316L stainless steel construction—316L VAR for bodies with butt weld end connections
- Flow coefficients ($C_v$): 0.30 and 0.70
- Swagelok tube fitting, weld, and VCR® and VCO® fitting end connections
- Butt-weld ended valves are weldable with the Swagelok welding system
- Full pressure rating in either flow direction for system versatility
- Easily purged to maintain clean operation

### Pneumatic Actuator

- Normally closed (C) model requires air to open and spring to close.
- Normally open (O) model requires air to close and spring to open.
- Pneumatic actuator rotates 360° for ease of installation.
- Green cap identifies normally open model.

## Performance Specifications

Refer to *BN Series Bellows Valve Technical Report,* MS-06-12, for additional information on surface finish specifications, particle counting, moisture analysis, hydrocarbon analysis, ionic cleanliness, and lab cycle testing data.

## Materials of Construction

### Valve

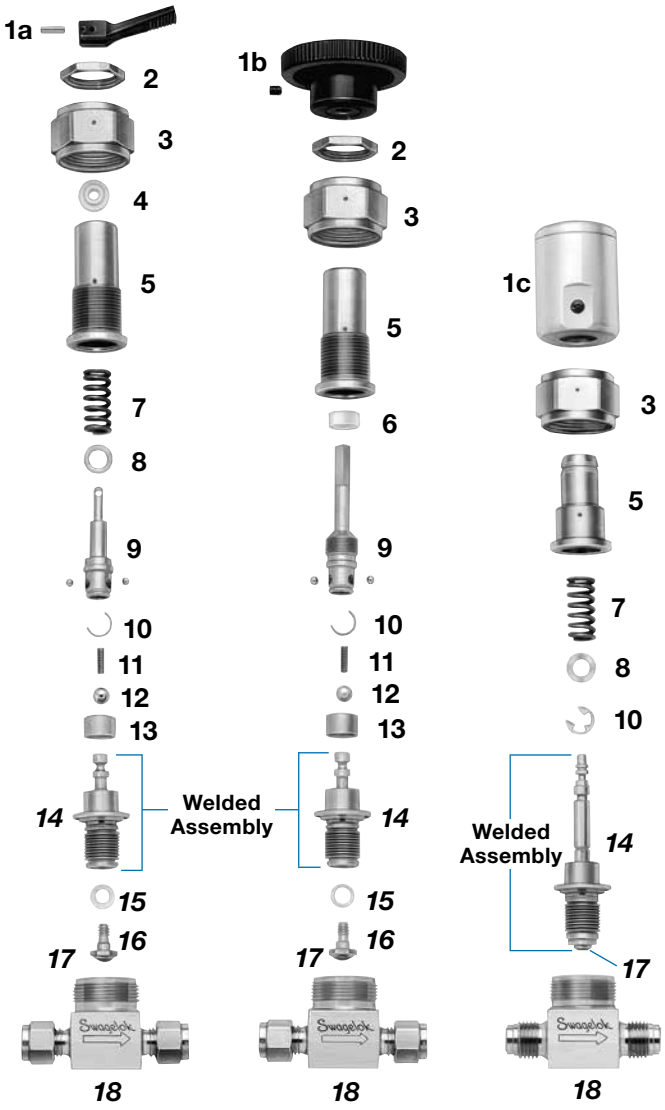
| | Component | Material Grade/ ASTM Specification |
|---|---|---|
| 1a | Toggle handle | Black nylon |
| | Handle pin | 302 SS |
| 1b | Rotary handle | Green phenolic |
| | Set screw | Alloy steel/ANSI 18.3 |
| 1c | Pneumatic actuator | See table below |
| 2 | Panel mount nut | 316 SS/B783 |
| 3 | Bonnet nut | Silver-plated 316 SS/A479 |
| 4 | Stem guide | 6/6 nylon/D4066 |
| 5 | Bonnet① | 316 SS/A479 |
| 6 | Stem wiper | PTFE/AMS 3656 |
| 7 | Spring | S17700 SS/AMS 5678 |
| 8 | Washer | 304 SS/A276 |
| 9 | Actuator② | S17400 SS/A564 |
| | Bearings (3)② | Chrome steel |
| 10 | Retaining ring | 302 SS or 15-7 PH® SS |
| 11 | Spring | 302 SS/A313 |
| 12 | Ball bearing② | 440C SS |
| 13 | Bearing retainer | 316 SS/A479 |
| *14* | *Stem* | *316L SS/A479* |
| | Bushing | Phosphor bronze C54400/B139 |
| | *Weld ring* | *316L SS/A479* |
| | *Bellows* | *300 series SS/A269 or A240* |
| *15* | *Gasket* | *PCTFE* |
| *16* | *Adapter* | *316L SS/A479* |
| *17* | *Stem insert* | *PCTFE* |
| *18* | *Body* | *316L SS/A479*③ |

Wetted components listed in *italics*.

① Molybdenum disulfide-based lubricant.

② Petroleum-based lubricant.

③ Bodies with butt weld ends are 316L VAR SS/SEMI F20 High-Purity, 20 % minimum elongation allowed.




### Pneumatic Actuator

| Component | Material Grade/ ASTM Specification |
|---|---|
| Cap, piston, cylinder | Aluminum |
| O-rings | Fluorocarbon FKM |
| Spring washer | 301 SS |
| Flat washers | 304 SS/A240 |
| Retaining ring | 15-7 PH SS |

## Technical Data

| Valve Series | Orifice in. (mm) | Flow Coefficient ($C_v$)① | Internal Volume① in.³ (cm³) | Valve Ratings: Pressure vacuum to...psig (bar) | Valve Ratings: Temperature °F (°C) | Actuator Ratings: Pressure psig (bar) | Actuator Ratings: Temperature °F (°C) | Actuator Ratings: Air Displacement (Actual Volume) in.³ (cm³) |
|---|---|---|---|---|---|---|---|---|
| BN4 | 0.157 (4.0) | 0.30 | 0.18 (2.9) | Rotary handle—500 (34.4)<br>Toggle handle—100 (6.8)<br>Normally closed—125 (8.6)<br>Normally open—400 (27.5) | –40 to 200 (–40 to 93) | 45 to 120 (3.1 to 8.2) | –10 to 300 (–23 to 148) | 0.045 (0.73) |
| BN8 | 0.313 (8.0) | 0.70 | 0.27 (4.4) | | | | | |

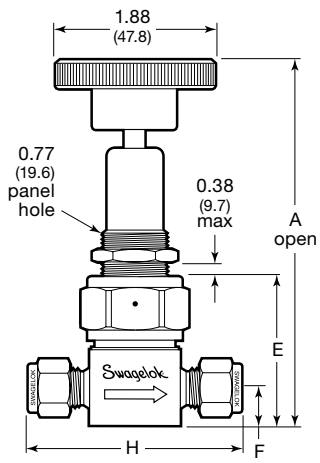
① Determined using valves with male VCR fitting end connections.

## Ordering Information and Dimensions

Select an ordering number from the table at right.

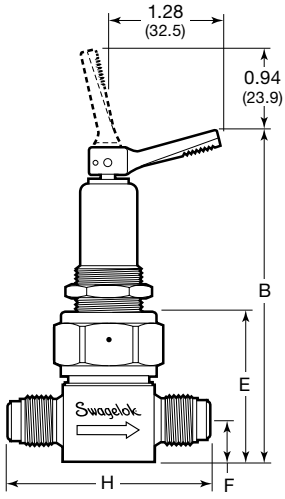
Dimensions, in inches (millimeters), are for reference only and are subject to change. Dimensions shown with Swagelok tube fitting nuts finger-tight.

**Rotary Handle**



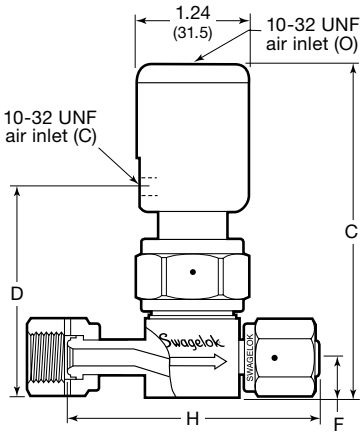

**Swagelok Tube Fittings**

**Toggle Handle**



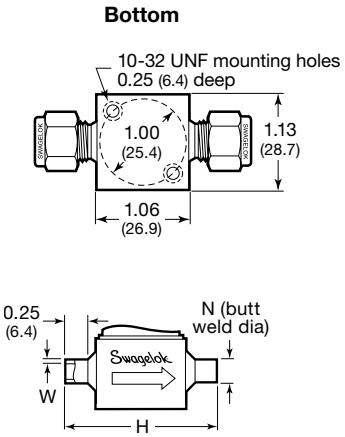

**Male VCR Fittings**

**Pneumatic Actuator**




**Female VCR Fittings**

**Bottom**




**Weld Body**

| End Connections | | Ordering Number | Dimensions, in. (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rotary | Toggle | Pneumatic | | All Models | | | Weld Bodies | |
| Inlet/Outlet | Size | | A | B | C | D | E | F | H | N | W |
| **BN4 Series** | | | | | | | | | | | |
| Swagelok tube fittings | 1/4 in. | SS-BNS4 | 4.33 (110) | 3.85 (97.8) | 3.67 (93.2) | 2.31 (58.7) | 1.72 (43.7) | 0.45 (11.4) | 2.46 (62.5) | — | — |
| | 3/8 in. | SS-BNS6 | | | | | | | 2.58 (65.5) | | |
| | 6 mm | SS-BNS6MM | | | | | | | 2.46 (62.5) | | |
| | 8 mm | SS-BNS8MM | | | | | | | 2.53 (64.3) | | |
| Butt weld ends | 1/4 in. | 6LV-BNBW4 | | | | | | | 1.74 (44.2) | 0.25 (6.4) | 0.035 (0.89) |
| | 3/8 in. | 6LV-BNBW6 | | | | | | | | 0.38 (9.6) | |
| | 6 mm | 6LV-BNBW6MM | | | | | | | | (6) | (1) |
| Tube weld ends | 1/4 in. | SS-BNTW4 | | | | | | | 1.75 (44.4) | 0.38 (9.6) | 0.060 (1.5) |
| Integral male VCR fittings | 1/4 in. | SS-BNVCR4 | | | | | | | 2.30 (58.4) | — | — |
| Integral male VCO fittings | 1/4 in. | SS-BNVCO4 | | | | | | | 2.00 (50.8) | | |
| Female VCR fittings | 1/4 in. | SS-BNV51① | | | | | | | 2.76 (70.1) | | |
| Female/male VCR fitting | 1/4 in. | SS-BNV51-VCR4 | | | | | | | 2.54 (64.5) | | |

① Use ordering number **SS-BNFR4-P** to obtain processing and surface finish in accordance with *Ultrahigh-Purity Process Specification (SC-01)* catalog, MS-06-61.

## Ordering Information and Dimensions

| End Connections | | Ordering Number | Dimensions, in. (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rotary | Toggle | Pneumatic | | All Models | | | Weld Bodies | |
| Inlet/Outlet | Size | | A | B | C | D | E | F | H | N | W |
| **BN8 Series** | | | | | | | | | | | |
| Swagelok tube fittings | 3/8 in. | SS-BN8S6 | 4.42 (112) | 3.93 (99.8) | 3.76 (95.5) | 2.40 (61.0) | 1.81 (46.0) | 0.53 (13.5) | 2.58 (65.5) | — | — |
| | 1/2 in. | SS-BN8S8 | | | | | | | 2.80 (71.1) | | |
| | 10 mm | SS-BN8S10MM | | | | | | | 2.60 (66.0) | | |
| | 12 mm | SS-BN8S12MM | | | | | | | 2.80 (71.1) | | |
| Butt weld ends | 3/8 in. | 6LV-BN8BW6 | | | | | | | 1.74 (44.2) | 0.38 (9.6) | 0.035 (0.89) |
| | 1/2 in. | 6LV-BN8BW8 | | | | | | | | 0.50 (12.7) | 0.049 (1.2) |
| Tube extension ends | 1/2 in. | SS-BN8T8A | | | | | | | 3.40 (86.4) | — | — |
| Integral male VCR fittings | 1/2 in. | SS-BN8VCR8 | 4.60 (117) | 4.11 (104) | 3.93 (99.8) | 2.58 (65.5) | 1.99 (50.5) | 0.66 (16.8) | 2.58 (65.5) | — | — |
| Female VCR fittings | 1/2 in. | SS-BN8FR8 | 4.54 (115) | 4.06 (103) | 3.88 (98.6) | 2.53 (64.3) | 1.93 (49.0) | | 3.15 (80.0) | | |

## Process Specifications

See Swagelok *Ultrahigh-Purity Process Specification (SC-01)* catalog, MS-06-61, Swagelok *Photovoltaic Process Specification (SC-06)* catalog, MS-06-64, and Swagelok *Special Cleaning and Packaging (SC-11)* catalog, MS-06-63, for details on processes, process controls, and process verification.

| Cleaning | Assembly and Packaging | Process Designator | Process Specification | Wetted Surface Roughness ($R_a$) | Testing |
|---|---|---|---|---|---|
| Special cleaning with non–ozone-depleting chemicals | Performed in specially cleaned areas; valves are individually bagged. | None | *Special Cleaning and Packaging (SC-11)* | 20 µin. (0.51 µm) average, machine finished | Inboard helium leak tested to a rate of $4 \times 10^{-9}$ std $cm^3/s$ at the seat, envelope, and all seals |
| High-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system | Performed in specially cleaned areas; valves are individually bagged. | -SC06 | *Photovoltaic Process Specification (SC-06)* | 20 µin. (0.51 µm) average, machine finished | |
| High-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system | Performed in specially cleaned areas; valves are individually bagged. | -P6 | *Photovoltaic Process Specification (SC-06)* | 8 µin. (0.20 µm) average, machine finished and electropolished | |
| Ultrahigh-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system | Performed in ISO Class 4 work areas; valves are double bagged and vacuum sealed in cleanroom bags. | -P | *Ultrahigh-Purity Process Specification (SC-01)* | 8 µin. (0.20 µm) average, machine finished and electropolished | |

### Standard (SC-11)

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

### Photovoltaic (SC-06)

Swagelok BN series valves with VCR or weld end connections are available cleaned and packaged in accordance with Swagelok *Photovoltaic Process Specification (SC-06)* catalog, MS-06-64, to meet the process requirements of solar cell production. To order, add **-SC06** to the ordering number.

Example: SS-BNBW4-**SC06**

SC-06–cleaned BN series valves with VCR or weld end connections are available with controlled wetted surface finishes and electropolishing. To order, add **-P6** to the ordering number.

Example: SS-BNVCR4-**P6**

### Ultrahigh-Purity (SC-01)

Swagelok BN series valves with VCR or weld end connections are available with wetted surface finishing, cleaning, and packaging in accordance with Swagelok *Ultrahigh-Purity Process Specification (SC-01)* catalog, MS-06-61. To order, add **-P** to the ordering number.

Example: SS-BNBW4-**P**

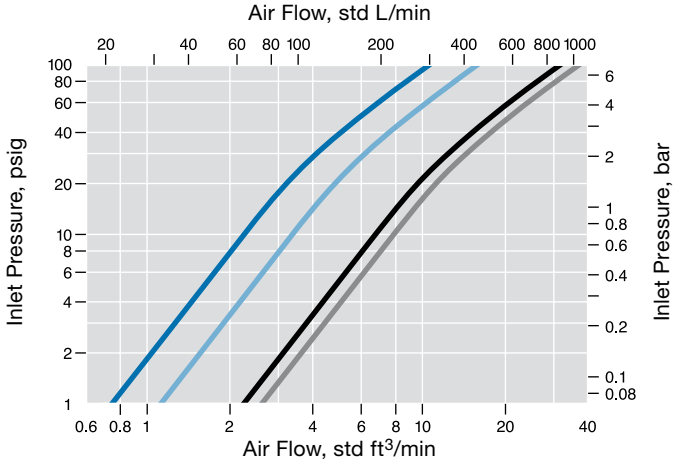
Exception: Use ordering number **SS-BNFR4-P** to obtain SC-01 processing and surface finish for SS-BNV51.

## Flow Data at 70°F (20°C)

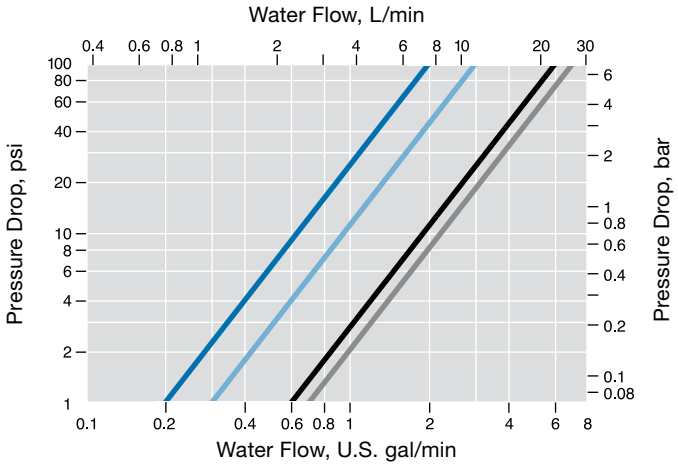
**BN4 Series** — Toggle Handle
— Rotary Handle and Pneumatic Actuator

**BN8 Series** — Toggle Handle
— Rotary Handle and Pneumatic Actuator

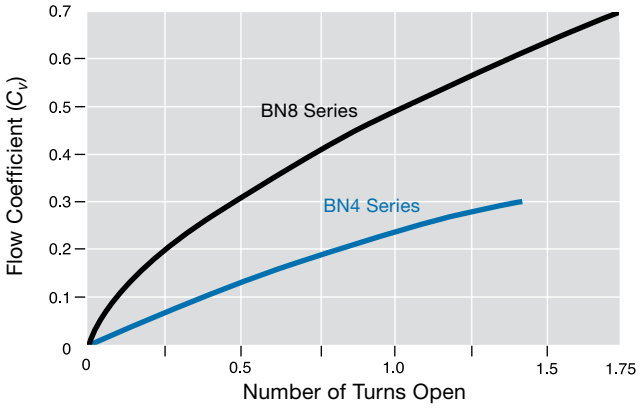
### Air




### Water




### Rotary Model Flow Coefficient at Turns Open




## Pneumatic Actuators

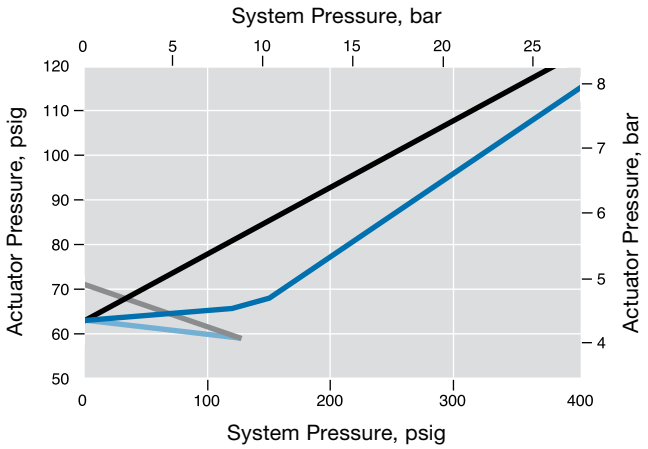
To order a pneumatically actuated valve, add **-C** for normally closed or **-O** for normally open to the valve ordering number.

Examples: SS-BNS4-**C**
SS-BNS4-**O**

### Pneumatic Actuator Performance

#### *Actuator Pressure at System Pressure*

**BN4 Series** — Normally Open — Normally Closed
**BN8 Series** — Normally Open — Normally Closed




### Optional Pneumatic Actuator Inlet Port

Standard inlet port is 10-32 UNF. A 1/8-27 NPT inlet port is available. The normally closed model has a cylinder extension to accommodate the larger port. To order, insert **2** in the valve ordering number.

Examples: SS-BNS4-**2**C
SS-BNS4-**2**O

### Hose Adapter Kits

Allows for use of soft plastic or rubber tubing at the inlet of the pneumatic actuator.

- Adapts pneumatic actuator port from the 10-32 UNF thread to 1/8 in. hose barb.
- Includes a nickel-plated brass hose barb fitting and Buna N gasket.

Kit ordering number: **B-BN4-K62**

# Pneumatic Actuators

## Bonnet Sniffer Tubes




Bonnet sniffer tubes allow monitoring of bellows integrity.

- 3/16 in. (4.7 mm) outside diameter, 1.38 in. (34.9 mm) long.
- 316 stainless steel material with fluorocarbon FKM O-ring.
- Threads to test port of bonnet.
- Pneumatically actuated valves only.

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

Example: 6LV-BNBW4-C**-T**

## Indicator Switches



- Transmits a signal to an electrical device indicating either the open or closed position of a pneumatically actuated valve.
- Features a single-pole, single-throw switch rated at:
  - 1/2 A for 115 V (ac) for normally open switch;
  - 1/4 A for 115 V (ac) for a normally closed switch;
  - –40 to 185°F (–40 to 85°C) temperature.
- Includes a 24 in. (61 cm) wire lead with an inline clip.
- Is available assembled on any normally closed BN series or for field assembly.

### *Factory-Assembled Indicator Switches*

To order a valve with an indicator switch, add **M** for a normally open switch or **M-2** for a normally closed switch to the valve ordering number.

Examples: SS-BNS4-C**M**
SS-BNS4-C**M-2**

### *Indicator Switch Kits*

To order a kit for an existing valve, use ordering number **MS-ISK-BN-CM** for a normally open switch or **MS-ISK-BN-CM-2** for a normally closed switch.

# Options and Accessories

## Polyimide Stem Tips



**Polyimide Stem Tip**
(Manually operated valve stem tip shown)

A PCTFE stem tip is standard. Polyimide stem tips are available in BN4 series valves, for temperatures up to 400°F (204°C) or where PCTFE is not compatible with the system fluid.

To order, insert **V** in the valve ordering number.

Example: SS-BN**V**S4-C

Replacement polyimide stem tips are available for manually operated valves. Replacement stem tips for pneumatically actuated valves are part of the bellows/stem/stem tip subassembly. Refer to *Bellows Valve Maintenance Kits* catalog, MS-02-66, for additional information.

## Toggle Handles

Ordering numbers specify rotary handle valves. To order a toggle-operated valve, insert **T** in the valve ordering number.

Example: SS-BN**T**S4

Black handles are standard for toggle-operated BN series valves. To order a colored toggle handle, add a handle color designator to the valve ordering number.

Example: SS-BNTS4**-BL**

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

# Maintenance Kits

Stem tip/adapter kits are available for manual BN series valves; bellows/stem/stem tip/adapter kits are available for manual and pneumatic BN series valves. Refer to *Bellows-Sealed Valve Maintenance Kits* catalog, MS-02-66.

# Oxygen Service Hazards

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

# Multiport and Elbow Valves and Monoblock Manifolds

BN series valves are available in multiport and elbow configurations and monoblock manifolds; refer to *Bellows- and Diaphragm-Sealed Multiport and Elbow Valves and Monoblock Manifolds* catalog, MS-02-442.

⚠ **To increase service life, ensure proper valve performance, and prevent leakage, apply only as much torque as is required to achieve positive shutoff.**

## Introduction

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We are pleased to provide this global edition of the book-bound *Swagelok Product Catalog,* which compiles more than 100 separate product catalogs, technical bulletins, and reference documents into one convenient, easy-to-use volume. Each product catalog is up to date at the time of printing, with its revision number shown on the last page of the individual catalog. Subsequent revisions will supersede the printed version and will be posted on the Swagelok website and in the Swagelok electronic Desktop Technical Reference (eDTR) tool.

For more information, visit your Swagelok website or contact your authorized Swagelok sales and service representative.

## Warranty Information

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

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

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

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PH 15-7 Mo, 17-7 PH—TM AK Steel Corp
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