



Valve Pressure-Temperature Ratings

Scope

This technical bulletin describes the design basis and standards that apply to Swagelok® valves and lists pressure-temperature ratings for Swagelok valves, filters, flow sensors, and sample cylinders.

Design Basis

Process industry piping systems are designed in accordance with one of the ASME Codes for Pressure Piping, B31, which define design and construction requirements for several kinds of piping systems. B31.1, Power Piping, and B31.3, Chemical and Petroleum Refinery Piping, relate to systems that use Swagelok products. (See “Standardization and National Codes,” page 8, for more about B31 and other standards.)

The B31 codes incorporate by reference various standards for valves and other components, many of which include pressure-temperature ratings. Such components may be used within those ratings, but not in excess of the general limits of the code.

Components for which the standards do not have ratings or for which there are no listed standards may be used within the manufacturer’s recommended pressure-temperature ratings. Ratings for such specially designed components shall be determined by accepted engineering practices consistent with the design criteria of the code. Pressure-temperature ratings for Swagelok products are established on that basis.

Process Valve Standard

The Swagelok 75 series process ball valve conforms to ANSI/ASME B16.34. Incorporated by reference in the B31 codes, B16.34 covers process valves with pipe flange, butt weld, socket weld, and pipe thread ends. It defines design requirements, acceptable materials, pressure-temperature rating classes, dimensions, wall thicknesses,

and quality requirements.

In the interest of standardization, B16.34 and its companion standard for flanges, ANSI/ASME B16.5, have established eight pressure classes and many material groups for process system valves and flanges, respectively. To facilitate product standardization, B16.34 also includes standard minimum wall thickness dimensions for each pressure class.

B16.34 and B16.5 list the pressure-temperature ratings for each class and material group. Process systems usually are designed to fit within one of those classes and material groups.

Materials. Pressure-containing parts are manufactured from materials listed in B16.34, the B31 codes, or ASME Boiler and Pressure Vessel (BPV) Code Section VIII. Materials are purchased in accordance with ASTM specifications.

Design. The design requirements of B16.34, including minimum wall thicknesses, are used for 75 series process ball valves.

Tests. Designs and ratings are qualified by strength and performance tests.

Instrument Valve Standard

The primary standard for instrument valves is MSS SP-99, developed by manufacturers to meet the special needs of these products, which are not covered in B16.34. It addresses material selection, design, ratings, testing, and end connections. Unlike B16.34, SP-99 does not include standard pressure classes, minimum wall thicknesses, or other dimensional requirements. Swagelok valves follow this standard where it is applicable.

To aid the user in selecting valves for use with systems designed to a pressure class, we have designed some valves with ratings that fit one of the B16.34 classes or an intermediate class. For those products, the class is listed in the rating table. Intermediate classes are determined by linear interpolation

Swagelok product ratings are established by practices consistent with the design criteria of the [ASME B31](#) codes.

The ratings in the tables are the highest the valve design can carry; *end connections* may reduce the final product rating.

from standard classes.

Materials. Materials for pressure-containing parts are selected from those listed in SP-99, B16.34, the B31 codes, or BPV Code Section VIII. Materials are purchased in accordance with ASTM specifications.

Design. Cold working pressure (CWP) ratings, wall thicknesses of pressure-containing parts, and dimensions of other stressed elements are developed using the practices of SP-99 and appropriate engineering methods. Allowable stresses given in the B31 piping codes and BPV Code Section II are used, and design criteria are consistent with these codes.

Tests. Designs and ratings are qualified by strength and performance tests.

Other Ratings

Some Swagelok valves do not follow any of the standard B16.34 rating tables because of other considerations, such as the properties of metallic or nonmetallic components, design or performance requirements, or combination of these (Fig. 1).

Metals Properties. Valve body or flange material ratings given in B16.34 and B16.5 are derived from reductions in material strength and allowable stress at elevated temperature. The effects of elevated temperature on other pressure-containing metal parts—such as gaskets, stems, diaphragms, or bellows—may dictate lower ratings.

Nonmetals Properties. Nonmetals are used widely in valves as seals, such as O-rings, plastic packings, gaskets, stem tip inserts, and seat inserts. The effects of elevated temperature on nonmetal parts may dictate lower pressure-temperature ratings.

The ratings listed in the tables and the product catalogs are based on tests of the seal design used in each product. The tests are conducted under controlled laboratory conditions with an inert liquid or gas. They do not take into account the effects of the system fluid, which may degrade the material and further limit its usable temperature range.

End Connections. Most valve products are available with many different types and sizes of end connections, such as Swagelok tube fittings, VCO[®] and VCR[®] fittings, weld connections, pipe threads, flanges, and

others. Several different sizes of fitting—each with its own pressure rating—often can be provided on one size and design of valve. The pressure ratings given in the valve rating tables are the highest the valve design can carry. If the rating of a specific end connection is lower, that lower rating becomes the pressure rating of the valve.

Pneumatic Actuators. The tables list the pressure ratings of manual valves, many of which can be equipped with pneumatic actuators. Typically, there are several choices of actuator size and type—double acting, spring return, normally closed, or normally open. Some actuators can actuate the valve at the full rating listed for the manual valve; others cannot.

Individual product catalogs provide detailed information on available actuator choices, required actuator pressures, and valve pressure ratings that result from various valve and actuator combinations.

Performance Tests. Valve performance is not addressed by industry standards because performance requirements vary widely among industries and must be considered separately for each application. The ratings in the tables include the effects of pressure and temperature—steady and fluctuating—on performance characteristics. If product performance is degraded by such effects, this is reflected in the ratings.

Valve Selection

Component Ratings

The tables that follow contain pressure-temperature ratings for Swagelok products. Table listings begin with the cold working pressure (CWP) rating for the valve, which applies over ambient temperature ranges, usually –20 to 100°F (–28 to 37°C). They continue with pressure ratings at temperature increments of 50 or 100 degrees and stop at the maximum temperature rating. Ratings at intermediate temperatures can be calculated by linear interpolation.

Note: The ratings in the tables apply to the standard materials and constructions of the listed products. Any change to the materials, lubricants, construction, or accessories may change the ratings.

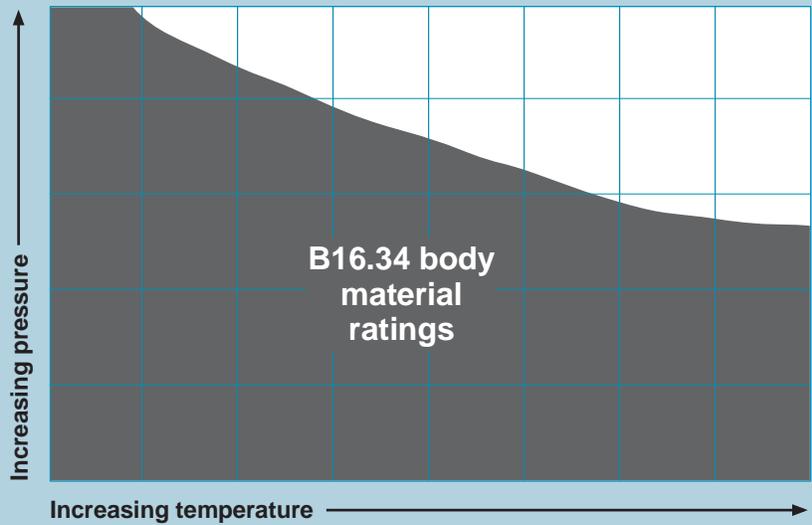
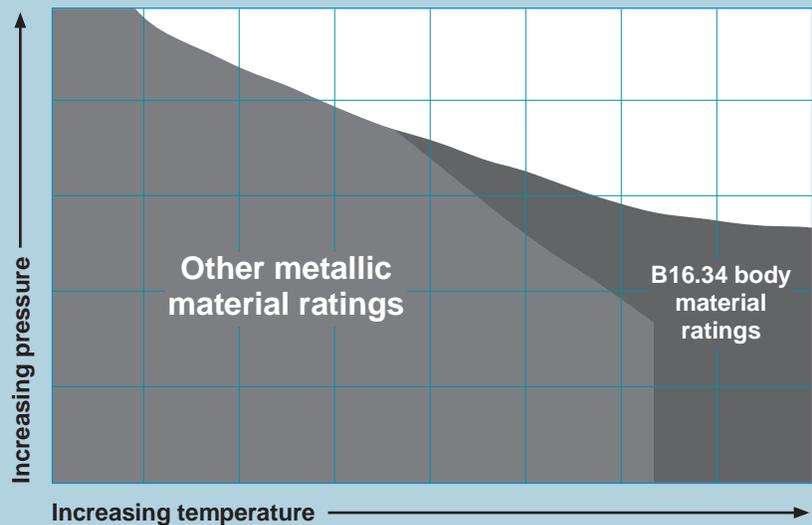
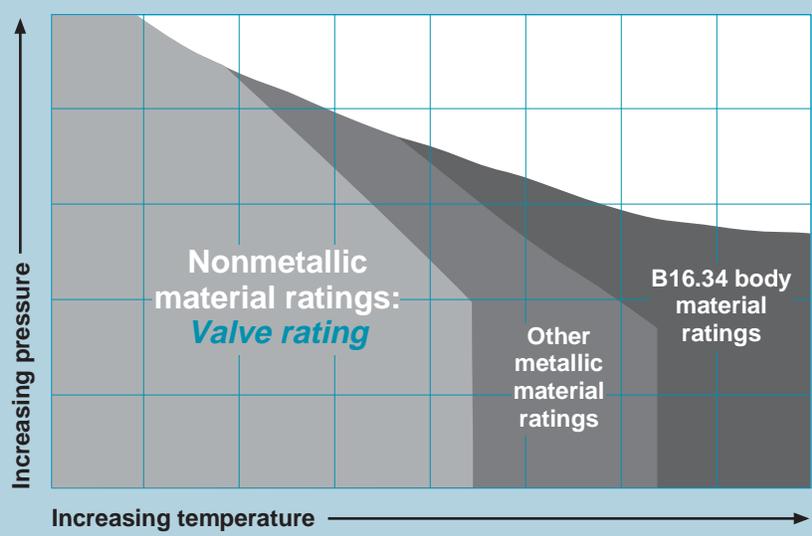


Fig. 1. Valve ratings are based on the B16.34 rating for the body material . . .

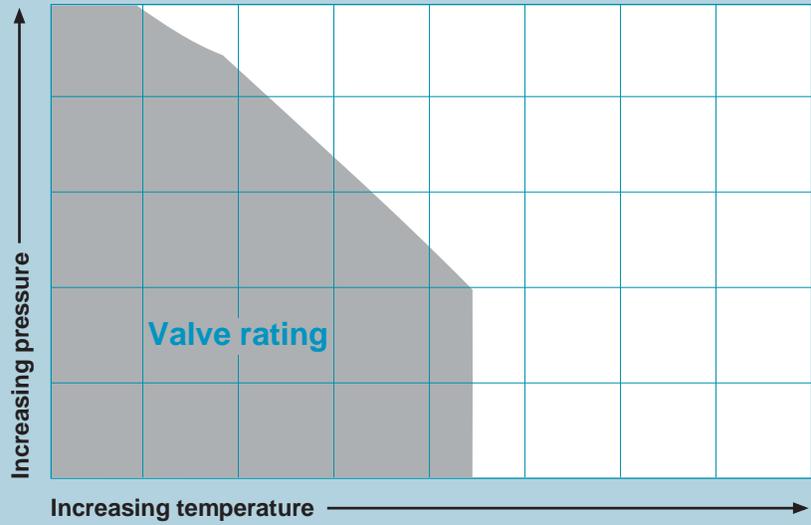


. . . and often are reduced because of temperature effects on other metallic parts . . .

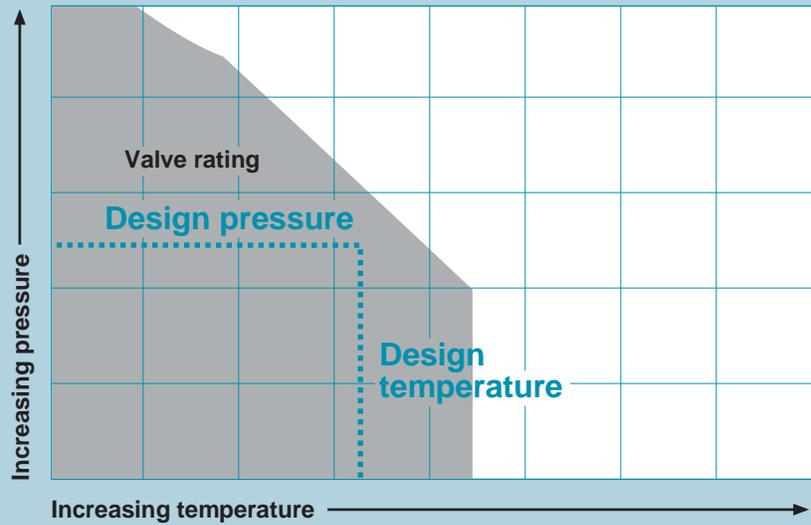


. . . and on nonmetallic parts such as seats or packings—resulting in a valve rating generally equivalent to the rating of the nonmetal.

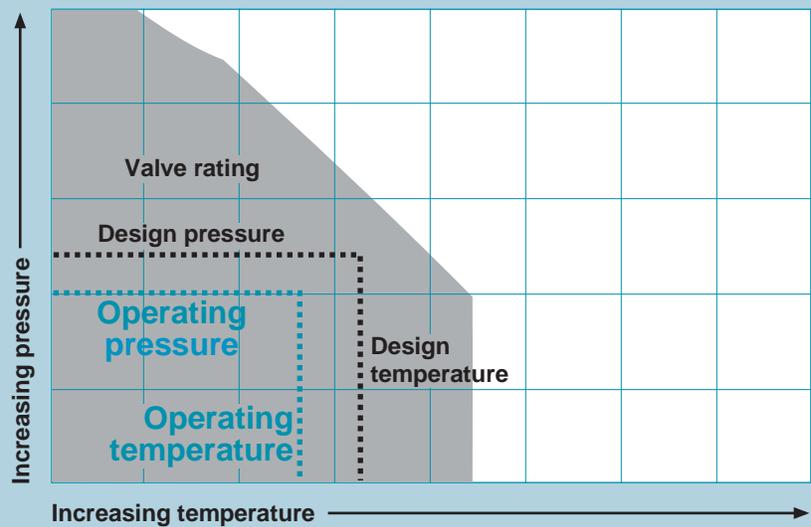
Fig. 2. The pressure-temperature rating of the valve must be equal to or greater than . . .



. . . the system design pressure and temperature . . .



. . . but some systems operate most of the time at pressures and temperatures well below design conditions.



System Requirements

The B31 piping codes require that component pressure-temperature ratings be equal to or greater than system design pressure and temperature to ensure system integrity and safety. However, systems may operate much of the time at less severe conditions of pressure and temperature, well below design conditions (Fig. 2).

Pressure and temperature requirements for both system design conditions and normal operating conditions should be considered in selecting the most suitable component.

Other Effects

In addition to component ratings and system requirements, effects outside the system should also be considered when selecting a component.

Low Temperature. Applications for service below the CWP temperature range require special consideration. Generally, material strengths do not increase with lower temperatures, nor do pressure ratings. Some materials lose impact strength and should not be used at low temperatures.

Many nonmetals become hard and lose their ability to seal. Most lubricants harden, which can make a valve inoperable. Humidity in the air can form ice in and around a cold valve, making it inoperable, and may even damage it.

Environment. When selecting a valve, the system designer and user must also consider the effect of the environment on valve function, materials compatibility, ratings, installation, operation, and maintenance. Following are examples of such considerations:

- Valve ratings, both here and in industrial standards, assume the temperature to be that of the valve body, heated by the system fluid. Temperature from an external source may have a different effect, such as overheating external parts that normally are not as hot as the system.

- Pneumatic actuators, handles, solenoids, and other accessories often have lower temperature ratings than the valves they operate, again because the heat source is assumed to be the system fluid. If a system is located in a heated or cooled chamber, the rating is determined by the

temperature limits of the valve and all accessories.

- A corrosive environment may damage external parts not exposed to the system fluid, reducing the valve's pressure-containing capability. Airborne solvents may damage seals and cause leaks or remove lubricants from external parts and make the valve inoperable.

- Outdoor environments can affect a valve even within its temperature rating. For example, water may enter a valve or actuator and prevent operation, particularly if it freezes. Dirt, mildew from humidity, mud from insects, and the like can plug valve or actuator openings, also preventing operation. Outdoor exposure to ozone or ultraviolet light can degrade both plastics and elastomers.

Terminology

The terminology used here is taken from B31, SP-99, B16.34, B16.5, and related standards. These terms are used commonly in the process industries. *Note: These terms can be defined in many ways and may have quite different meanings in other industries.*

Material Strength, Stress, and Safety Factors

These terms are closely related and should be used with care. Material strengths are defined by tensile and yield strengths, which are determined by a destructive test on a sample of the material. ASTM material specifications establish minimum values of tensile and yield strengths, which are the basis for the allowable stresses given in BPV Code Section II and used in product design (Fig. 3, next page). Material strength and stress are expressed as force per unit area, given in units of pounds per square inch (psi), newtons per square millimeter (N/mm²), or megapascals (MPa).

Tensile Strength. The stress required to break a material when a test specimen is pulled in tension. Also called *ultimate strength*.

Yield Strength. The stress at which the test specimen has elongated and will no longer return to its original length. At this point, the material has undergone permanent deformation, or yielded. Yield strength is lower than tensile strength.

When selecting a valve, requirements of the *system* and effects *outside the system* should all be considered.

Depending on the industry and the code, *safety factor* is defined in many different ways.

Allowable Stress. The value of stress used in calculations to determine the dimensions and pressure ratings of piping systems, valves, and other components. The value of allowable stress is always less than the minimum yield and tensile strengths of the material and normally is specified in a code.

Safety Factor. The ratio between the allowable stress and the minimum tensile or yield strength of the material. The allowable stresses given in BPV Section II and the B31 piping codes include safety factors. In B31.1, the safety factor is based on one fourth of the minimum tensile strength or two thirds of the minimum yield strength, whichever is less; in B31.3, it is based on one third of the minimum tensile strength or two thirds of the minimum yield strength, whichever is less. As a result, there are small differences in allowable stress between these design codes. *Note: Depending on the industry and the code, this*

term is defined in many different ways and should be used with care.

Testing

The terms *shell test*, *proof test*, and *hydrostatic test* often are used synonymously. Each refers to a test to check for leaks and verify that there are no structural weaknesses in the valve or system. The component shell test and the system hydrostatic test are done at 1.5 times the CWP or the system design pressure, respectively—which raises the stress level to a value close to the minimum yield strength of the material. Therefore, these tests would show significant distortion if any pressure-containing parts were overstressed.

Shell Test (Proof Test). A test of *valves*, defined by B16.34, whose purpose is to check for distortion and external leakage, but not seat leakage. B16.34 requires valves to be tested with water or other suitable fluid at 1.5 times the 100°F *valve* rating for 15 seconds or longer. The valve is partially open. This test is done by the valve manufacturer when required by the order. It is not normally required for instrument valves. A similar test is defined by API 598. The shell test defined by B16.34 or API 598 is available for most Swagelok valves on special order. Bellows- and diaphragm-sealed valves are tested at the valve rating, not at 1.5 times the rating. This modified shell test also is available on special order.

Hydrostatic Test. A pressure test of a finished system, required by piping codes such as ANSI B31.1. It is done at 1.5 times the system design pressure, with water, for at least 10 minutes, and its purpose also is to check for distortion or leakage. System valves are partially open during the test. Other codes may require a hydrostatic test at some pressure other than 1.5 times the system design pressure. Valves should not be tested above 1.5 times the valve pressure rating.

Note 1: B31.1 permits leakage at valve packings during the hydrostatic test of a system. If the valve packing is tightened to prevent leakage during any test above normal operating pressure, it should be readjusted afterwards.

Proper readjustment for normal service

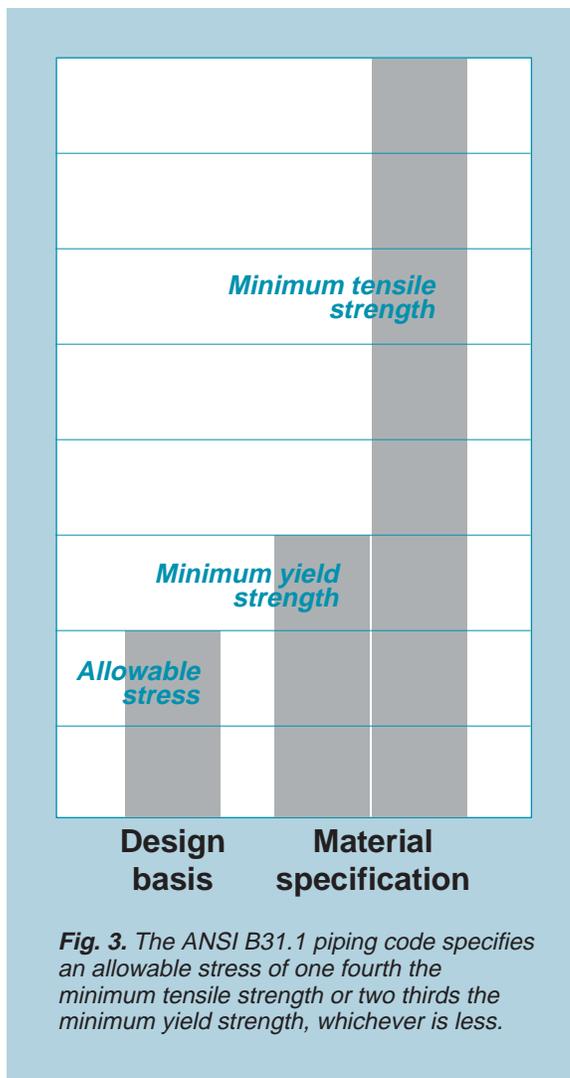


Fig. 3. The ANSI B31.1 piping code specifies an allowable stress of one fourth the minimum tensile strength or two thirds the minimum yield strength, whichever is less.

conditions will prevent excessive packing wear.

Note 2: Bellows and diaphragm valves should not be tested at pressures above their maximum allowable working pressure. A bellows or diaphragm is a thin, flexible member, easily damaged by overpressure or other abnormal stresses.

Burst Pressure. The pressure at which the valve may rupture or fail by gross leakage. A burst test is a destructive test, usually used to verify the pressure rating of instrument valves.

Valve Ratings

Cold Working Pressure (CWP) Rating. The *maximum allowable working pressure* of a valve in ambient conditions, usually from –20 to 100°F (–28 to 37°C).

Pressure Rating. The *maximum allowable working pressure* of the valve at the temperature given in the table.

Rating Temperature. The temperature of the *pressure-containing shell* of the valve. It is assumed to be the same as the system fluid temperature.

Temperature Ratings. The maximum and minimum temperatures at which the valve can be used.

System Ratings

Design Pressure. The *maximum sustained operating pressure (MSOP)* within the piping system including the effects of static pressure.

Design Temperature. The metal temperature at the maximum sustained conditions expected. It is assumed to be the same as the fluid temperature, unless shown to be different.

Overpressure or Overtemperature. Pressures or temperatures higher than design conditions. Codes usually allow systems and components to operate at higher pressures or temperatures for short periods, such as during relief valve operation. This is usually restricted to 10 to 20 % overpressure for 1 to 10 % of a 24-hour period. See the system code for specific limits.

Normal Operating Pressure and Temperature. Conditions under which a system operates most of the time. Some systems normally operate at close to design pressure and temperature, whereas others normally operate at much lower pressures or temperatures.

Conclusions

Numerous codes, standards, and specifications have been written to guide the design and construction of piping systems and components.

Swagelok valves are designed and manufactured to provide safe, effective, dependable operation within their rated pressure and temperature ranges. These pressure-temperature ratings are based on design requirements of nationally accepted codes and adjusted by material characteristics, design factors, and performance requirements.

Valve ratings—whether from standard rating classes or other ratings—are confirmed by engineering analyses and tests conducted under controlled laboratory conditions. Neither analyses nor tests can simulate any specific application or duplicate the endless variety of actual operating conditions. Therefore, ratings should be considered minimum and maximum limits that may have to be reduced in specific applications—as guides to select candidate products for an application.

Safe Valve Selection

Standards also serve to promote safety by aiding the system designer in selecting components. When selecting a valve, total system design must be considered to ensure safe, trouble-free performance. Valve function, materials compatibility, adequate ratings, and proper installation, operation, and maintenance are the responsibilities of the system designer and user.

Valve ratings are minimum and maximum limits that may need to be *reduced* for actual applications.

Standardization and National Codes

National standards are a cornerstone of industry in modern industrialized nations, and international standards are increasingly important in today's global economy. Standards serve both users and manufacturers: in piping systems, for example, standards ensure that valves, fittings, pumps, vessels, instruments, and other components from many different manufacturers and countries fit together and function properly.

Standards define goods that many can use, *reducing* the need for *customized* products.

Standards also enable manufacturers to produce goods that many customers can use, greatly reducing the need for customized products. This requires a common design basis and, in some instances, standardized dimensions. A clearly rationalized design basis, well defined terminology, and standard ratings and dimensions assist the user in proper component selection.

Standards Organizations

Of the thousands of commonly used standards in existence, only a few apply to instrument valves. These are published by ANSI, API, ASME, ASTM, DOT, ISA, and MSS. Each of these organizations publishes standards relevant to the industries it represents. They are voluntary standards, written by committees of members with expertise in the specific subject matter. Use of the standards by industry is also voluntary unless they are mandated by the regulations of a government jurisdiction.

ANSI (American National Standards Institute), 11 W. 42nd St., New York, NY 10036. ANSI is the coordinator of U.S. voluntary standards. Standards written by other organizations are submitted to ANSI for issuance as national standards when ANSI determines that they represent a balanced consensus of affected interests.

API (American Petroleum Institute), 1220 L St. N.W., Washington, DC 20005. API is a trade association representing the U.S. petroleum industry. One function of API is to develop technical standards for the petroleum industry, several of which apply to valves and piping systems.

ASME (American Society of Mechanical Engineers), 345 E. 47th St., New York, NY 10017. ASME is a technical society whose members write standards and codes for the mechanical industries. ASME pressure vessel and piping codes

and component standards affect the design and manufacture of fluid system components.

ASTM (American Society for Testing and Materials), 100 Barr Harbor Dr., West Conshohocken, PA 19428. ASTM is a technical society that develops standards for materials, test methods, and products. These standards are used for most of the materials and test methods used in our products.

DOT (Department of Transportation) is the U.S. Government agency that regulates hazardous material transportation. This includes the transportation of compressed gases and vapors, and the cylinders and other equipment used for such transportation.

ISA (Instrument Society of America), P.O. Box 12277, Research Triangle Park, NC 27709. ISA develops standards for the design and construction of instrument systems, including valve requirements.

MSS (Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.), 127 Park St. N.E., Vienna, VA 22180. MSS is an association of valve and fitting manufacturers who develop standards for their products. MSS standards often are adopted as ASME or ANSI standards if they become widely used and meet consensus requirements.

ASME has developed two codes for pressure vessels and piping systems that have become the standard of the industrial process industries: the Boiler and Pressure Vessel Code and the Code for Pressure Piping. Their primary role has been to foster safety in the design and construction of pressurized systems, but they also promote standardization in design, materials, equipment, and construction.

ANSI/ASME Boiler and Pressure Vessel Code (BPV) consists of 11 sections including:

- Power Boilers (Section I)
- Material Specifications (Section II)
- Nuclear Power Plant Components (Section III)
- Pressure Vessels (Section VIII)
- Welding and Brazing Qualifications (Section IX)

Although this code does not apply to valves, it is used so widely that it often is employed as a design guide. The material specifications in Section II are similar to ASTM specifications; many are identical. The welding qualifications of Section IX often are used for welds on valves.

ANSI/ASME B31, Code for Pressure Piping, is divided into several sections covering specific piping systems. The two that are most relevant to Swagelok products are:

- B31.1, Power Piping
- B31.3, Chemical Plant and Petroleum Refinery Piping

These codes define the design requirements, acceptable materials, allowable stresses, component standards, dimensional standards, test requirements, construction, and related topics for systems and components.

ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings, is a component standard that defines materials, dimensions, and pressure-temperature ratings for standard flanges used in piping systems. It does not include valves. It is incorporated by reference in B31.

ANSI/ASME B16.34, Valves—Flanged, Threaded, and Welding Ends, covers process valves with pipe flange, butt weld, socket weld, and pipe thread ends. It is a component standard that defines pressure-temperature ratings, materials, design requirements, and wall thicknesses for process valves; it does not apply to instrument valves. It is incorporated by reference in B31.

Both B16.34 and B16.5 have established standard pressure classes, material groups, and pressure-temperature ratings based on them. The rating tables in the two standards are identical.

ANSI/ASME B1.20.1, Pipe Threads, defines the dimensions for standard NPT pipe threads.

ANSI B16.11, Steel Fittings, Socket Weld and Threaded, defines the standard dimensions for pipe fittings.

ANSI/ASME B16.25, Buttwelding Ends, defines the dimensions and tolerances for butt weld preparations used on pipe, valve ends, flanges, and other components.

MSS SP-99, Instrument Valves, applies to steel and alloy valves of 1-inch nominal pipe size and smaller and pressure ratings of 10 000 psi and lower at 100°F.

API 598, Valve Inspection and Testing, defines the inspection and test requirements for valves purchased under API valve standards; it may be applied to other valves. It is widely recognized in the petroleum and chemical industries.

49CFR, Code of Federal Regulations, Title 49, sets forth the specifications for pressure-containing cylinders used in transportation of hazardous materials. These specifications cover pressure ratings, design, dimensions, materials, fabrication, marking, testing, and inspection. In addition, DOT regulations cover the application and use of cylinders, including filling limits, overpressure protection, and in-service inspection.

B31.1 and B31.3 are the two ANSI/ASME codes that are most relevant to Swagelok products.

Pressure-Temperature Tables

Series. Subgroup based on catalog designators.

Title. Type of product—general series and descriptive name.

Class. Standard B16.34 pressure class, an intermediate class, or “N/A.”

Material group. Standard B16.34 material group or “N/A.”

Material name. Common name or grade of body material.

Temperature, °F. Temperature of the pressure-containing shell of the component.

Working pressure, psig. Maximum allowable working pressure for which the component is rated at the temperature listed.

Notes. Additional information on materials, configurations, special limitations.

| Table 0 — AB Series Valves Class: 1750. | |
|--|-------------------------------|
| Series | XY, XZ |
| Material group | 2.3 |
| Material name | 316LSS |
| Temperature, °F | Working pressure, psig |
| – 40 to 100 | 3500 |
| 150 | 3220 |
| 200 | 2950 |
| 300 | 2640 |
| 400 | 2400 |

Body ratings based on optional PEEK stem tip. Ratings limited to 150°F with standard PCTFE stem tip. See catalog for pneumatic actuator ratings.

Using the Tables

The pressure-temperature ratings for each group of products are given in the tables. See “Design Basis,” pages 1 and 2, for detailed descriptions of the factors on which the ratings are based.

Title. The title gives the general series designation of the product, along with a descriptive name.

Class. If a product rating fits one of the eight standard pressure classes defined in B16.34 or an intermediate class, the class is listed. If not, the class is omitted or given as “N/A.”

Series. A major valve group shown in the table title may be divided into subgroups, based on catalog designators, for the pressure ratings.

Material Group. If the valve fits into a pressure class and the body material is included in one of the material groups classified in B16.34, that number is given. Otherwise, “N/A” is entered.

Material Name. The common name or grade of the valve body material is given.

Temperature, °F. The temperature of the pressure-containing shell of the component is listed; see *rating temperature* in B16.34.

Working Pressure, psig. Working pressure is the *maximum allowable working pressure*, expressed as gage pressure, for which the

component is rated at the temperature listed.

Notes. Footnotes provide additional information, such as:

- the materials or configuration on which the published ratings are based.
- special limitations on pressure or temperature imposed by polymers or elastomers used in packings, seats, stem tips, gaskets, or O-rings.

Metric Conversions. To obtain approximate pressure ratings in bar, multiply the psi value by the factor 0.0689:

$$\text{bar} = \text{psi} \times 0.0689$$

To obtain approximate pressure ratings in kPa, multiply the psi value by the factor 6.895:

$$\text{kPa} = \text{psi} \times 6.895$$

To obtain approximate pressure ratings in kg/cm², multiply the psi value by the factor 0.0703:

$$\text{kg/cm}^2 = \text{psi} \times 0.0703$$

To obtain temperatures in degrees Celsius (°C), subtract 32 from the degrees Fahrenheit (°F) temperature value and divide the result by 1.8:

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32)/1.8$$

Contents

| Table | Page | Table | Page |
|---|---------------------------------------|---|-----------------------------------|
| <i>Instrument Ball and Plug Valves</i> | | <i>Metering Valves</i> | |
| 1 | 40 Series12 | 35 | 21 and 22 Series24 |
| 2 | 33 Series12 | 36 | 31 Series24 |
| 3 | 83 and 83X Series12 | 37 | S, M, and L Series.....24 |
| 4 | H83P and H83XP Series.....12 | 43 | BM Series26 |
| 5 | Plug Valves13 | <i>Check Valves and Excess Flow Valves</i> | |
| 6 | PFA 43 Series13 | 25 | 50 Series20 |
| <i>Process Ball Valves</i> | | 38 | CA, CP, and CPA Series25 |
| 7 | 60T, 60XT, W63T, and W65T Series..14 | 38 | 2C, 4C, 6C, and 8C Series25 |
| 8 | 60E, 60XE, W63E, and W65E Series 14 | 39 | 12C and 16C Series25 |
| 9 | 60M Series15 | 40 | CH Series25 |
| 10 | 60P and 60XP Series15 | 40 | XS Series.....25 |
| 11 | 60C, 60XC, W63C, and W65C Series15 | 41 | CW Series25 |
| 12 | Q60 Series.....16 | <i>Proportional Relief Valves</i> | |
| 13 | Chlorine Series16 | 42 | R Series.....26 |
| 14 | Sour Gas Series16 | <i>Bellows Valves</i> | |
| 15 | Thermal Series17 | 43 | B and BM Series26 |
| 16 | Fire Series17 | 44 | BK Series.....26 |
| 17 | Steam Series17 | 45 | H and HK Series27 |
| 18 | 75 Series18 | 46 | BN Series27 |
| 19 | D60T Series.....18 | 47 | HB Series27 |
| <i>Needle Valves</i> | | 48 | U Series.....27 |
| 20 | Toggle Valves19 | <i>Diaphragm Valves</i> | |
| 21 | JB Series19 | 49 | DL and DS Series28 |
| 21 | JN Series19 | 50 | LD and ELD Series28 |
| 22 | D Series.....19 | 51 | DA Series.....29 |
| 23 | O, 1, and 18 Series20 | 52 | RD Series29 |
| 24 | 20 and 26 Series20 | 53 | DF Series.....29 |
| 25 | N Series.....20 | 54 | HD Series29 |
| 26 | Rising Plug Valves.....21 | <i>Filters and Flow Sensors</i> | |
| 27 | HN Series21 | 55 | TF, FW, and F Series30 |
| 28 | PFA 4RP Series.....21 | 56 | FC Series.....30 |
| 29 | 410, 445, 645, and 945 Series21 | 57 | FV4 Series.....30 |
| <i>Purge, Bleed, and Pinch Valves</i> | | <i>Sample Cylinders</i> | |
| 30 | P Series22 | 58 | Sample Cylinders31 |
| 31 | BV Series.....22 | | |
| 32 | Pinch Valves22 | | |
| <i>Manifolds and Gauge/Root Valves</i> | | | |
| 33 | M2, M3, and M5 Series23 | | |
| 33 | 6P Series23 | | |
| 34 | T2 Series23 | | |

Instrument Ball and Plug Valves

See "Ball/Plug Valves" subsection in your Swagelok Product Binder

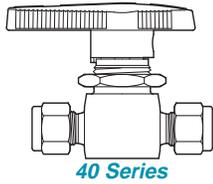


Table 1 — 40 Series Ball Valves
Class: N/A

| | | |
|---|--|--|
| Material | 316SS, brass, alloy 400 | |
| Temperature, °F | 50 to 150 (40 Series) – 65 to 150 (40T, 40E Series) | |
| Series | Working pressure, psig | |
| 43 | 3000 | |
| 41, 41-A, 41X, 42, 42-A, 42X, 43-A, 43X, 43Y, 43Z, 44, 45 | 2500 | |
| 44-A, 44X, 45-A, 45X, 45Y, 45Z | 1500 | |
| 41V, 42V, 43V, 43Y6, 43Z6, 44V, 45V, 41XV, 42XV, 43XV, 44XV, 45XV | 500 | |

Ratings based on TFE, PFA, or UHMW-PE seat materials.

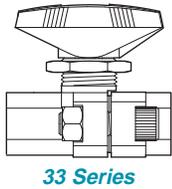


Table 2 — 33 Series Multipurpose Ball Valves
Class: N/A

| | | |
|------------------------|-------------------------------|---------------------|
| Seat material | TFE PFA | Polyethylene |
| Material | CF8M, WCB | |
| Temperature, °F | Working pressure, psig | |
| – 20 to 100 | 6000 | 6000 |
| 150 | 4000 | 3000 |
| 200 | 2000 | 1625 |
| 250 | 1700 | 250 |
| 300 | 1400 | — |
| 350 | 1100 | — |
| 400 | 800 | — |
| 450 | 500 | — |

Ratings for valves with TFE PFA seats based on: TFE PFA backup rings, bushing, and seats; and fluorocarbon FKM O-rings.
Ratings for valves with polyethylene seats based on: UHMW-PE backup rings, LLD-PE bushing and seats, and ethylene propylene O-rings.
Stainless steel L33 series assemblies: temperature limits of – 65 to 250 °F at pressures listed.

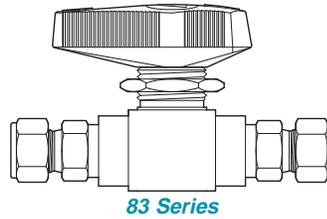


Table 3 — 83 and 83X Series
Multiservice Trunnion Ball Valves
Class: N/A

| | | | |
|------------------------|-------------------------------|------------|-------------|
| Material | 316SS | | |
| Seat material | PCTFE | TFE | PEEK |
| Temperature, °F | Working pressure, psig | | |
| – 20 to 100 | 6000 | 1500 | 6000 |
| 150 | 3000 | 1125 | 5500 |
| 200 | 2000 | 750 | 5000 |
| 250 | 1000 | 625 | 4100 |
| 300 | — | 500 | 3200 |
| 350 | — | 375 | 2300 |
| 400 | — | 250 | 1400 |
| 450 | — | 125 | 500 |

Ratings based on: seats listed above, fluorocarbon FKM O-rings and Quad-Rings®, and TFE backup rings.
L83 and L83X series assemblies: temperature limits of – 65 to 200 °F at pressures listed.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

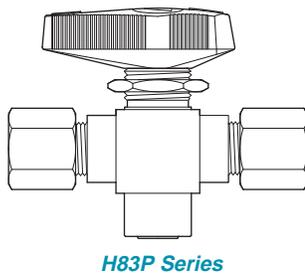


Table 4 — H83P and H83XP Series Multiservice Trunnion Ball Valves
Class: N/A

| | | | | | | |
|------------------------|-------------------------------|-------------|--------------|-----------|-----------|--------------|
| Material | 316SS | | | | | |
| End connection | F2, F4, S6MM, S4 | S8MM | S12MM | S6 | S8 | S10MM |
| Temperature, °F | Working pressure, psig | | | | | |
| – 20 to 100 | 10 000 | 7500 | 6600 | 6500 | 6700 | 6000 |
| 150 | 7 500 | 7500 | 6600 | 6500 | 6700 | 6000 |
| 200 | 5 000 | 5000 | 5000 | 5000 | 5000 | 5000 |
| 250 | 4 100 | 4100 | 4100 | 4100 | 4100 | 4100 |
| 300 | 3 200 | 3200 | 3200 | 3200 | 3200 | 3200 |
| 350 | 2 300 | 2300 | 2300 | 2300 | 2300 | 2300 |
| 400 | 1 400 | 1400 | 1400 | 1400 | 1400 | 1400 |
| 450 | 500 | 500 | 500 | 500 | 500 | 500 |

Ratings based on: PEEK seats, fluorocarbon FKM O-rings and Quad-Rings, and TFE backup rings.
LH83P and LH83XP series assemblies: temperature limits of – 65 to 200 °F at pressures listed.

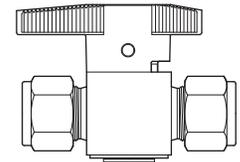
Instrument Ball and Plug Valves

See "Ball/Plug Valves" subsection in your Swagelok Product Binder

Table 5 — Plug Valves
Class: N/A

| Series | P4T, P6T | P4T | P6T | P4T, P6T | | P4T | | | |
|-----------------|------------------------|-------|------|----------|----------|-------------|-----------|-------------|----------|
| Material | 316SS | Brass | | Steel | Alloy 20 | Alloy R-405 | Alloy 600 | Alloy C-276 | Titanium |
| Temperature, °F | Working pressure, psig | | | | | | | | |
| - 10 to 100 | 3000 | 3000 | 2000 | 3000 | 2500 | 2500 | 3000 | 3000 | 1785 |
| 150 | 3000 | 2500 | 2000 | 3000 | 2410 | 2350 | 2900 | 3000 | 1710 |
| 200 | 3000 | 2000 | 2000 | 3000 | 2320 | 2200 | 2800 | 3000 | 1555 |
| 250 | 2000 | 1500 | 1500 | 2000 | 2000 | 2000 | 2000 | 2000 | 1420 |
| 300 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 350 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 400 | 1000 | 400 | 400 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |

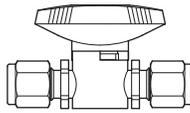
Ratings based on TFE-coated fluorocarbon FKM O-rings. Ratings limited to 0 to 200°F and 1000 psig max with Kalrez® O-rings.



P6T Series

Table 6 — PFA 43 Series Plug Valves
Class: N/A

| Material | PFA 440-HP |
|-----------------|------------------------|
| Temperature, °F | Working pressure, psig |
| - 20 to 70 | 60 |
| 100 | 50 |
| 150 | 30 |
| 200 | 10 |



PFA 43 Series

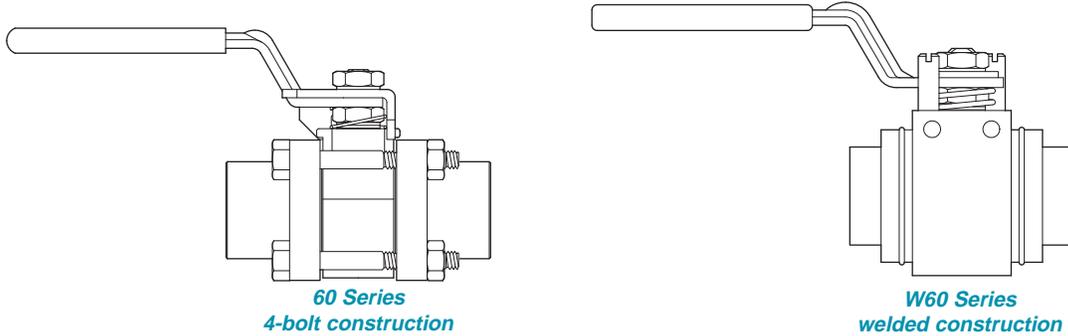
Ratings based on liquid service; gas service temperature range is 50 to 150°F at pressures listed.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

Process Ball Valves

See your Swagelok Process Ball Valves Binder

Pressure-temperature tables for 60 series ball valves list ratings for standard combinations of body materials, bolting, and seats and other nonmetallic components. This provides a single rating for the complete valve. **Changing any of the valve components will change the rating.**



**Table 7 — 60T, 60XT, W63T, and W65T Series Manual Ball Valves with Reinforced TFE Seats
Class: N/A**

| Series | 62, 63, 65, W63, W65 | 62X, 63X, 65X | 67, 68 | 67X, 68X | 62 | 63, 65 | 62, 63, 65, 67, 68 |
|-----------------|-------------------------|---------------|--------|----------|-------|--------|-----------------------|
| Material | 316SS, 316LSS, CF3M | | | | Brass | | WCB |
| Temperature, °F | Working pressure, psig | | | | | | |
| -20 to 100 | 2200 | 1000 | 1500 | 500 | 2000 | 1500 | 2200 |
| 150 | 1850 | 1000 | 1210 | 500 | 1680 | 1260 | 1850 |
| 200 | 1500 | 1000 | 930 | 500 | 1360 | 1030 | 1500 |
| 250 | 1150 | 1000 | 880 | 500 | 1050 | 800 | 1150 |
| 300 | 800 | 800 | 780 | 500 | 730 | 560 | 800 |
| 350 | 560 | 560 | 560 | 500 | 410 | 330 | 560 |
| 400 | 330 | 330 | 330 | 330 | 100 | 100 | 330 |
| 450 | 100 | 100 | 100 | 100 | — | — | 100 |

Ratings based on: reinforced TFE seats and packings and alloy X750 stem bearings on 316SS, 316LSS, CF3M, and WCB; PEEK stem bearings on brass; and fluorocarbon FKM O-rings.
Fastener materials: 304SS on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade 8 on brass and WCB assemblies.
Stainless steel or brass L60T series and stainless steel L60XT series assemblies: temperature limits of -65 to 250°F at pressures listed.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

**Table 8 — 60E, 60XE, W63E, and W65E Series Manual Ball Valves with Polyethylene Seats
Class: N/A**

| Series | 62 | 63, 65 W63, W65 | 62X, 63X, 65X | 67, 68 | 67X, 68X | 62 | 63, 65 | 62 | 63, 65 | 67, 68 |
|-----------------|------------------------|--------------------|------------------|--------|----------|-------|--------|------|--------|--------|
| Material | 316SS, 316LSS, CF3M | | | | | Brass | | WCB | | |
| Temperature, °F | Working pressure, psig | | | | | | | | | |
| -20 to 100 | 3000 | 2500 | 1000 | 1500 | 500 | 2000 | 1500 | 3000 | 2500 | 2200 |
| 150 | 2080 | 2030 | 1000 | 1210 | 500 | 1680 | 1260 | 2080 | 2080 | 1960 |
| 200 | 1160 | 1160 | 1000 | 930 | 500 | 1160 | 1030 | 1160 | 1160 | 1160 |
| 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |

Ratings based on: UHMW-PE seats and packings, PEEK stem bearings, and ethylene propylene O-rings.
Fastener materials: 304SS on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade 8 on brass and WCB assemblies.
Stainless steel or brass L60E series and stainless steel L60XE series assemblies: temperature limits of -65 to 250°F at pressures listed.

See your Swagelok Process Ball Valves Binder

**Table 9 — 60M Series Manual Ball Valves with Alloy X750 Seats
Class: N/A**

| Series | 63M, 65M | 67M, 68M | 63M, 65M | 67M, 68M |
|-----------------|------------------------|----------|----------|----------|
| Material | 316SS, 316LSS, CF3M | | WCB | |
| Temperature, °F | Working pressure, psig | | | |
| -20 to 200 | 1000 | 500 | 1000 | 500 |
| 250 | 1000 | 500 | 1000 | 500 |
| 300 | 1000 | 500 | 1000 | 500 |
| 350 | 1000 | 500 | 1000 | 500 |
| 400 | 970 | 500 | 1000 | 500 |
| 450 | 800 | 500 | 800 | 500 |

Ratings based on: alloy X750 seats and stem bearings, reinforced TFE packings, and fluorocarbon FKM Quad-Rings.
Fastener materials: 304SS/303SS on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade 8 on WCB assemblies.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

**Table 10 — 60P and 60XP Series Manual Ball Valves with PEEK Seats
Class: N/A**

| Series | 62 | 63, 65 | 62X | 63X, 65X | 67, 68 | 67X, 68X | 62 | 63, 65 | 62 | 63, 65 | 67, 68 |
|-----------------|------------------------|--------|------|----------|--------|----------|-------|--------|------|--------|--------|
| Material | 316SS, 316LSS, CF3M | | | | | | Brass | | WCB | | |
| Temperature, °F | Working pressure, psig | | | | | | | | | | |
| -20 to 100 | 3000 | 2500 | 1000 | 1000 | 1500 | 500 | 2000 | 1500 | 3000 | 2500 | 2200 |
| 150 | 2420 | 2030 | 1000 | 1000 | 1210 | 500 | 1680 | 1260 | 2250 | 2250 | 1960 |
| 200 | 1870 | 1560 | 1000 | 1000 | 930 | 500 | 1360 | 1030 | 2010 | 2010 | 1760 |
| 250 | 1770 | 1480 | 1000 | 1000 | 880 | 500 | 1050 | 800 | 1770 | 1770 | 1570 |
| 300 | 1600 | 1310 | 1000 | 1000 | 780 | 500 | 730 | 560 | 1520 | 1520 | 1370 |
| 350 | 1430 | 1140 | 1000 | 1000 | 690 | 500 | 410 | 330 | 1280 | 1280 | 1180 |
| 400 | 1260 | 970 | 1000 | 970 | 590 | 500 | 100 | 100 | 1040 | 1040 | 990 |
| 450 | 1100 | 800 | 1000 | 800 | 500 | 500 | — | — | 800 | 800 | 800 |

Ratings based on: PEEK seats, packings, and stem bearings; and fluorocarbon FKM Quad-Rings.
Fastener materials: 304SS on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade 8 on brass and WCB assemblies.

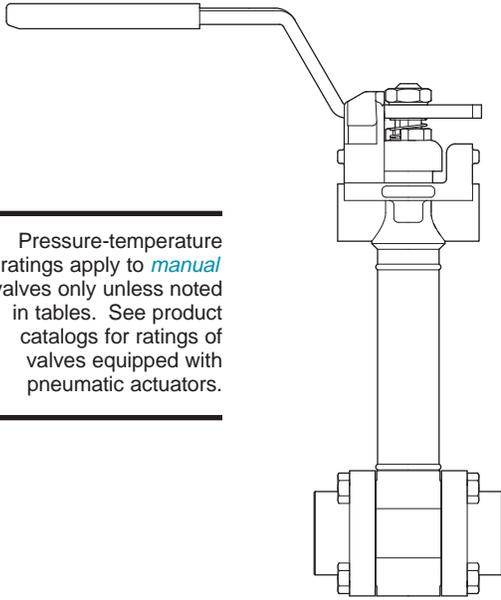
**Table 11 — 60C, 60XC, W63C, and W65C Series Manual Ball Valves with Carbon/Glass TFE Seats
Class: N/A**

| Series | 62 | 63, 65 W63, W65 | 62X, 63X, 65X | 67, 68 | 67X, 68X | 62 | 63, 65 | 62, 63, 65 | 67, 68 |
|-----------------|------------------------|--------------------|------------------|--------|----------|-------|--------|---------------|--------|
| Material | 316SS, 316LSS, CF3M | | | | | Brass | | WCB | |
| Temperature, °F | Working pressure, psig | | | | | | | | |
| -20 to 100 | 2500 | 2500 | 1000 | 1500 | 500 | 2000 | 1500 | 2500 | 2200 |
| 150 | 2430 | 2030 | 1000 | 1210 | 500 | 1680 | 1260 | 2250 | 1960 |
| 200 | 1870 | 1560 | 1000 | 930 | 500 | 1360 | 1030 | 2000 | 1760 |
| 250 | 1620 | 1480 | 1000 | 880 | 500 | 1050 | 800 | 1620 | 1570 |
| 300 | 1240 | 1240 | 1000 | 780 | 500 | 730 | 560 | 1240 | 1240 |
| 350 | 860 | 860 | 860 | 680 | 500 | 410 | 330 | 860 | 860 |
| 400 | 480 | 480 | 480 | 480 | 480 | 100 | 100 | 480 | 480 |
| 450 | 100 | 100 | 100 | 100 | 100 | — | — | 100 | 100 |

Ratings based on: carbon/glass TFE seats, reinforced TFE packings, and alloy X750 stem bearings on 316SS, 316LSS, CF3M, and WCB; PEEK stem bearing on brass; and fluorocarbon FKM O-rings.
Fastener materials: 304SS/303SS on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade 8 on brass and WCB assemblies.
Stainless steel or brass L60C series and stainless steel L60XC series assemblies: temperature limits of -65 to 250°F at pressures listed.

Process Ball Valves

See your Swagelok Process Ball Valves Binder



Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

Q60 Series

**Table 12 — Q60 Series Extended Bonnet Manual Ball Valves
Class: N/A**

| Series | Q63T, Q65T | Q63E, Q65E | Q63P, Q65P | Q63C, Q65C | Q63M, Q65M | SQ63P, SQ65P |
|------------------------|-------------------------------|------------|------------|------------|------------|--------------|
| Material | 316SS, 316LSS, CF3M | | | | | |
| Temperature, °F | Working pressure, psig | | | | | |
| - 20 to 100 | 2200 | 2500 | 2500 | 2500 | 1000 | 2500 |
| 150 | 1850 | 2080 | 2320 | 2320 | 1000 | 2320 |
| 200 | 1500 | 1160 | 2150 | 2000 | 1000 | 2150 |
| 250 | 1150 | 250 | 1980 | 1620 | 1000 | 1980 |
| 300 | 800 | — | 1910 | 1240 | 1000 | 1910 |
| 350 | 560 | — | 1840 | 860 | 1000 | 1840 |
| 400 | 330 | — | 1770 | 480 | 1000 | 1770 |
| 450 | 100 | — | 1700 | 100 | 1000 | 1700 |
| 500 | — | — | — | — | — | 1660 |
| 550 | — | — | — | — | — | 1100 |
| 600 | — | — | — | — | — | 200 |

Fastener materials: 316SS grade B8M on 316SS, 316LSS, and CF3M assemblies.

Q60T ratings based on: reinforced TFE seats and packings, PEEK stem bearings, and fluorocarbon FKM O-rings. Stainless steel LQ60T assemblies: temperature limits of - 65 to 250°F at pressures listed.

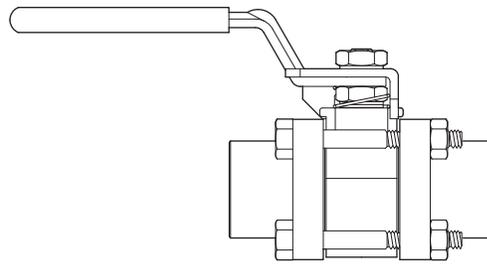
Q60E ratings based on: UHMW-PE seats and packings, PEEK stem bearings, and ethylene propylene O-rings. Stainless steel LQ60E assemblies: temperature limits of - 65 to 250°F at pressures listed.

Q60P ratings based on: PEEK seats, packings, and stem bearings; and fluorocarbon FKM O-rings.

Q60C ratings based on: carbon/glass TFE seats, reinforced TFE packings, PEEK stem bearings, and fluorocarbon FKM O-rings. Stainless steel LQ60C assemblies: temperature limits of - 65 to 250°F at pressures listed.

Q60M ratings based on: alloy X750 seats, reinforced TFE packings, PEEK stem bearings, and fluorocarbon FKM Quad-Rings.

SQ60P ratings based on: PEEK seats, packings, and stem bearings; and reinforced Grafoil® flange seals.



**Chlorine Series
Sour Gas Series**

**Table 13 — Chlorine Series Ball Valves
Class: N/A**

| Series | C62V, C63V, C65V, C67V, C68V |
|------------------------|-------------------------------|
| Material | WCB |
| Temperature, °F | Working pressure, psig |
| - 20 to 250 | 300 |

Ratings based on: virgin TFE seats and packings, ECTFE stem bearings, and fluorocarbon FKM O-rings.

Fastener materials: carbon steel grade 8.

**Table 14 — Sour Gas Series Ball Valves
Class: N/A**

| Series | N62T, N63T, N65T | N67T, N68T | N62T, N63T, N65T, N67T, N68T |
|------------------------|-------------------------------|------------|------------------------------|
| Material | 316SS, 316LSS, CF3M | | WCB |
| Temperature, °F | Working pressure, psig | | |
| - 20 to 100 | 2200 | 1500 | 2200 |
| 150 | 1850 | 1210 | 1850 |
| 200 | 1500 | 930 | 1500 |
| 250 | 1150 | 880 | 1150 |

Ratings based on: reinforced TFE seats and packings, alloy X750 stem bearings, and ethylene propylene O-rings.

Fastener materials: 304SS/303SS on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade 8 on WCB assemblies.

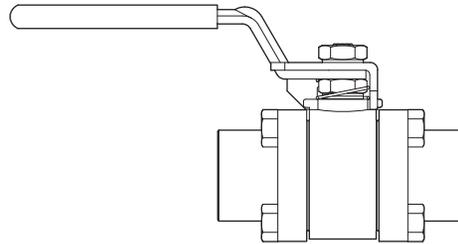
See your Swagelok Process Ball Valves Binder

Table 15 — Thermal Series Ball Valves
Class: N/A

| Series | T63M, T65M | T67M, T68M | T63M, T65M | T67M, T68M |
|------------------------|-------------------------------|---------------|---------------|---------------|
| Material | 316SS, 316LSS, CF3M | | WCB | |
| Temperature, °F | Working pressure, psig | | | |
| - 65 to 400 | 1000 | 500 | 1000 | 500 |
| 450 | 1000 | 500 | 800 | 500 |
| 500 | 1000 | 500 | 710 | 500 |
| 550 | 1000 | 500 | 620 | 500 |
| 600 | 1000 | 500 | 540 | 500 |
| 650 | 1000 | 500 | 450 | 450 |
| 700 | 1000 | 500 | 370 | 370 |
| 750 | 1000 | 500 | 280 | 280 |
| 800 | 1000 | 500 | 200 | 200 |
| 850 | 1000 | 500 | — | — |

Ratings based on: alloy X750 seats and stem bearings and reinforced Grafoil packing and flange seals. Ratings limited to -20°F min with WCB.

Fastener materials: 316SS grade B8M on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade B7 on WCB assemblies.



Thermal Series
Fire Series
Steam Series

Table 16 — Fire Series Ball Valves
Class: N/A

| Series | A63T, A65T | A67T, A68T | F63T, F65T | F67T, F68T |
|------------------------|-------------------------------|---------------|---------------|---------------|
| Material | 316SS, 316LSS, CF3M, WCB | | | |
| Temperature, °F | Working pressure, psig | | | |
| - 40 to 100 | 2200 | 2000 | 2200 | 2000 |
| 150 | 1600 | 1600 | 1600 | 1600 |
| 200 | 1000 | 1000 | 1000 | 1000 |
| 250 | 400 | 400 | 400 | 400 |
| 300 | 300 | 300 | — | — |
| 350 | 200 | 200 | — | — |
| 400 | 100 | 100 | — | — |

Ratings apply only to the materials, construction, and tests detailed in the catalog. Ratings limited to -20°F min with WCB.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

Table 17 — Steam Series Ball Valves
Class: N/A

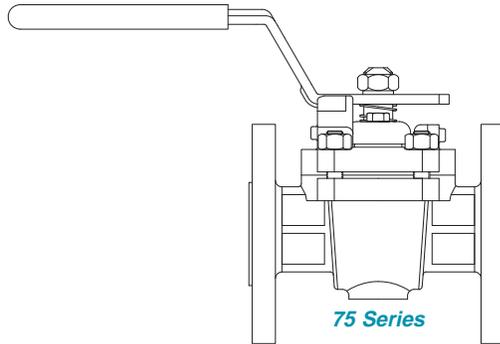
| Series | S62P | S63P, S65P | S67P, S68P | S62P, S63P, S65P | S67P, S68P |
|------------------------|-------------------------------|------------|------------|---------------------|------------|
| Material | 316SS, 316LSS, CF3M | | | WCB | |
| Temperature, °F | Working pressure, psig | | | | |
| - 20 to 100 | 2500 | 2500 | 2000 | 2500 | 2000 |
| 150 | 2420 | 2320 | 1920 | 2250 | 1820 |
| 200 | 2350 | 2150 | 1830 | 2010 | 1650 |
| 250 | 2280 | 1980 | 1750 | 1770 | 1480 |
| 300 | 2200 | 1910 | 1670 | 1520 | 1310 |
| 350 | 2120 | 1840 | 1600 | 1280 | 1140 |
| 400 | 2050 | 1770 | 1530 | 1040 | 970 |
| 450 | 1980 | 1700 | 1460 | 800 | 800 |
| 500 | 1910 | 1660 | 1410 | 710 | 710 |
| 550 | 1100 | 1100 | 1100 | 620 | 620 |
| 600 | 200 | 200 | 200 | 200 | 200 |

Ratings based on: PEEK seats, packings, and stem bearings; and reinforced Grafoil flange seals. Fastener materials: 316SS grade B8M on 316SS, 316LSS, and CF3M assemblies; and carbon steel grade B7 on WCB assemblies.

Process Ball Valves

See your Swagelok Process Ball Valves Binder

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.



**Table 18 — 75 Series
Flange-Ended Ball Valves
Class: 150 (meets ANSI B16.34)**

| Series | 75T, 75V | 75E |
|------------------------|-------------------------------|-----|
| Material group | 2.2 | |
| Material name | CF3M, CF8M | |
| Temperature, °F | Working pressure, psig | |
| - 20 to 100 | 275 | 275 |
| 150 | 255 | 255 |
| 200 | 235 | 235 |
| 250 | 225 | 225 |
| 300 | 215 | — |
| 350 | 205 | — |
| 400 | 195 | — |
| 450 | 100 [Ⓢ] | — |

75T series ratings based on: reinforced TFE seat and packing, PFA stem bearings, virgin TFE carrier back seals, fluorocarbon FKM O-rings, and 316SS ball.

75V series ratings based on: virgin TFE seat, packing, and carrier back seals; PFA stem bearings; fluorocarbon FKM O-rings; and 316SS ball.

75E series ratings based on: UHMW-PE seat, packing, and carrier back seals; PEEK stem bearings; ethylene propylene O-rings; uncoated gland; and 316SS ball.

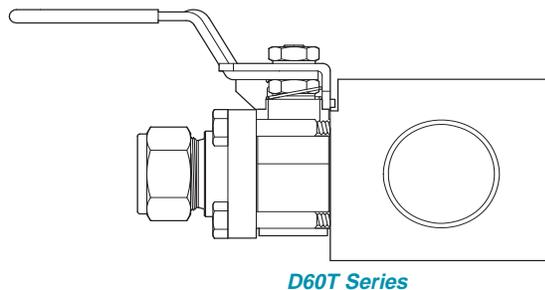
L75 series assemblies: temperature limits of - 65 to 250°F at pressures listed.

[Ⓢ]100 psig rating is lower than given in B16.34 class 150 tables.

**Table 19 — D60T Series Distribution Block Valves
Class: N/A**

| Series | D67T, D68T | D63T, D65T | D63T | D63T | D62T, D65T |
|--|-------------------------------|------------|---------------|---------|---------------------|
| Tubing | 316L welded | | 316L seamless | | |
| Material | 316SS, 316LSS, CF3M | | | | |
| Main line tube size wall thickness, in. | 4 0.083 | 2 0.065 | 1Ω 0.065 | 1 0.065 | æ 0.065, Ω 0.049 |
| Temperature, °F | Working pressure, psig | | | | |
| - 20 to 100 | 530 | 990 | 1300 | 2000 | 2200 |
| 150 | 480 | 910 | 1190 | 1850 | 1850 |
| 200 | 440 | 830 | 1090 | 1500 | 1500 |
| 250 | 420 | 790 | 1040 | 1150 | 1150 |
| 300 | 400 | 750 | 800 | 800 | 800 |
| 350 | 380 | 560 | 560 | 560 | 560 |
| 400 | 330 | 330 | 330 | 330 | 330 |
| 450 | 100 | 100 | 100 | 100 | 100 |

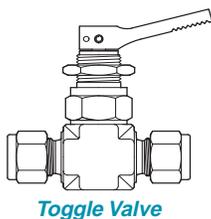
Ratings based on: reinforced TFE seats and packing, alloy X750 stem bearings, and fluorocarbon FKM O-rings. Fastener materials: 304SS.



See "Needle Valves" subsection in your Swagelok Product Binder

Table 20 — Toggle Valves
Class: N/A

| Series | OG, 1G | 1G |
|-----------------|------------------------|-----------|
| Material | 316SS, brass | |
| Orifice | 0.080 in., 0.125 in. | 0.250 in. |
| Temperature, °F | Working pressure, psig | |
| -20 to 200 | 300 | 200 |

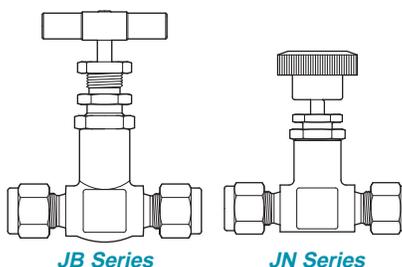


Ratings based on manually actuated assemblies with fluorocarbon FKM O-rings and TFE stem tips. See catalog for ratings of pneumatically actuated 92 series models.
Low-temperature assembly available with temperature limits of -65 to 200°F at pressures listed.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

Table 21 — JB Series
Severe-Service Needle Valves
JN Series Screwed-Bonnet Needle Valves

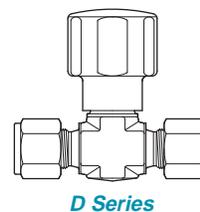
| Series | JB | JN |
|-----------------|------------------------|-----------|
| Class | 1250 | N/A |
| Material group | 2.2 | N/A |
| Material name | 316SS | Brass 377 |
| Temperature, °F | Working pressure, psig | |
| -20 to 100 | 3000 | 600 |
| 200 | 2580 | 425 |
| 300 | 2330 | 250 |
| 400 | 2140 | — |



JB series ratings based on TFE stem packing; can be extended to 1880 psig at 600°F with Grafoil stem packing.

Table 22 — D Series Nonrotating-Stem Valves

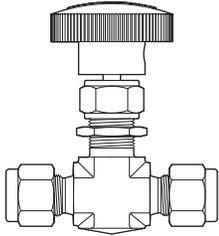
| Class | 1250 | | N/A | | 1500 | |
|-------------------|------------------------|------|-------|------|-----------|------|
| Material group | 2.2 | | N/A | | 3.4 | |
| Material name | 316SS | | Brass | | Alloy 400 | |
| Stem tip material | PCTFE | PEEK | PCTFE | PEEK | PCTFE | PEEK |
| Temperature, °F | Working pressure, psig | | | | | |
| -20 to 100 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| 150 | 2790 | 2790 | 2675 | 2675 | 2820 | 2820 |
| 200 | 2580 | 2580 | 2350 | 2350 | 2640 | 2640 |
| 250 | — | 2455 | — | 2200 | — | 2555 |
| 300 | — | 2330 | — | 2050 | — | 2470 |
| 350 | — | 2235 | — | 1220 | — | 2430 |
| 400 | — | 2140 | — | 390 | — | 2390 |
| 450 | — | 2065 | — | — | — | 2380 |



Ratings limited to:
 • -20 to 400°F with fluorocarbon FKM O-rings.
 • -20 to 450°F with Kalrez O-rings.
 • -20 to 250°F with Buna N, silicone, or ethylene propylene O-rings.
 • -65 to 250°F with Buna C O-rings.

Needle Valves

See "Needle Valves" subsection in your Swagelok Product Binder

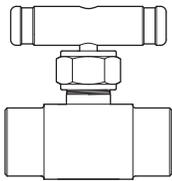


O, 1, and 18 Series

Table 23 — O, 1, and 18 Series Integral-Bonnet Needle Valves

| Class | 2080 | N/A | | 1500 |
|------------------------|-------------------------------|-------|-------|-----------|
| Material group | 2.2 | N/A | N/A | 3.4 |
| Material name | 316SS | Brass | Steel | Alloy 400 |
| Temperature, °F | Working pressure, psig | | | |
| - 65 to 100 | 5000 | 3000 | 3000 | 3000 |
| 200 | 4295 | 2350 | 2730 | 2640 |
| 250 | 4085 | 2200 | 2695 | 2555 |
| 300 | 3875 | 2050 | 2660 | 2470 |
| 350 | 3715 | 1470 | 2615 | 2430 |
| 400 | 3560 | 390 | — | 2390 |
| 450 | 3435 | — | — | 2380 |
| 500 | 3310 | — | — | 2375 |
| 600 | 3130 | — | — | — |

- Ratings limited to:
- - 20°F min with steel.
 - 200°F max with PCTFE stem tip.
 - 250°F max with polyethylene stem packing.
 - 450°F max with TFE or PFA stem packing.
 - 600°F max with PEEK stem packing.
 - - 20 to 400°F with fluorocarbon FKM O-rings.
 - - 20 to 450°F with Kalrez O-rings.
 - - 20 to 200°F with Buna N, silicone, or ethylene propylene O-rings.
 - 200°F max with Buna C O-rings.

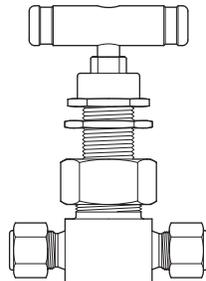


20 and 26 Series

Table 24 — 20 and 26 Series Integral-Bonnet Needle Valves

| Class | 2500 | N/A | 1500 |
|------------------------|-------------------------------|-------|-----------|
| Material group | 2.2 | N/A | 3.4 |
| Material name | 316SS | Steel | Alloy 400 |
| Temperature, °F | Working pressure, psig | | |
| - 65 to 100 | 6000 | 6000 | 3000 |
| 200 | 5160 | 5420 | 2640 |
| 250 | 4910 | 5370 | 2550 |
| 300 | 4660 | 5320 | 2470 |
| 350 | 4470 | 5230 | 2430 |
| 400 | 4280 | — | 2390 |
| 450 | 4130 | — | 2380 |
| 500 | 3980 | — | 2375 |
| 600 | 3760 | — | — |

- Ratings limited to:
- - 20°F min with steel.
 - 200°F max with PCTFE stem tip.
 - 250°F max with polyethylene stem packing.
 - 450°F max with TFE or PFA stem packing.
 - 600°F max with PEEK stem packing.
 - - 20 to 400°F with fluorocarbon FKM O-rings.
 - - 20 to 450°F with Kalrez O-rings.
 - - 20 to 200°F with Buna N, silicone, or ethylene propylene O-rings.
 - 200°F max with Buna C O-rings.



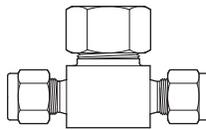
N Series

Table 25 — N Series Severe-Service Union-Bonnet Valves 50 Series Lift Check Valves

| Class | 2500 | | | | N/A | |
|------------------------|-------------------------------|----------|-----------|-----------|-------------|----------|
| Material group | 2.2 | 3.1 | 3.4 | 3.5 | N/A | N/A |
| Material name | 316SS | Alloy 20 | Alloy 400 | Alloy 600 | Alloy C-276 | Titanium |
| Temperature, °F | Working pressure, psig | | | | | |
| - 65 to 100 | 6000 | 5000 | 5000 | 6000 | 6000 | 3570 |
| 200 | 5160 | 4640 | 4400 | 5600 | 6000 | 3110 |
| 250 | 4910 | 4500 | 4260 | 5460 | 6000 | 2840 |
| 300 | 4660 | 4360 | 4120 | 5320 | 6000 | 2570 |
| 350 | 4470 | 4185 | 4050 | 5220 | 5975 | 2385 |
| 400 | 4280 | 4010 | 3980 | 5120 | 5880 | 2200 |
| 450 | 4130 | 3955 | 3970 | 5030 | 5710 | 2055 |
| 500 | 3980 | 3900 | 3960 | 4940 | 5540 | 1885 |
| 600 | 3760 | 3790 | — | 4780 | 5040 | 1625 |
| 650 | 3700 | 3750 | — | 4700 | 4905 | — |
| 700 | 3600 | 3710 | — | 4640 | 4730 | — |
| 750 | 3520 | 3665 | — | 4430 | 4430 | — |
| 800 | 3460 | 3600 | — | 4230 | 4230 | — |
| 850 | 3380 | — | — | 4060 | 4060 | — |
| 900 | 3280 | — | — | 3745 | 3745 | — |
| 950 | 3220 | — | — | 2725 | 3220 | — |
| 1000 | 3030 | — | — | 1800 | 3030 | — |
| 1050 | 3000 | — | — | 1155 | 3000 | — |
| 1100 | 2685 | — | — | 770 | 2685 | — |
| 1150 | 2285 | — | — | 565 | 2285 | — |
| 1200 | 1715 | — | — | 515 | 1545 | — |

- Ratings based on Grafoil packing. Ratings limited to:
- 200°F max with PCTFE stem tip.
 - 250°F max with polyethylene stem packing.
 - 450°F max with TFE stem tip or stem packing.
 - 600°F max with PEEK packing.

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

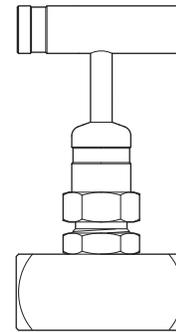


50 Series

See "Needle Valves" subsection in your Swagelok Product Binder

Table 26 — 4P and 5P Series Rising Plug Valves
Class: N/A

| Material | 316SS | | | Alloy 400 | | |
|-----------------|------------------------|---------|------|-----------|---------|------|
| Seat material | Acetal | TFE PFA | PEEK | Acetal | TFE PFA | PEEK |
| Temperature, °F | Working pressure, psig | | | | | |
| -20 to 100 | 6000 | 750 | 6000 | 5000 | 750 | 5000 |
| 200 | 2650 | 625 | 3000 | 2650 | 625 | 3000 |
| 250 | 1000 | 450 | 1600 | 1000 | 450 | 1600 |
| 300 | — | 300 | 1300 | — | 300 | 1300 |
| 350 | — | 200 | 1200 | — | 200 | 1200 |
| 400 | — | 100 | 1000 | — | 100 | 1000 |



Rising Plug Valve

Pressure-temperature ratings apply to *manual* valves only unless noted in tables. See product catalogs for ratings of valves equipped with pneumatic actuators.

- Ratings based on fluorocarbon FKM or Kalrez O-rings. Ratings limited to:
- 250°F max for fluids compatible with acetal seat material, except for water and steam, which are not recommended for temperatures greater than 200°F.
 - 250°F max with Buna N, Buna C, silicone, or ethylene propylene O-rings.

Table 27 — HN Series Severe-Service Needle Valves
Class: N/A

| Material | 316SS |
|-----------------|------------------------|
| Temperature, °F | Working pressure, psig |
| -65 to 100 | 10 000 |
| 200 | 9 290 |
| 250 | 8 840 |
| 300 | 8 390 |
| 350 | 8 045 |
| 400 | 7 705 |
| 450 | 7 435 |
| 500 | 7 165 |
| 600 | 6 770 |
| 650 | 6 660 |
| 700 | 6 480 |
| 750 | 6 335 |
| 800 | 6 230 |
| 850 | 6 085 |
| 900 | 5 905 |
| 950 | 5 795 |
| 1000 | 5 450 |
| 1050 | 5 400 |
| 1100 | 4 835 |
| 1150 | 4 115 |
| 1200 | 3 085 |

- Ratings based on Grafoil packing. Ratings limited to:
- 200°F max with PCTFE stem tip.
 - 250°F max with polyethylene stem packing.
 - 450°F max with TFE stem tip or stem packing.
 - 600°F max with PEEK packing.

Table 28 — PFA 4RP Series Needle Valves
Class: N/A

| Material | PFA 440-HP | |
|-----------------|------------------------|-----|
| End connection | S4, S6 | S8 |
| Temperature, °F | Working pressure, psig | |
| 0 to 70 | 180 | 125 |
| 100 | 160 | 110 |
| 150 | 126 | 87 |
| 200 | 95 | 66 |
| 250 | 69 | 49 |
| 300 | 50 | 33 |

See your Swagelok representative for catalog information.

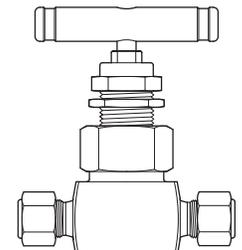
Table 29 — 410, 445, 645, and 945 Series Severe-Service and High-Pressure Needle Valves
Class: N/A

| Series | 410 | 445, 645, 945 |
|-----------------|------------------------|---------------|
| Material | 316SS | |
| Temperature, °F | Working pressure, psig | |
| -65 to 100 | 10 000 | 45 000 |
| 200 | 9 290 | 41 800 |
| 300 | 8 390 | 37 700 |
| 400 | 7 705 | 34 600 |
| 450 | 7 435 | 33 400 |
| 500 | 7 165 | — |
| 550 | 6 970 | — |
| 600 | 6 770 | — |
| 650 | 6 660 | — |
| 700 | 6 480 | — |
| 750 | 6 335 | — |
| 800 | 6 230 | — |
| 850 | 6 085 | — |

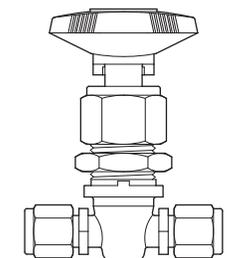
445, 645, 945 series ratings based on glass-filled TFE packing. Ratings with Grafoil packing are equal to 410 series ratings.

410 series ratings based on Grafoil packing. Ratings limited to 450°F max with glass-filled TFE packing.

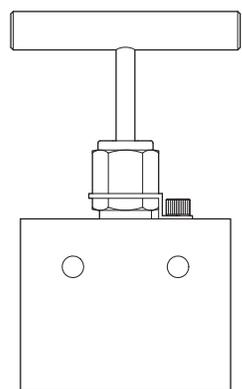
Pressure ratings for 445, 645, and 945 series sour gas assemblies: 18 000 psig max.



HN Series



PFA 4RP Series



410, 445, 645, 945 Series

Purge Valves, Bleed Valves, Pinch Valves

See "Check/Relief/Bleed/Purge Valves" subsection in your Swagelok Product Binder



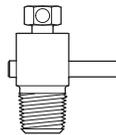
P Series

Table 30 — P Series Purge Valves

| Class | 1660 | | N/A | |
|-----------------|------------------------|-------|-------|----------|
| Material group | 2.2 | N/A | N/A | With |
| Material name | 316SS | Brass | Steel | TFE ball |
| Temperature, °F | Working pressure, psig | | | |
| - 65 to 100 | 4000 | 3000 | 3000 | 200 |
| 150 | 3720 | 2800 | 3000 | 150 |
| 200 | 3440 | 2600 | 3000 | 100 |
| 300 | 3105 | 2210 | 3000 | 50 |
| 350 | 2975 | 1480 | 2985 | 25 |
| 400 | 2850 | 740 | — | — |
| 450 | 2750 | — | — | — |
| 500 | 2650 | — | — | — |
| 600 | 2500 | — | — | — |

Ratings limited to:

- - 20°F min with steel.
- 450°F max with SAE end connections using fluorocarbon FKM O-rings.



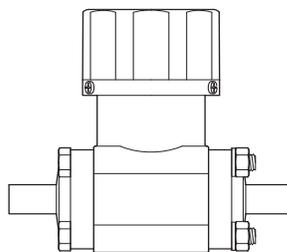
BV Series

Table 31 — BV Series Bleed Valves
Class: N/A

| Material | 316SS | WCB | Alloy R-405 |
|-----------------|------------------------|--------|-------------|
| Temperature, °F | Working pressure, psig | | |
| - 65 to 100 | 10 000 | 10 000 | 10 000 |
| 200 | 9 290 | 9 110 | 8 800 |
| 300 | 8 390 | 8 860 | 8 240 |
| 400 | 7 705 | 8 555 | 7 960 |
| 450 | 7 435 | 8 315 | 7 940 |
| 500 | 7 165 | — | 7 920 |
| 600 | 6 770 | — | — |
| 650 | 6 660 | — | — |
| 700 | 6 480 | — | — |
| 750 | 6 335 | — | — |
| 800 | 6 230 | — | — |
| 850 | 6 085 | — | — |

Ratings based on all metal seals. Ratings limited to:

- - 20°F min with steel.
- 450°F max with SAE end connections using fluorocarbon FKM O-rings.
- 9100 psig max with 316SS or WCB and SAE end connections.
- 8000 psig max with alloy R-405 and SAE end connections.



A3 Series

Table 32 — Pinch Valves
Class: N/A

| Series | A3 | HA3 |
|--------------------|----------------------------|-----|
| Material | PEEK (body), 316L (flange) | |
| Pinch tube element | Red silicone, EPDM | |
| Temperature, °F | Working pressure, psig | |
| 0 to 285 | 50 | 125 |

Ratings based on EPDM O-rings.

A3 Series: low-temperature rating 50°F with optional Atlas® pinch tube element.

See your Swagelok representative for catalog information.

Manifolds and Gauge/Root Valves

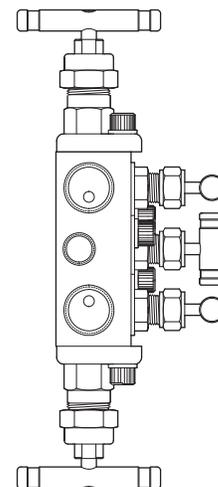
See "Manifolds" subsection in your Swagelok Product Binder

**Table 33 — Two, Three, and Five-Valve Manifolds
6P Series Valves**

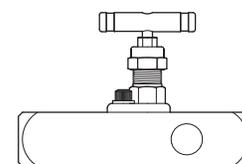
| Series | M2, M3, M5, 6P | | M2 | | | M3, M5, 6P | | |
|------------------|------------------------|-----------------|-------|--------|------|------------|--------|------|
| Class | 2500 | | N/A | | | | | |
| Material group | 2.2 | | N/A | | | | | |
| Material name | 316SS | | 316SS | | | | | |
| Seat material | Stainless steel | Stainless steel | PFA | Acetal | PEEK | PFA | Acetal | PEEK |
| Packing material | TFE | Grafoil | TFE | TFE | PEEK | TFE | TFE | PEEK |
| Temperature, °F | Working pressure, psig | | | | | | | |
| - 65 to 100 | 6000 | 6000 | 6000 | 6000 | 6000 | 750 | 6000 | 6000 |
| 200 | 5160 | 5160 | 3000 | 3650 | 3000 | 625 | 2650 | 3000 |
| 250 | 4910 | 4910 | 1500 | 2500 | 1600 | 450 | 1000 | 1600 |
| 300 | 4660 | 4660 | — | — | 1300 | 300 | — | 1300 |
| 350 | 4470 | 4470 | — | — | 1200 | 200 | — | 1200 |
| 400 | 4280 | 4280 | — | — | 1000 | 100 | — | 1000 |
| 450 | 4130 | 4130 | — | — | 800 | — | — | 800 |
| 500 | — | 3980 | — | — | 600 | — | — | 600 |
| 550 | — | 3870 | — | — | 400 | — | — | 400 |
| 600 | — | 3760 | — | — | 200 | — | — | 200 |
| 650 | — | 3700 | — | — | — | — | — | — |
| 700 | — | 3600 | — | — | — | — | — | — |
| 750 | — | 3520 | — | — | — | — | — | — |
| 800 | — | 3460 | — | — | — | — | — | — |
| 850 | — | 3380 | — | — | — | — | — | — |
| 900 | — | 3280 | — | — | — | — | — | — |
| 950 | — | 3220 | — | — | — | — | — | — |
| 1000 | — | 3030 | — | — | — | — | — | — |
| 1050 | — | 3000 | — | — | — | — | — | — |
| 1100 | — | 2685 | — | — | — | — | — | — |
| 1150 | — | 2285 | — | — | — | — | — | — |
| 1200 | — | 1715 | — | — | — | — | — | — |

Ratings limited to:

- -20°F min for manifolds assembled with fluorocarbon FKM flange seals.
- 250°F max with acetal seat material.
- 600°F max with Grafoil flange seals.
- 850°F max with Grafoil packing in M2 and M5 configurations.
- 1200°F max with Grafoil packing in M3 configuration and in 6P series valve.



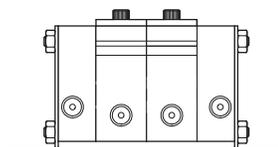
M5 Series



6P Series

**Table 34 — T2 Series
Compact Pneumatic Valve Assemblies
Class: N/A**

| Actuator | C | O | D | H |
|-----------------|------------------------|-----|-----|-----|
| Temperature, °F | Working pressure, psig | | | |
| 0 to 300 | 100 | 300 | 300 | 200 |



T2 Series

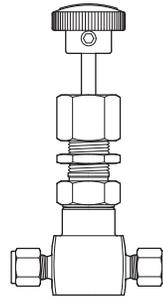
Actuators: **C** designates normally closed; **O** designates normally open; **D** designates double acting; **H** designates high-pressure normally closed.

Ratings based on: fluorocarbon FKM and Kalrez O-rings. Ratings limited to 200°F with ethylene propylene O-rings.

See your Swagelok representative for catalog information.

Metering Valves

See "Metering Valves" subsection in your Swagelok Product Binder



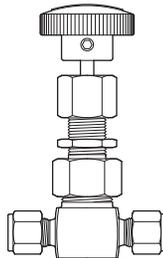
21 Series

Table 35 — 21 and 22 Series Micrometering Valves

| Class | 1250 | N/A |
|-----------------------|------------------------|-------|
| Material group | 2.2 | N/A |
| Material name | 316SS | Brass |
| Temperature, °F | Working pressure, psig | |
| - 65 to 100 | 3000 | 3000 |
| 200 | 2580 | 2350 |
| 300 | 2330 | 2050 |
| 400 | 2140 | 390 |
| 450 | 2065 | — |
| 500 | 1990 | — |
| 600 | 1880 | — |
| 650 | 1845 | — |
| 700 | 1795 | — |
| 750 | 1760 | — |
| 800 | 1725 | — |
| 850 | 1690 | — |

21 series ratings based on Grafoil packing. Ratings limited to 450°F with TFE packing.
 22 series ratings limited to - 20 to 400°F, based on TFE backup rings and fluorocarbon FKM O-rings.

Ratings apply to *standard* materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.

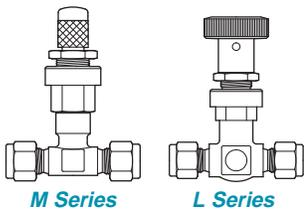


31 Series

Table 36 — 31 Series Union-Bonnet Metering Valves
Class: 2080

| Material group | 2.2 |
|-----------------------|------------------------|
| Material name | 316SS |
| Temperature, °F | Working pressure, psig |
| - 65 to 100 | 5000 |
| 200 | 4295 |
| 300 | 3875 |
| 400 | 3560 |
| 450 | 3435 |
| 500 | 3310 |
| 600 | 3130 |
| 650 | 3080 |
| 700 | 3000 |
| 750 | 2930 |
| 800 | 2880 |
| 850 | 2815 |

Ratings based on Grafoil packing. Ratings limited to 450°F with TFE packing.



M Series

L Series

Table 37 — S, M, and L Series Metering Valves
Class: N/A

| Series | S | M, L | S | M, L | S | M |
|-----------------------|------------------------|------|-----------|------|-----------|------|
| Material group | 2.2 | | N/A | | 3.4 | |
| Material name | 316SS | | Brass 377 | | Alloy 400 | |
| Temperature, °F | Working pressure, psig | | | | | |
| - 10 to 400 | 2000 | 1000 | 2000 | 1000 | 2000 | 1000 |

Ratings based on fluorocarbon FKM O-rings. Ratings limited to:
 • 300°F with Buna N or ethylene propylene O-rings.
 • 250°F with neoprene O-rings.

See "Check/Relief/Bleed/Purge Valves" subsection in your Swagelok Product Binder

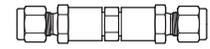
**Table 38 — CA Series Adjustable Check Valves
CP Series Pipe-Ended Check Valves
CPA Series Pipe-Ended Adjustable Check Valves
2C, 4C, 6C, and 8C Series Poppet Check Valves
Class: 1250**

| Material group | 2.2 | N/A | 1.4 | 3.1 | 3.4 | 3.5 | 3.8 | N/A | N/A |
|-----------------|------------------------|-------|-------|----------|-------------|-----------|-------------|----------|----------|
| Material name | 316SS | Brass | Steel | Alloy 20 | Alloy R-405 | Alloy 600 | Alloy C-276 | Titanium | Aluminum |
| Temperature, °F | Working pressure, psig | | | | | | | | |
| - 10 to 100 | 3000 | 3000 | 2570 | 2500 | 2500 | 3000 | 3000 | 1785 | 2210 |
| 200 | 2575 | 2600 | 2340 | 2320 | 2200 | 2800 | 3000 | 1555 | 2210 |
| 250 | 2450 | 2405 | 2305 | 2245 | 2130 | 2725 | 3000 | 1420 | 1845 |
| 300 | 2325 | 2210 | 2275 | 2175 | 2055 | 2655 | 3000 | 1285 | 1485 |
| 375 | 2185 | 1105 | 2220 | — | 2005 | 2580 | 2960 | 1145 | 850 |

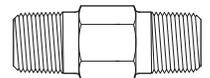
Ratings based on fluorocarbon FKM or Kalrez O-rings. Ratings limited to:

- - 20°F min with steel.
- - 10 to 250°F with Buna N O-rings.
- - 40 to 250°F with neoprene O-rings.
- - 50 to 300°F with ethylene propylene O-rings.
- - 50 to 350°F with TFE O-rings.

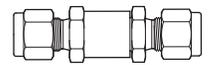
Ratings apply to *standard* materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.



CA Series



CP Series
CPA Series



C Series

**Table 39 — 12C and 16C Series Poppet Check Valves
Class: 830**

| Material group | 2.2 | N/A | 3.1 | 3.4 | 3.5 | 3.8 | N/A |
|-----------------|------------------------|-------|----------|-------------|-----------|-------------|----------|
| Material name | 316SS | Brass | Alloy 20 | Alloy R-405 | Alloy 600 | Alloy C-276 | Titanium |
| Temperature, °F | Working pressure, psig | | | | | | |
| - 10 to 100 | 2000 | 1500 | 1660 | 1660 | 1990 | 2000 | 1185 |
| 200 | 1715 | 1300 | 1540 | 1460 | 1860 | 2000 | 1030 |
| 250 | 1630 | 1200 | 1495 | 1415 | 1810 | 2000 | 940 |
| 300 | 1545 | 1105 | 1445 | 1370 | 1765 | 2000 | 850 |
| 375 | 1450 | 550 | — | 1335 | 1715 | 1965 | 760 |

Ratings based on fluorocarbon FKM or Kalrez O-rings. Ratings limited to:

- - 10 to 250°F with Buna N O-rings.
- - 40 to 250°F with neoprene O-rings.
- - 50 to 300°F with ethylene propylene O-rings.
- - 50 to 350°F with TFE O-rings.

**Table 40 — CH Series Compact Check Valves
XS Series Excess Flow Valves**

| Series | CH4, CH8 | | CH8 | |
|-----------------|------------------------|-------------|----------|--------------|
| | XS4, XS6, XS8 | 2500 | XS6, XS8 | CH16 2080 |
| Material group | 2.2 | 3.4 | 1.4 | 2.2 |
| Material name | 316SS | Alloy R-405 | Steel | 316SS |
| Temperature, °F | Working pressure, psig | | | |
| - 10 to 100 | 6000 | 5000 | 6000 | 5000 |
| 200 | 5160 | 4400 | 5160 | 4290 |
| 250 | 4910 | 4260 | 4910 | 4080 |
| 300 | 4660 | 4120 | 4660 | 3875 |
| 400 | 4280 | 3980 | 4280 | 3560 |

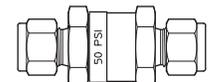
Ratings based on fluorocarbon FKM O-rings. Ratings limited to:

- - 40 to 250°F with Buna N and neoprene O-rings.
- - 50 to 300°F with ethylene propylene O-rings.
- 0 to 380°F with Aflas O-rings.

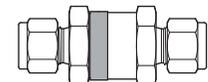
**Table 41 — CW Series All-Welded Check Valves
Class: 1500**

| Series | CW4 |
|-----------------|------------------------|
| Material group | 2.3 |
| Material name | 316LSS |
| Temperature, °F | Working pressure, psig |
| - 10 to 100 | 3000 |
| 200 | 2530 |
| 300 | 2270 |
| 400 | 2065 |

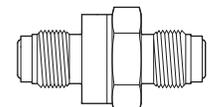
See your Swagelok representative for catalog information.



CH Series



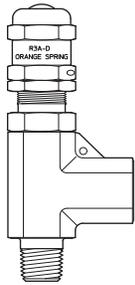
XS Series



CW Series

Proportional Relief Valves

See "Check/Relief/Bleed/Purge Valves" subsection in your Swagelok Product Binder



R3A Series

Swagelok R series relief valves are proportional relief valves that open gradually as the relieving pressure increases. Consequently, they do not have a capacity rating at a given pressure rise (accumulation). ASME BPV Code Section VIII and other industry standards define performance characteristics for relief valves—such as set pressure, relieving capacity, testing, and certification—that are not applicable to R series relief valves.

The system designer and user must determine the applicable code requirements and whether R series relief valves are acceptable for use.

Table 42 — R Series Proportional Relief Valves

| Series Class | R3A 2500 | R4 N/A | RL3, RL4 N/A |
|-----------------|------------------------|--------|--------------|
| Material group | 2.2 | N/A | N/A |
| Material name | 316SS | 316SS | 316SS |
| Temperature, °F | Working pressure, psig | | |
| – 40 to 100 | 6000 | 1500 | 300 |
| 200 | 5160 | 1500 | 300 |
| 250 | 4910 | 1500 | 300 |
| 300 | 4660 | 1500 | 300 |

R3A Series ratings limited to:

- 30 to 250°F with fluorocarbon FKM or ethylene propylene O-rings.
- 0 to 250°F with Buna N O-rings.
- – 10 to 300°F with neoprene O-rings.

RL3 and RL4 Series ratings limited to:

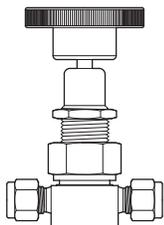
- 10 to 300°F with fluorocarbon FKM O-rings.
- 0 to 200°F with Buna N O-rings.
- – 30 to 300°F with neoprene O-rings.
- – 40 to 300°F with ethylene propylene O-rings.

R4 Series ratings limited to:

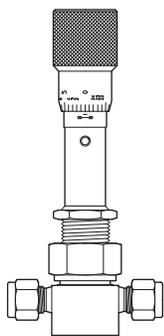
- 50 to 300°F with fluorocarbon FKM O-rings.
- 50 to 250°F with Buna N, neoprene, or ethylene propylene O-rings.

Bellows Valves

See "Packless Valves" subsection in your Swagelok Product Binder



B Series



BM Series

Table 43 — B Series General Purpose Bellows Valves
BM Series Bellows-Sealed Metering Valves

Class: N/A

| Series | BW | BRW, BRG, BG | BMRW, BMW | BMRG, BMG | BG | BRG | BMRG, BMG | BRW, BW, BMRW, BMW, BRG, BG, BMRG, BMG |
|-----------------|------------------------|--------------|-----------|-----------|-----------|-----|-----------|--|
| Material | 316SS | | | | Brass 360 | | | Alloy 400 |
| Temperature, °F | Working pressure, psig | | | | | | | |
| – 20 to 100 | 1000 | 1000 | 700 | 700 | 1000 | 450 | 350 | 700 |
| 200 | 830 | 830 | 610 | 610 | 710 | 350 | 280 | 610 |
| 300 | 660 | 660 | 530 | 530 | 430 | 250 | 210 | 530 |
| 400 | 500 | 500 | 450 | 450 | 150 | 150 | 150 | 450 |
| 500 | 450 | 450 | 375 | 375 | — | — | — | 375 |
| 600 | 400 | 400 | 300 | 300 | — | — | — | — |
| 650 | 360 | — | 260 | — | — | — | — | — |
| 700 | 330 | — | 230 | — | — | — | — | — |
| 750 | 300 | — | 200 | — | — | — | — | — |
| 800 | 260 | — | 160 | — | — | — | — | — |
| 850 | 230 | — | 130 | — | — | — | — | — |
| 900 | 200 | — | 100 | — | — | — | — | — |

Series: **W** suffix designates welded body-to-bellows seal; **G** suffix designates gasketed body-to-bellows seal; **R** suffix designates regulating stem. Ratings apply to manual valves and valves with 5 Series pneumatic actuators. BRW and BMRW not recommended for shutoff above 600°F.

Table 44 — BK Series Bellows Valves with PCTFE Stem Inserts

Class: N/A

| Series | BK | BK-1C | BK-1O | BK-1D | BK | BK-1C | BK-1O | BK-1D | BK | BK-1C | BK-1O | BK-1D |
|-----------------|------------------------|-------|-------|-------|-------|-------|-------|-------|-----------|-------|-------|-------|
| Material | 316SS | | | | Brass | | | | Alloy 400 | | | |
| Temperature, °F | Working pressure, psig | | | | | | | | | | | |
| – 20 to 100 | 1000 | 125 | 500 | 700 | 1000 | 125 | 500 | 700 | 700 | 125 | 500 | 700 |
| 200 | 830 | 125 | 500 | 700 | 710 | 125 | 500 | 700 | 610 | 125 | 500 | 610 |

Ratings apply to manual valves (BK). Low-temperature rating of pneumatically actuated valves (BK-1C, BK-1O, and BK-1D) is – 40°F. See catalog for pneumatic actuator ratings. Pneumatic actuators: **1C** suffix designates normally closed; **1O** suffix designates normally open; **1D** suffix designates double acting. Toggle-operated 4BKT ratings: 100 psig at – 20 to 200°F.

See "Packless Valves" subsection in your Swagelok Product Binder

**Table 45 — H Series Compact Bellows Valves
HK Series Compact Bellows Valves
with PCTFE Stem Inserts
Class: N/A**

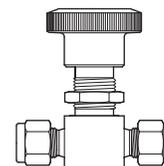
| Material | 316SS | Brass 360 | Alloy 400 | |
|--|------------------------|-----------|-----------|-----------|
| Temperature, °F | Working pressure, psig | | | |
| Manual valves | H | HG, HW | HK | HK |
| Up to 100 | 1000 | 1000 | 1000 | 1000 |
| 200 | 1000 | 750 | 500 | 500 |
| 300 | 1000 | 500 | — | — |
| 400 | 1000 | 150 | — | — |
| 500 | 1000 | — | — | — |
| 600 | 1000 | — | — | — |
| Pneumatically actuated valves Up to 200 | N/A | N/A | HK 300 | HK 300 |

Manual valve low-temperature ratings:
 • – 40°F for brass and alloy 400.
 • – 80°F for 316SS.

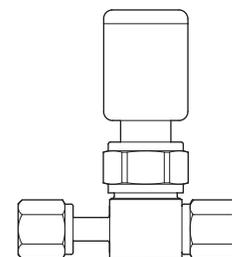
**Table 46 — BN Series Bellows Valves
for High-Purity Systems
Class: N/A**

| Series | BN | BN-C | BN-O |
|-----------------|------------------------|------|------|
| Material | 316LSS | | |
| Temperature, °F | Working pressure, psig | | |
| – 40 to 200 | 500 | 125 | 400 |

Ratings apply to manual valves and pneumatically actuated valves (BN-C and BN-O). See catalog for pneumatic actuator ratings. Pneumatic actuators: **C** designates normally closed; **O** designates normally open. Toggle-operated BNT ratings: 100 psig at – 40 to 200°F.



H Series



BN Series

**Table 47 — HB Series High-Pressure
Pneumatically Actuated Bellows Valves
Class: 1750**

| Material group | 2.3 |
|-----------------|------------------------|
| Material name | 316LSS |
| Temperature, °F | Working pressure, psig |
| – 40 to 100 | 3500 |
| 150 | 3220 |
| 200 | 2950 |
| 300 | 2640 |
| 400 | 2400 |

Ratings based on optional Vespel® stem tip. Ratings limited to 150°F with standard PCTFE stem tip. See catalog for pneumatic actuator ratings.

**Table 48 — U Series Severe-Service
Bellows Valves with Secondary Seals
Class: N/A**

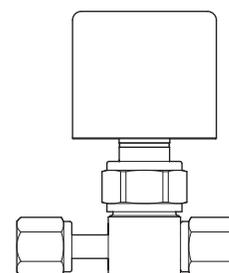
| Series | UW | UG | UK |
|-----------------|------------------------|------|------|
| Material | 316SS | | |
| Temperature, °F | Working pressure, psig | | |
| – 20 to 200 | 2500 | 2500 | 2500 |
| 300 | 2500 | 2500 | — |
| 400 | 2500 | 2500 | — |
| 500 | 2500 | 2500 | — |
| 600 | 2500 | 2500 | — |
| 650 | 2500 | 2500 | — |
| 700 | 2120 | — | — |
| 750 | 1740 | — | — |
| 800 | 1360 | — | — |
| 850 | 980 | — | — |
| 900 | 600 | — | — |
| 950 | 540 | — | — |
| 1000 | 480 | — | — |
| 1050 | 425 | — | — |
| 1100 | 360 | — | — |
| 1150 | 300 | — | — |
| 1200 | 250 | — | — |

Series: **W** suffix designates welded body-to-bellows seal; **G** suffix designates gasketed body-to-bellows seal; **K** suffix designates PCTFE stem insert.

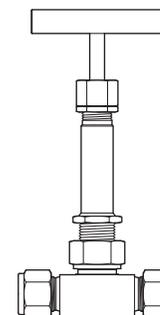
Ratings apply to manual valves and valves with 6 and 8 series pneumatic actuators. Ratings limited to 400°F with TFE stem packing.

UW Series:

- Suggested for applications involving thermal cycling above 650°F.
- High-temperature model required for service above 900°F.
- Ratings can be extended to 1500°F and 50 psig in high-temperature service with self-lubricating fluids such as liquid metals.



HB Series



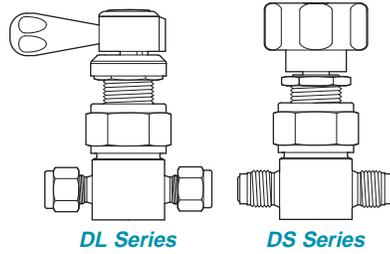
U Series

Ratings apply to *standard* materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.

Diaphragm Valves

See "Packless Valves" subsection in your Swagelok Product Binder

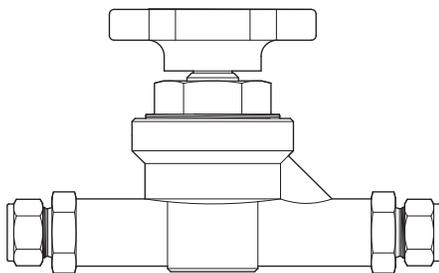
Table 49 — DL and DS Series Multipurpose Diaphragm Valves Class: 1750



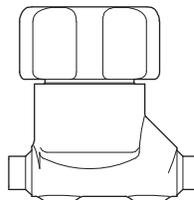
| | |
|------------------------|-------------------------------|
| Material group | 2.3 |
| Material name | 316LSS |
| Temperature, °F | Working pressure, psig |
| - 100 to 100 | 3500 |
| 200 | 2950 |
| 250 | 2800 |
| 300 | 2645 |
| 400 | 2405 |
| 500 | 2225 |
| 600 | 2100 |

Ratings based on optional cobalt-based alloy stem tip. Ratings limited to 250°F max with standard PCTFE stem tip.

**Table 50 — LD and ELD Series Cast-Body Diaphragm Valves
ELD8 Series Forged-Body Diaphragm Valves
ELD Series Isolation Diaphragm Valves
ELD Series Block Diaphragm Valves**



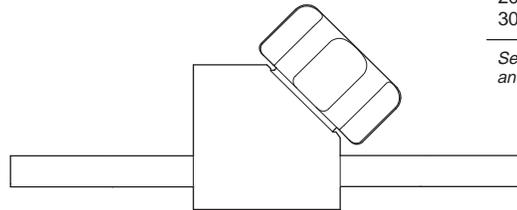
LD16 Series Cast-Body Valve



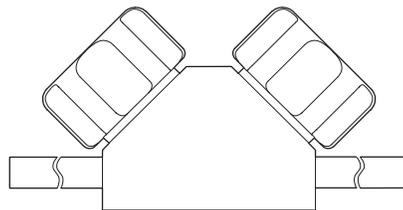
ELD8 Series Forged-Body Valve

| Series Class | LD, ELD 160 | ELD N/A | |
|------------------------|-------------------------------|----------------|---------|
| Material group | 2.2 | N/A | N/A |
| Material name | CF3M | 316LSS | 316LVAR |
| Temperature, °F | Working pressure, psig | | |
| - 20 to 100 | 300 | 300 | |
| 200 | 265 | 255 | |
| 300 | 240 | 230 | |

See your Swagelok representative for ELD forged-body, isolation, and block diaphragm valve catalog information.



ELD8 Series Isolation Valve



ELD8 Series Block Valve

Ratings apply to standard materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.

Diaphragm Valves

See your Swagelok representative for catalog information

**Table 51 — DA Series
Springless Diaphragm Valves
Class: N/A**

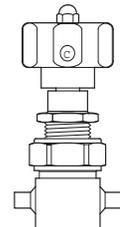
| | |
|------------------------|-------------------------------|
| Material | 316L VAR |
| Temperature, °F | Working pressure, psig |
| - 10 to 150 | 145 |

Ratings apply to manual, toggle-operated (DAT Series), and pneumatically actuated valves. See catalog for pneumatic actuator ratings.

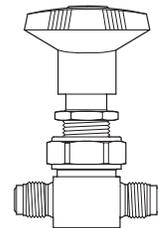
**Table 52 — RD Series Replaceable-Seat
Springless Diaphragm Valves
Class: N/A**

| | |
|------------------------|-------------------------------|
| Material | 316L VAR |
| Temperature, °F | Working pressure, psig |
| - 10 to 150 | 100 |

Ratings apply to manual valves and pneumatically actuated valves. See catalog for pneumatic actuator ratings.



DA Series



RD Series

**Table 53 — DF Series
High-Flow Springless Diaphragm Valves
Class: N/A**

| | | | |
|------------------------|-------------------------------|-------------|-------------|
| Material | 316L VAR | | |
| Series | DF | DF-C | DF-O |
| Temperature, °F | Working pressure, psig | | |
| - 10 to 150 | 300 | 125 | 125 |

Ratings apply to manual valves and pneumatically actuated valves (DF-C and DF-O). See catalog for pneumatic actuator ratings.

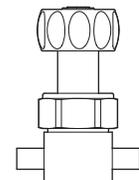
Pneumatic actuators: **C** suffix designates normally closed; **O** suffix designates normally open.

Temperature rating 50 to 270°F with optional Vespel seat.

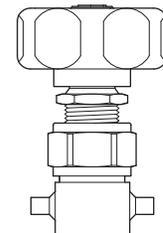
**Table 54 — HD Series
High-Pressure Springless Diaphragm Valves
Class: N/A**

| | | |
|------------------------|-------------------------------|-----------------|
| Material | 316L VAR | |
| Series | Manual, Model I | Model II |
| Temperature, °F | Working pressure, psig | |
| - 10 to 100 | 3045 | 2345 |
| 140 | 2855 | 2345 |

Ratings apply to manual valves and pneumatically actuated valves (Model I and Model II). See catalog for pneumatic actuator ratings.



DF Series

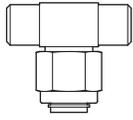


HD Series

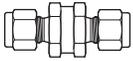
Ratings apply to *standard* materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.

Filters, Flow Sensors

See "Filters/Snubbers" subsection in your Swagelok Product Binder



TF Series



FW Series

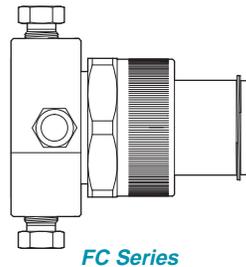


F Series

**Table 55 — TF Series Tee-Type Removable Filters
FW Series All-Welded Filters
F Series Compact In-Line Filters**

| Series Class | TF, FW 2500 | 2F, 4F 1250 | 6F, 8F 1040 | 2F, 4F N/A | TF, 6F, 8F N/A | 2F, 4F 1500 | 6F, 8F 1250 | TF 2500 | 4F 1200 |
|-----------------|------------------------|----------------|----------------|---------------|-------------------|------------------|----------------|-------------|------------|
| Material group | 2.2 | | | N/A | | 3.4 | | 3.8 | |
| Material name | 316SS | | | Brass 360 | | Alloy 400, R-405 | | Alloy C-276 | |
| Temperature, °F | Working pressure, psig | | | | | | | | |
| - 20 to 100 | 6000 | 3000 | 2500 | 3000 | 2000 | 3000 | 2500 | 5000 | 3000 |
| 200 | 5160 | 2580 | 2150 | 2600 | 1730 | 2640 | 2200 | 4400 | 3000 |
| 300 | 4660 | 2330 | 1940 | 2210 | 1470 | 2470 | 2060 | 4120 | 2910 |
| 400 | 4280 | 2140 | 1780 | — | — | 2390 | 1990 | 3980 | 2820 |
| 500 | 3980 | 1990 | 1660 | — | — | 2375 | 1980 | 3960 | 2660 |
| 600 | 3760 | 1880 | 1560 | — | — | — | — | — | 2420 |
| 650 | 3700 | 1845 | 1540 | — | — | — | — | — | 2350 |
| 700 | 3600 | 1800 | 1500 | — | — | — | — | — | 2270 |
| 750 | 3520 | 1760 | 1460 | — | — | — | — | — | 2125 |
| 800 | 3460 | 1725 | 1440 | — | — | — | — | — | 2030 |
| 850 | 3380 | 1690 | 1410 | — | — | — | — | — | — |
| 900 | 3280 | 1640 | 1360 | — | — | — | — | — | — |

TF filter with optional PCTFE gasket: 200°F and 3000 psi max.



FC Series

**Table 56 — FC Series Coalescing Filters
Class: 444**

| | |
|-----------------|------------------------|
| Material group | 2.2 |
| Material name | 316SS |
| Temperature, °F | Working pressure, psig |
| - 20 to 100 | 1000 |
| 150 | 955 |
| 200 | 915 |
| 250 | 870 |
| 300 | 825 |
| 350 | 795 |
| 400 | 760 |

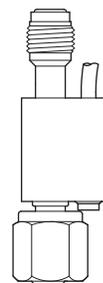
See your Swagelok representative for catalog information.

Ratings apply to *standard* materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.

**Table 57 — FV4 Series Flow Sensors
Class: 2500**

| | |
|-----------------|------------------------|
| Material group | 2.3 |
| Material name | 316LSS |
| Temperature, °F | Working pressure, psig |
| - 40 to 100 | 5000 |
| 175 | 4415 |

See your Swagelok representative for catalog information.



FV4 Series

See “Sample Cylinders/Tube Plugs” subsection in your Swagelok Product Binder

Swagelok HD, 05S, and 50D series sample cylinders conform to U.S. Code of Federal Regulations, Title 49, Department of Transportation (DOT) specifications 3A, 4B, 3E, and exemption E7458. CS and CD series miniature cylinders are not covered by DOT specifications because of their small size. DOT regulations only apply to cylinders used in transportation in the United States; users in other countries should determine whether the cylinders comply with local regulations.

HD, 05S, and 50D series CWP ratings listed first in the table for temperatures up to 100°F are in accordance with DOT specifications; there are no DOT provisions for elevated temperature ratings. The pressure ratings for non-DOT cylinders and the ratings above 100°F are developed from appropriate engineering methods, including the use of the allowable stresses and formulas in the B31 piping codes and BPV Code Section II. Materials are selected from those listed in BPV Code Section VIII and the B31 codes and are purchased in accordance with ASTM specifications. Additional quality and performance requirements are imposed as necessary to meet DOT and Swagelok requirements.

Table 58 — Sample Cylinders
Class: N/A

| Series | 50D | HD | | CS, CD | 05S |
|--------------------------|-------------------------------|--|-----------|--------|--------|
| Material | 316LSS | 316LSS, 304LSS | Alloy 400 | 316SS | 304LSS |
| DOT specification | 3A 5000 | 3E 1800: 316L, all sizes, and 304L, 40 to 500 cm \geq 3A 1800: 304L, 1000 to 3785 cm \geq | E7458 | N/A | 4B 500 |
| Temperature, °F | Working pressure, psig | | | | |
| - 65 to 100 | 5000 | 1800 | 1800 | 1000 | 500 |
| 200 | 3960 | 1360 | 1580 | 840 | 500 |
| 300 | 3570 | 1230 | 1490 | 760 | 500 |
| 400 | 3290 | 1130 | 1430 | 700 | 500 |
| 500 | 3060 | 1050 | 1420 | 650 | 500 |
| 600 | 2920 | 1000 | 1420 | 620 | 500 |
| 650 | 2870 | 980 | 1420 | 610 | 500 |
| 700 | 2810 | 970 | 1420 | 590 | 500 |
| 750 | 2750 | 950 | 1410 | 580 | 500 |
| 800 | 2700 | 930 | — | 570 | 500 |
| 850 | 2640 | — | — | 560 | — |



Sample Cylinder

Ratings limited to 300°F max with TFE internal coating.
Ratings may be limited by individual country government regulations.

Aflas—TM Asahi Glass Co., Ltd.
Kalrez, Vespel—TM DuPont
Grafoil—TM UCAR Carbon Company Inc.
Quad-Ring—TM Quadion Corporation
Swagelok, VCO, VCR—TM Swagelok Marketing Co.

© 1993, 1998 Swagelok Marketing Co.
Printed in U.S.A., MI
September 1998, R0