



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.

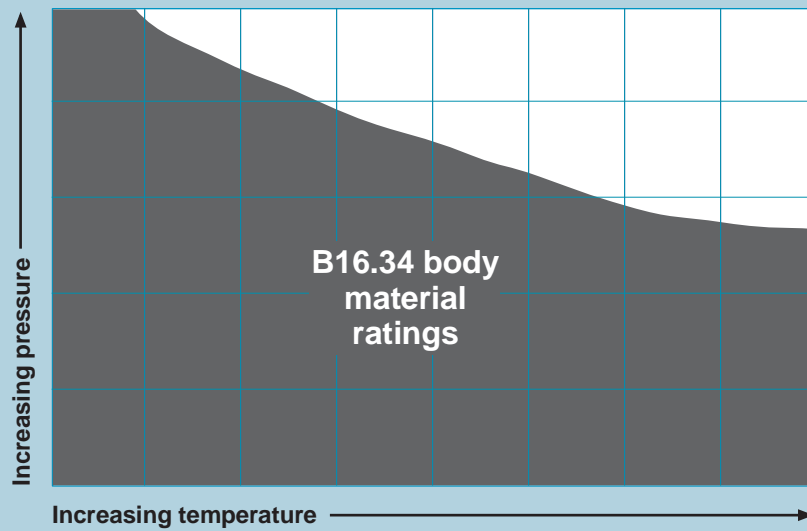
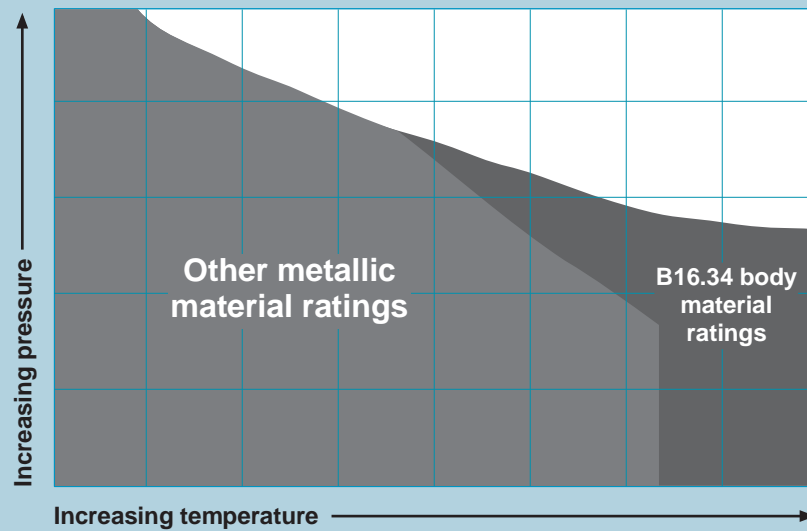
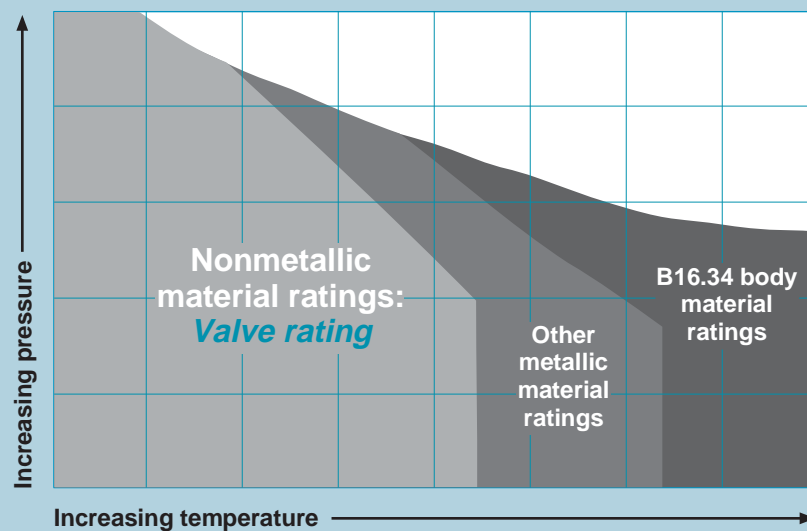


Fig. 1. Valve ratings are based on the B16.34 rating for the body material . . .

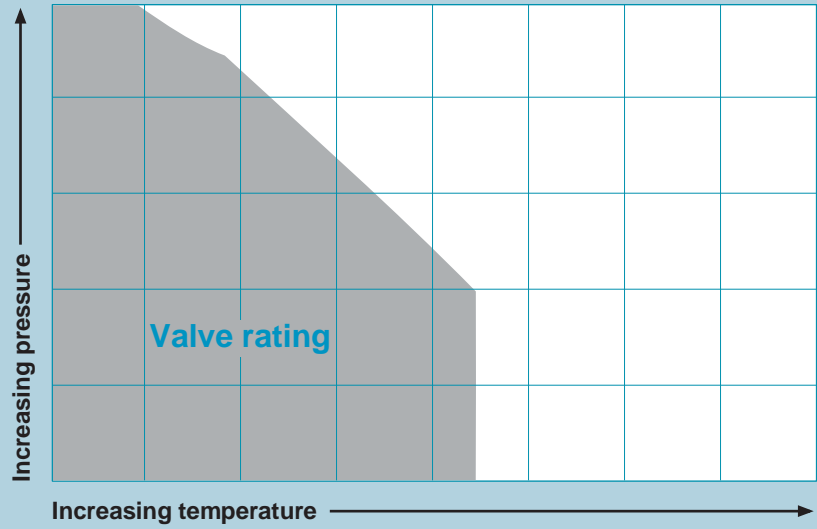


. . . and often are reduced because of temperature effects on other metallic parts . . .

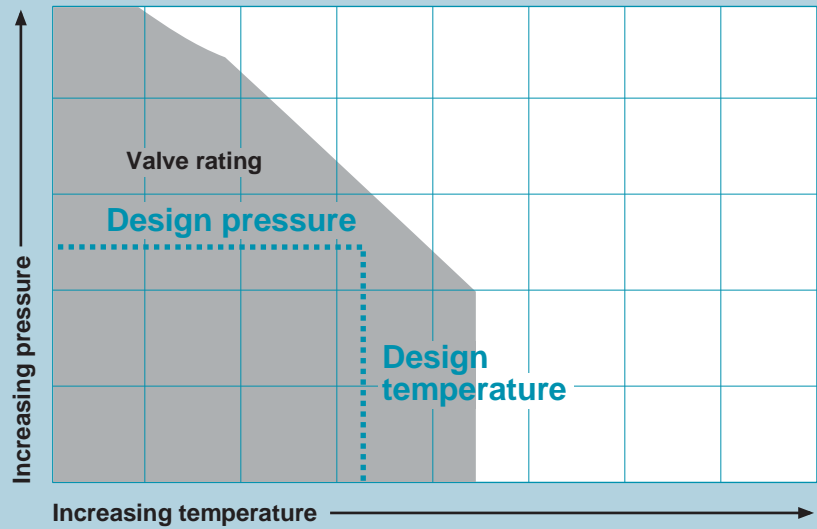


. . . and on nonmetallic parts such as seats or packings—resulting in a valve rating generally equivalent to the rating of the nonmetal.

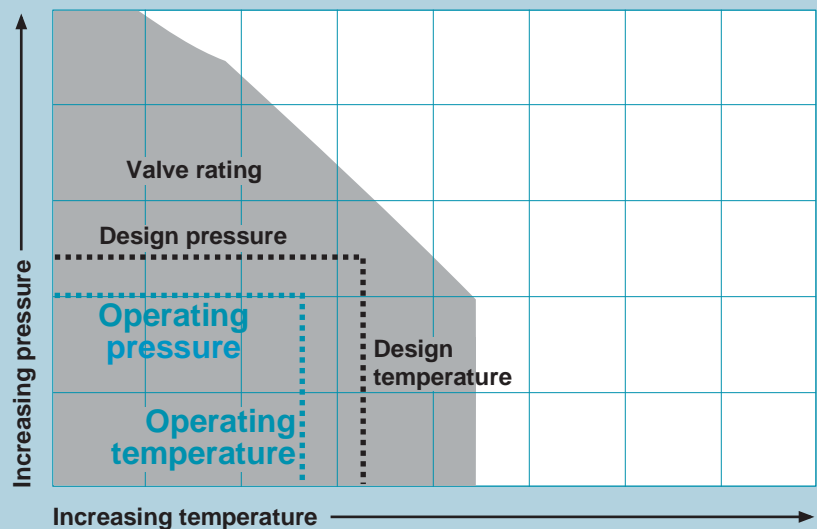
Fig. 2. The pressure-temperature rating of the valve must be equal to or greater than . . .



. . . 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

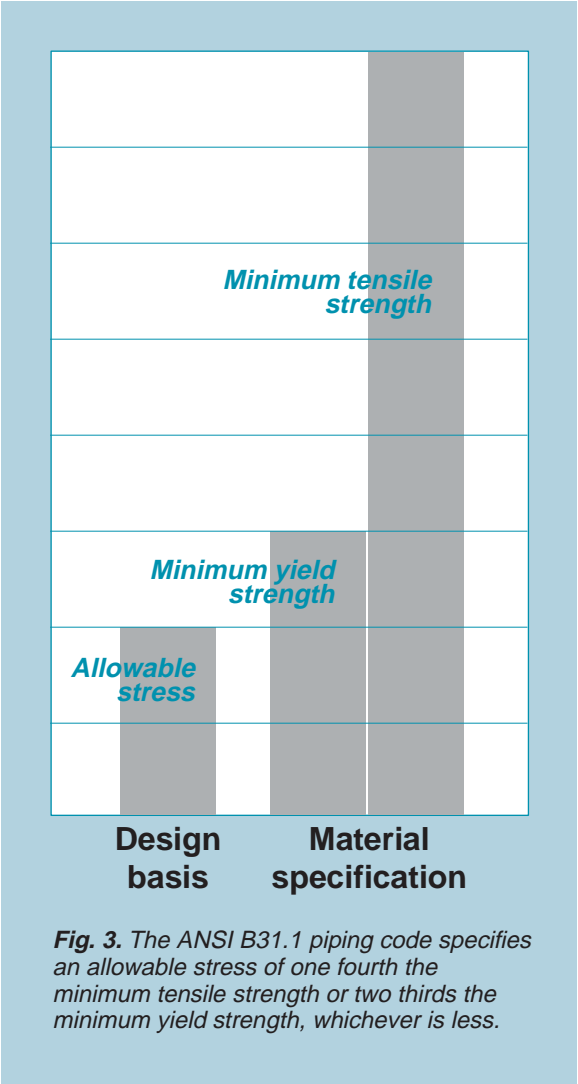
The terms *shell test*, *proof test*, and *hydrostatic test* often are used synonymously. Each refers to a test to check for leaks and verify that there are no structural weaknesses in the valve or system. The component shell test and the system hydrostatic test are done at 1.5 times the CWP or the system 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



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

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

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

Instrument Ball and Plug Valves

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

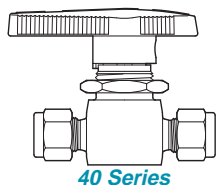


Table 1 — 40 Series Ball Valves
Class: N/A

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.

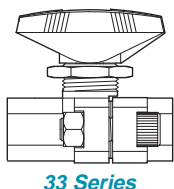


Table 2 — 33 Series Multipurpose Ball Valves
Class: N/A

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.

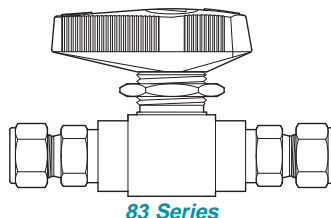


Table 3 — 83 and 83X Series
Multiservice Trunnion Ball Valves
Class: N/A

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.

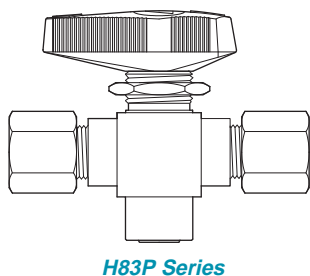


Table 4 — H83P and H83XP Series Multiservice Trunnion Ball Valves
Class: N/A

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.

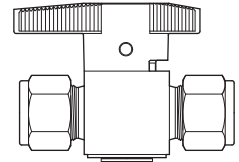
Instrument Ball and Plug Valves

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.

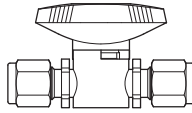


P6T Series

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

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



PFA 43 Series

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.

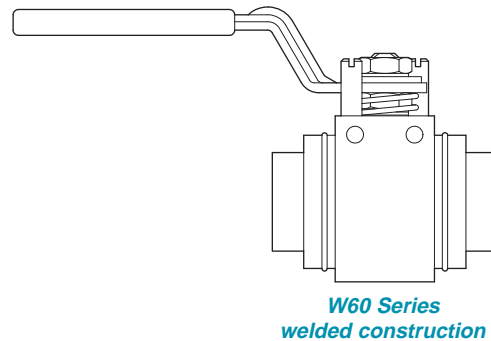
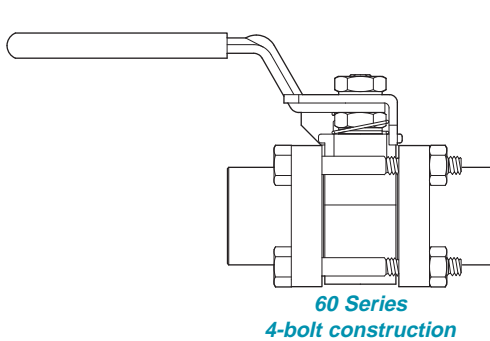


Table 7 — 60T, 60XT, W63T, and W65T Series Manual Ball Valves with Reinforced TFE Seats
Class: N/A

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.

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.

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

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.

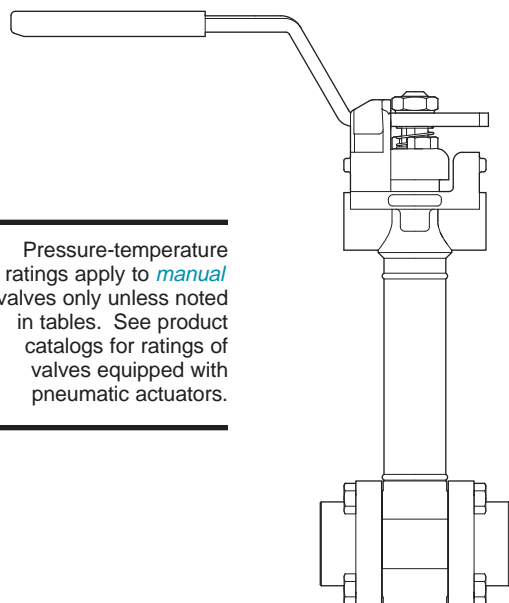
Table 11 — 60C, 60XC, W63C, and W65C Series Manual Ball Valves with Carbon/Glass TFE Seats
Class: N/A

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.

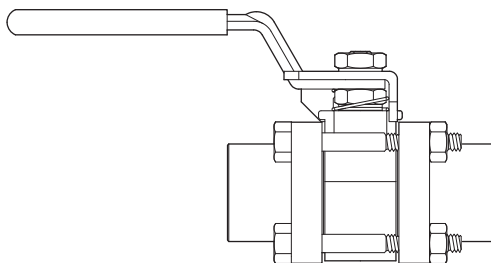
Q60E ratings based on: UHMW-PE seats and packings, PEEK stem bearings, and ethylene propylene O-rings. Stainless steel LQ60E assemblies: temperature limits of – 65 to 250°F at pressures listed.

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.

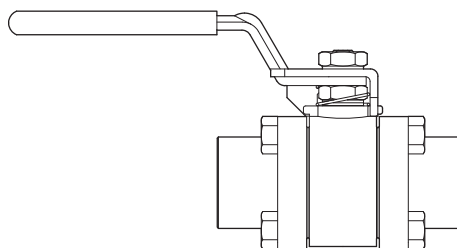
See your Swagelok Process Ball Valves Binder

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.

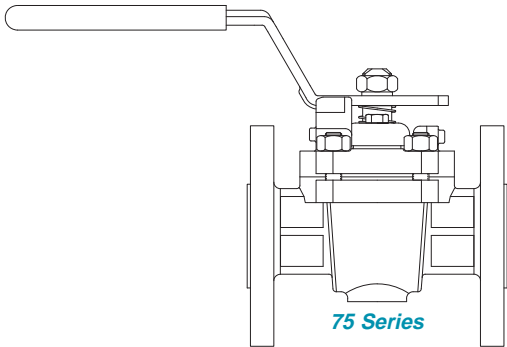


Table 18 — 75 Series
Flange-Ended Ball Valves
Class: 150 (meets ANSI B16.34)

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.

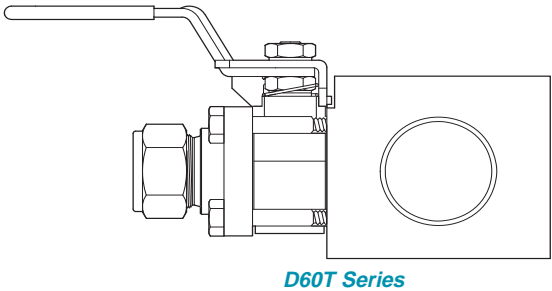
L75 series assemblies: temperature limits of – 65 to 250°F at pressures listed.

[Ⓢ]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.

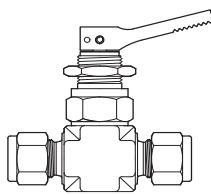


See "Needle Valves" subsection in your Swagelok Product Binder

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.



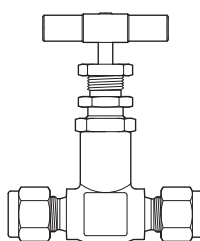
Toggle Valve

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

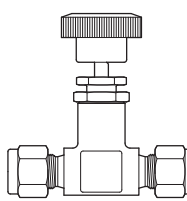
Table 21 — JB Series
Severe-Service Needle Valves
JN Series Screwed-Bonnet Needle Valves

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.



JB Series

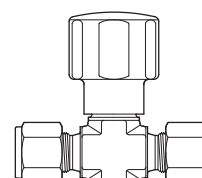


JN Series

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

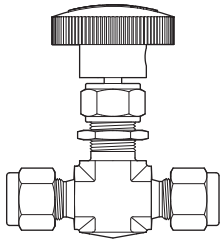
Ratings limited to:
• – 20 to 400°F with fluorocarbon FKM O-rings.
• – 20 to 450°F with Kalrez O-rings.
• – 20 to 250°F with Buna N, silicone, or ethylene propylene O-rings.
• – 65 to 250°F with Buna C O-rings.



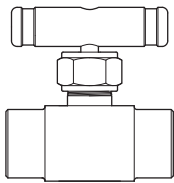
D Series

Needle Valves

See "Needle Valves" subsection in your Swagelok Product Binder



O, 1, and 18 Series



20 and 26 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.

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

Class	2500	N/A		1500
Material group	2.2	N/A	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.

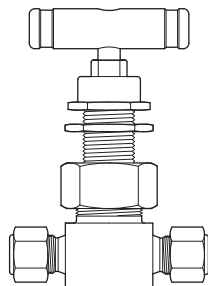
Table 25 — N Series Severe-Service Union-Bonnet Valves
50 Series Lift Check Valves

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	—

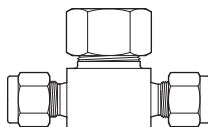
Ratings based on Grafoil packing. Ratings limited to:

- 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.



N Series



50 Series

Needle Valves

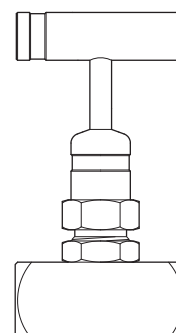
See "Needle Valves" subsection in your Swagelok Product Binder

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

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.



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.

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

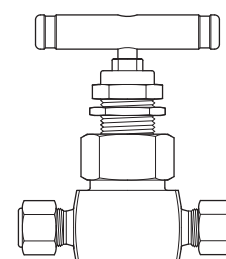
Ratings based on Grafoil packing. Ratings limited to:

- 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.



HN Series

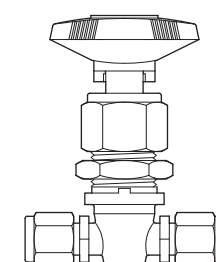
Table 29 — 410, 445, 645, and 945 Series Severe-Service and High-Pressure Needle Valves
Class: N/A

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	—

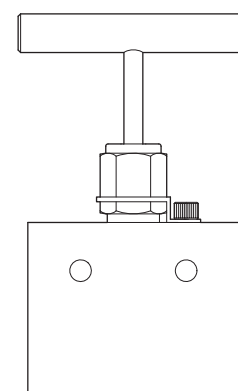
445, 645, 945 series ratings based on glass-filled TFE packing. Ratings with Grafoil packing are equal to 410 series ratings.

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.



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



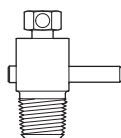
P Series

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.



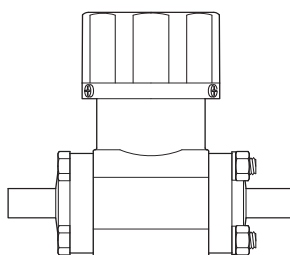
BV Series

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

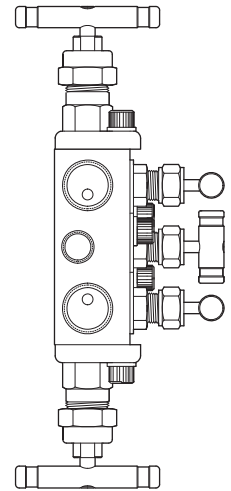
See “Manifolds” subsection in your Swagelok Product Binder

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

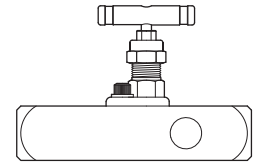
Series	M2, M3, M5, 6P		M2			M3, M5, 6P		
Class	2500		N/A					
Material group	2.2		N/A					
Material name	316SS		316SS					
Seat material	Stainless steel	Stainless steel	PFA	Acetal	PEEK	PFA	Acetal	PEEK
Packing material	TFE	Grafoil	TFE	TFE	PEEK	TFE	TFE	PEEK
Temperature, °F	Working pressure, psig							
– 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.



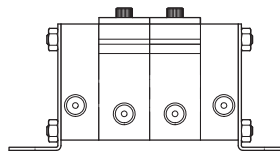
M5 Series



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

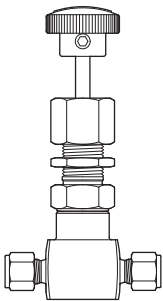
Actuators: **C** designates normally closed; **O** designates normally open; **D** designates double acting; **H** designates high-pressure normally closed.

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



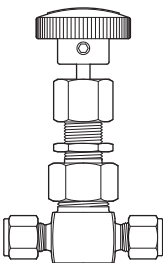
21 Series

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.

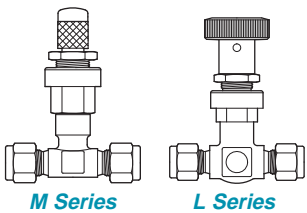


31 Series

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 Material name	2.2 316SS	N/A Brass	1.4 Steel	3.1 Alloy 20	3.4 Alloy R-405	3.5 Alloy 600	3.8 Alloy C-276	N/A Titanium	N/A 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

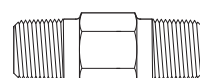
Ratings based on fluorocarbon FKM or Kalrez O-rings. Ratings limited to:

- – 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.

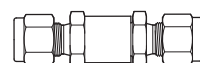
Ratings apply to *standard* materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.



CA Series



**CP Series
CPA Series**



C Series

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

Material group Material name	2.2 316SS	N/A Brass	3.1 Alloy 20	3.4 Alloy R-405	3.5 Alloy 600	3.8 Alloy C-276	N/A 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 Class	CH4, CH8 XS4, XS6, XS8 2500		CH8 XS6, XS8 N/A	CH16 2080	
	Material group Material name	2.2 316SS	3.4 Alloy R-405	1.4 Steel	2.2 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

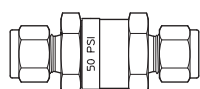
Ratings based on fluorocarbon FKM O-rings. Ratings limited to:

- – 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.

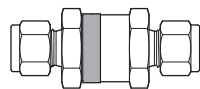
**Table 41 — CW Series All-Welded Check Valves
Class: 1500**

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

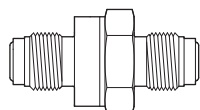
See your Swagelok representative for catalog information.



CH Series



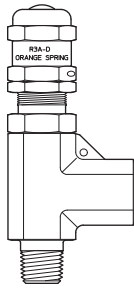
XS Series



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:

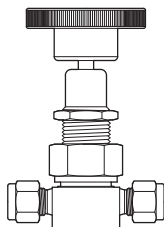
- 10 to 300°F with fluorocarbon FKM O-rings.
- 0 to 200°F with Buna N O-rings.
- – 30 to 300°F with neoprene O-rings.
- – 40 to 300°F with ethylene propylene O-rings.

R4 Series ratings limited to:

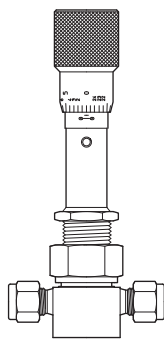
- 50 to 300°F with fluorocarbon FKM O-rings.
- 50 to 250°F with Buna N, neoprene, or ethylene propylene O-rings.

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	N/A	N/A	HK	HK
Up to 200			300	300

Manual valve low-temperature ratings:

- – 40°F for brass and alloy 400.
- – 80°F for 316SS.

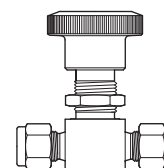
**Table 46 — BN Series Bellows Valves
for High-Purity Systems
Class: N/A**

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

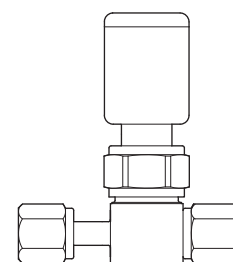
Ratings apply to manual valves and pneumatically actuated valves (BN-C and BN-O). See catalog for pneumatic actuator ratings.

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**

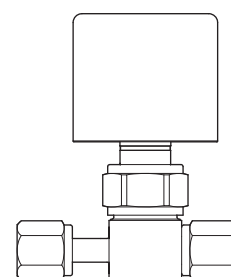
Series	UW	UG	UK
Material	316SS		
Temperature, °F	Working pressure, psig		
– 20 to 200	2500	2500	2500
300	2500	2500	—
400	2500	2500	—
500	2500	2500	—
600	2500	2500	—
650	2500	2500	—
700	2120	—	—
750	1740	—	—
800	1360	—	—
850	980	—	—
900	600	—	—
950	540	—	—
1000	480	—	—
1050	425	—	—
1100	360	—	—
1150	300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

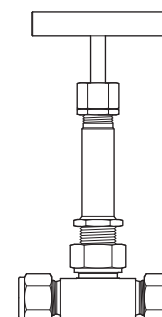
Ratings apply to manual valves and valves with 6 and 8 series pneumatic actuators. Ratings limited to 400°F with TFE stem packing.

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

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

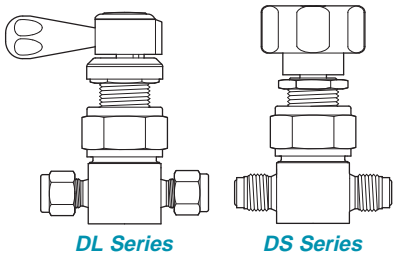


Table 49 — DL and DS Series Multipurpose Diaphragm Valves Class: 1750

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.

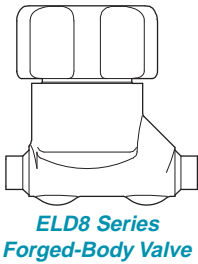
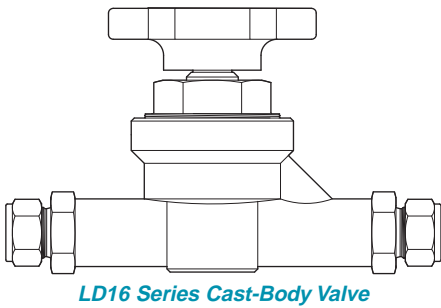
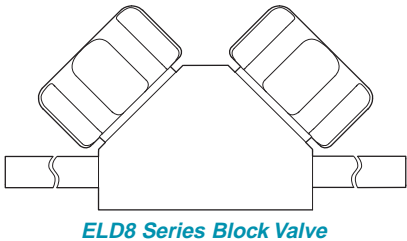
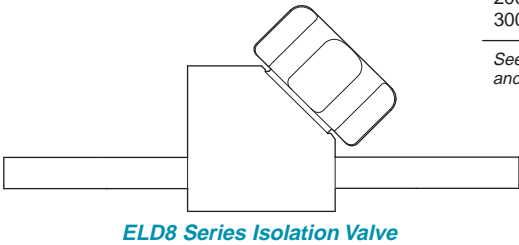


Table 50 — LD and ELD Series Cast-Body Diaphragm Valves ELD8 Series Forged-Body Diaphragm Valves ELD Series Isolation Diaphragm Valves ELD Series Block Diaphragm Valves

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.



Diaphragm Valves

See your Swagelok representative for catalog information

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

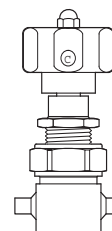
Material	316L VAR
Temperature, °F	Working pressure, psig
– 10 to 150	145

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

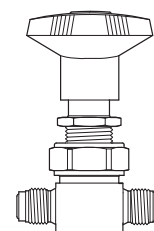
**Table 52 — RD Series Replaceable-Seat
Springless Diaphragm Valves
Class: N/A**

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.

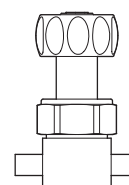
Pneumatic actuators: **C** suffix designates normally closed; **O** suffix designates normally open.

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

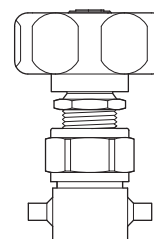
**Table 54 — HD Series
High-Pressure Springless Diaphragm Valves
Class: N/A**

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

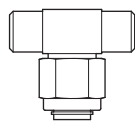


HD Series

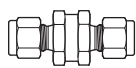
Ratings apply to **standard** materials and constructions. Changes in materials, lubricants, construction, or accessories may change ratings.

Filters, Flow Sensors

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



TF Series



FW Series

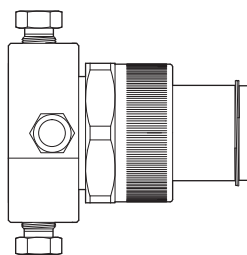


F Series

**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**

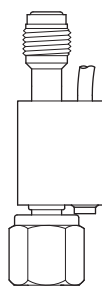
Material group	2.2
Material name	316SS
Temperature, °F	Working pressure, psig
– 20 to 100	1000
150	955
200	915
250	870
300	825
350	795
400	760

See your Swagelok representative for catalog information.

**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

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

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≥ 3A 1800: 304L, 1000 to 3785 cm≥	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	—

Ratings limited to 300°F max with TFE internal coating.

Ratings may be limited by individual country government regulations.



Sample Cylinder

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