INSTALLATION, OPERATION AND MAINTENANCE MANUAL

19000 Series Consolidated® Safety Relief Valve

Series types include the following design options:

- *O-Ring Seat Seal (DA)*
- *19096M-DA-BP*

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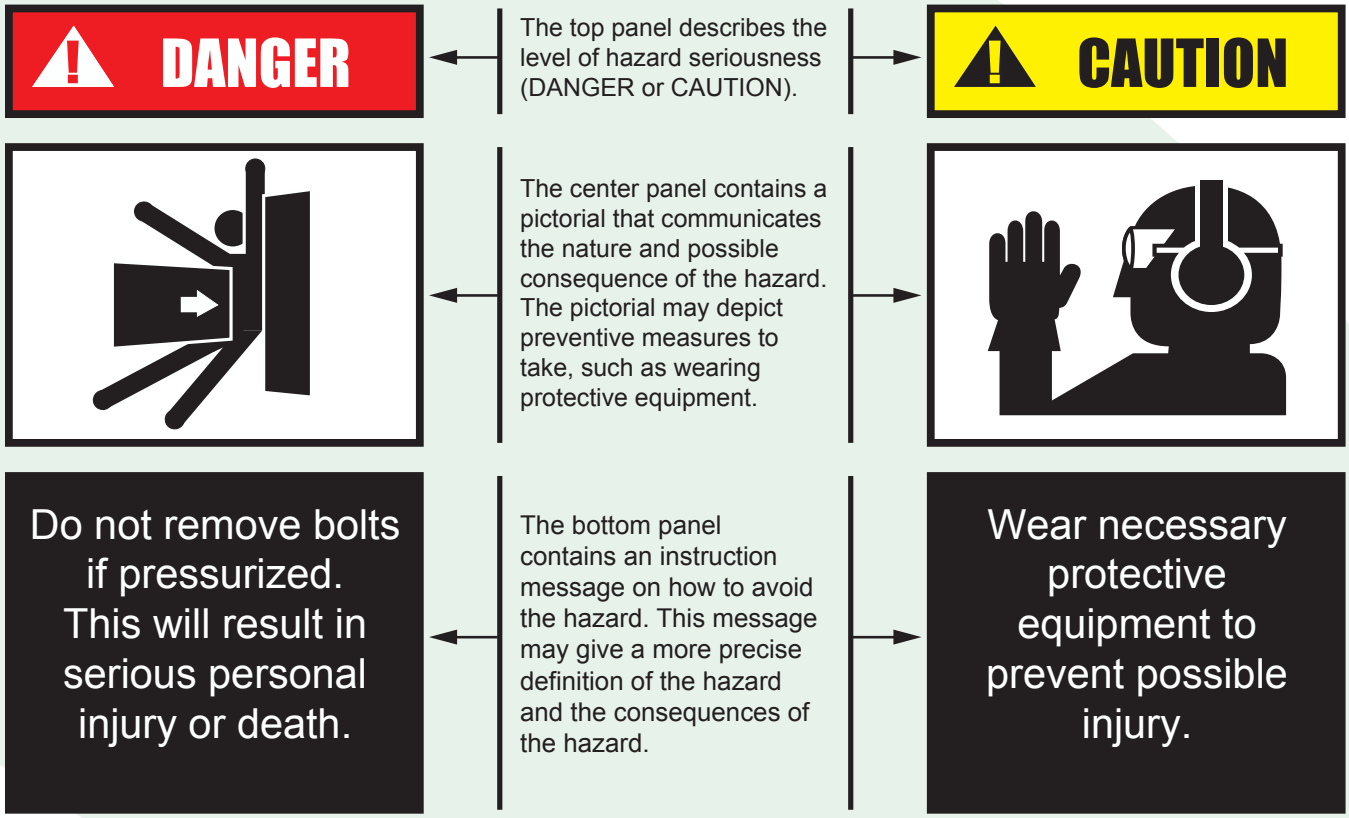
Safety Sign and Label System

Appropriate safety labels have been included in the practices and procedures throughout this manual. The labels communicate:

- Level of hazard seriousness
- Nature of the hazard
- Consequence of human or product interaction with the hazard
- Instructions on how to avoid the hazard



ATTENTION! labels are horizontal bands describing special situations and issues that could potentially damage the SRV.

ATTENTION!

Exercise care when inserting a rod or pipe in the outlet. Ensure the valve nozzle is not damaged during the operation.

NOTE:

Any service questions not covered in this manual should be referred to Dresser Consolidated Field Service Department, Phone + (1) (318) 640-6055.

In addition, you can contact your local Green Tag® Center or Dresser Consolidated authorized sales representative (contact information can be found on pages 44 & 45).

Safety Alerts! Read – Understand – Practice

Danger Alerts

A DANGER alert describes actions that may cause severe personal injury or death. In addition, it may provide preventive measures to avoid severe personal injury or death.

DANGER alerts are not all-inclusive. Dresser Consolidated cannot know all conceivable service methods nor evaluate all potential hazards. Some dangers are listed below:

- High temperature/pressure can cause injury. Ensure all system pressure is absent before repairing or removing valves.
- Do not stand in front of a valve outlet when discharging. STAND CLEAR OF VALVE to avoid exposure to trapped, corrosive media.
- Exercise extreme caution when inspecting a pressure relief valve for leakage.
- Allow the system to cool to room temperature before cleaning, servicing or repairing. Hot components or fluids can cause severe personal injury or death.
- Always read and comply with safety labels on all containers. Do not remove or deface container labels. Improper handling or misuse could result in severe personal injury or death.
- Never use pressurized fluids/gas/air to clean clothing or body parts. Never use body parts to check for leaks, flow rates or areas. Pressurized fluids/gas/air injected into or near the body can cause severe personal injury or death.
- It is the owner's responsibility to specify and provide protective wear to protect persons from pressurized or heated parts. Contact with pressurized or heated parts can result in severe personal injury or death.
- Do not work or allow anyone under the influence of intoxicants or narcotics to work on or around pressurized systems. Workers under the influence of intoxicants or narcotics are a hazard to themselves and other employees. Actions taken by an intoxicated employee can result in severe personal injury or death to themselves or others.
- Always perform correct service and repair. Incorrect service and repair can result in product or property damage or severe personal injury or death.
- Always use the correct tool for a job. The misuse of a tool or the use of an improper tool can result in personal injury, damage to product or property.
- Ensure the proper "health physics" procedures are followed, if applicable, before starting operation in a radioactive environment.

Caution Alerts

CAUTION alerts describe actions that may result in a personal injury. In addition, they may describe preventive measures that must be taken to avoid personal injury. Some caution alerts are listed below.

- Heed all service manual warnings. Read installation instructions before installing valve(s).
- Wear hearing protection when testing or operating valves.
- Wear appropriate eye and clothing protection.
- Wear protective breathing apparatus to protect against toxic media.

Terminology for Safety Relief Valves (SRV)

- **Accumulation**—the pressure increase over the maximum allowable working pressure of the vessel during discharge through the SRV, expressed as a percentage of that pressure or in actual pressure units.
- **Backpressure**—the pressure on the discharge side of the SRV:
  - **Built-up Backpressure**—the pressure that develops at the valve outlet, after the SRV has been opened, as a result of flow.
  - **Superimposed Backpressure**—the pressure in the discharge header before the SRV is opened.
  - **Constant Backpressure**—the superimposed backpressure that is constant with time.
  - **Variable Backpressure**—the superimposed backpressure that varies with time.
- **Blowdown**—the difference between set pressure and re-seating pressure of the SRV, expressed as a percentage of the set pressure or in actual pressure units.
- **Cold Differential Test Pressure**—the pressure at which the valve is adjusted to open on the test stand. This pressure includes the corrections for backpressure and/or temperature service conditions.
- **Differential Between Operating and Set Pressures**—Valves installed in process services will generally give best results if the operating pressure does not exceed 90% of the set pressure. However, on pump and compressor discharge lines, the differential required between the operating and set pressures may be greater because of pressure pulsations coming from a reciprocating piston. The valve should be set as far above the operating pressure as possible.
- **Lift**—the actual travel of the disc away from the closed position when a valve is relieving.
- **Maximum Allowable Working Pressure**—the maximum gauge pressure permissible in a vessel at a designated temperature. A vessel may not be operated above this pressure, or its equivalent, at any metal temperature other than that used in its design. Consequently, for that metal temperature, it is the highest pressure at which the primary pressure SRV is set to open.
- **Operating Pressure**—the gauge pressure to which the vessel is normally subjected in service. A suitable margin is provided between operating pressure and maximum allowable working pressure. For reliability of the valve, the operating pressure should be at least 10% under the maximum allowable working pressure or 5 psi (.34 bar), whichever is greater.
- **Overpressure**—a pressure increase over the set pressure of the primary relieving device. Overpressure is similar to accumulation when the relieving device is set at the maximum allowable working pressure of the vessel. Normally, overpressure is expressed as a percentage of set pressure.
- **Rated Capacity**—the percentage of measured flow at an authorized percent overpressure permitted by the applicable code. Rated capacity is generally expressed in pounds per hour (lb/hr) for vapors, standard cubic feet per minute (SCFM) or m^3/min for gases, and in gallons per minute (GPM) for liquids.
- **Relief Valve**—an automatic pressure-relieving device, actuated by static pressure upstream from the valve. A relief valve is used primarily for liquid service.
- **Safety Relief Valve (SRV)**—an automatic pressure-relieving device used as either a safety or relief valve, depending upon application. The SRV is used to protect personnel and equipment by preventing excessive overpressure.
- **Safety Valve**—an automatic pressure-relieving device actuated by the static pressure upstream of the valve and characterized by a rapid opening or “pop” action. It is used for steam, gas or vapor service.
- **Set Pressure**—the gauge pressure at the valve inlet for which the relief valve has been adjusted to open under service conditions. In liquid service, the inlet pressure at which the valve starts to discharge determines set pressure. In gas or vapor service, the inlet pressure at which the valve pops determines the set pressure.
- **Simmer**—the audible passage of a gas or vapor across the seating surfaces just before “pop.” The difference between this start-to-open pressure and the set pressure is called “simmer.” Simmer is generally expressed as a percentage of set pressure.

Introduction

The Consolidated® Series 19000 portable pressure relief valves are designed to meet ASME Section VIII requirements for fixed blowdown pressure relief valves and liquid relief valves. They may be used for various media such as air, liquids, process steam and hydrocarbons and may serve as either a safety valve or a relief valve, depending upon the application.

Design Features and Nomenclature

General Information

The Series 19000 portable safety relief valve has 316 stainless steel trim as standard material. Reliable performance and easy maintenance procedures are characteristics of this valve, when properly installed in suitable applications for its design.

The 19000 Series SRV has three pressure classes—19000L 5-290 psig, 19000M 291-2000 psig and 19000H 2001 psig and up. Standard 19000 parts are used for both liquid applications and gas applications. It is designed for short blowdown on all types of media, typically less than 10%.

All 19000 Series safety relief valves have fixed blowdown. This means that the parts are designed so that there is no blowdown adjustment required when setting or testing the valve.

Design Options

O-Ring Seat Seal Valves
All 19000 Series Valves are available with an O-Ring seat seal as a design option. This optional design is bubble tight at 97% of set pressures over 100 psig, in order to meet application requirements beyond the normal capabilities of metal to metal seat valves. Consolidated Series 19000 Valves with the O-Ring seat seal option are identified by the suffix DA. (See Table X on page 31.)

Lifting Levers, Caps and Gags
All 19000 Series Valves are designed so that field conversion from the standard screwed cap to a plain lifting lever cap, or to a packed lifting lever cap (or vice versa), does not require valve disassembly or resetting. The lifting lever option is designed to open the valve at 75% of the valve set pressure, in compliance with ASME Code Section VIII. Further, all available 19000 Series Valve caps may be equipped with a gag upon customer request.

Inlet/Outlet Connections
All 19000 Series Valves can be provided by Dresser Consolidated with flanged, or socket weld inlet and outlet connections, upon customer request.

Nomenclature

Applicable valve nomenclature for Types 19000 Male and Female inlet configurations are illustrated in Figures 1 through 3. Relevant parts nomenclature for optional lifting levers, caps and the gag, as applicable, is provided in Figures 4 through 7.

Design Features and Nomenclature

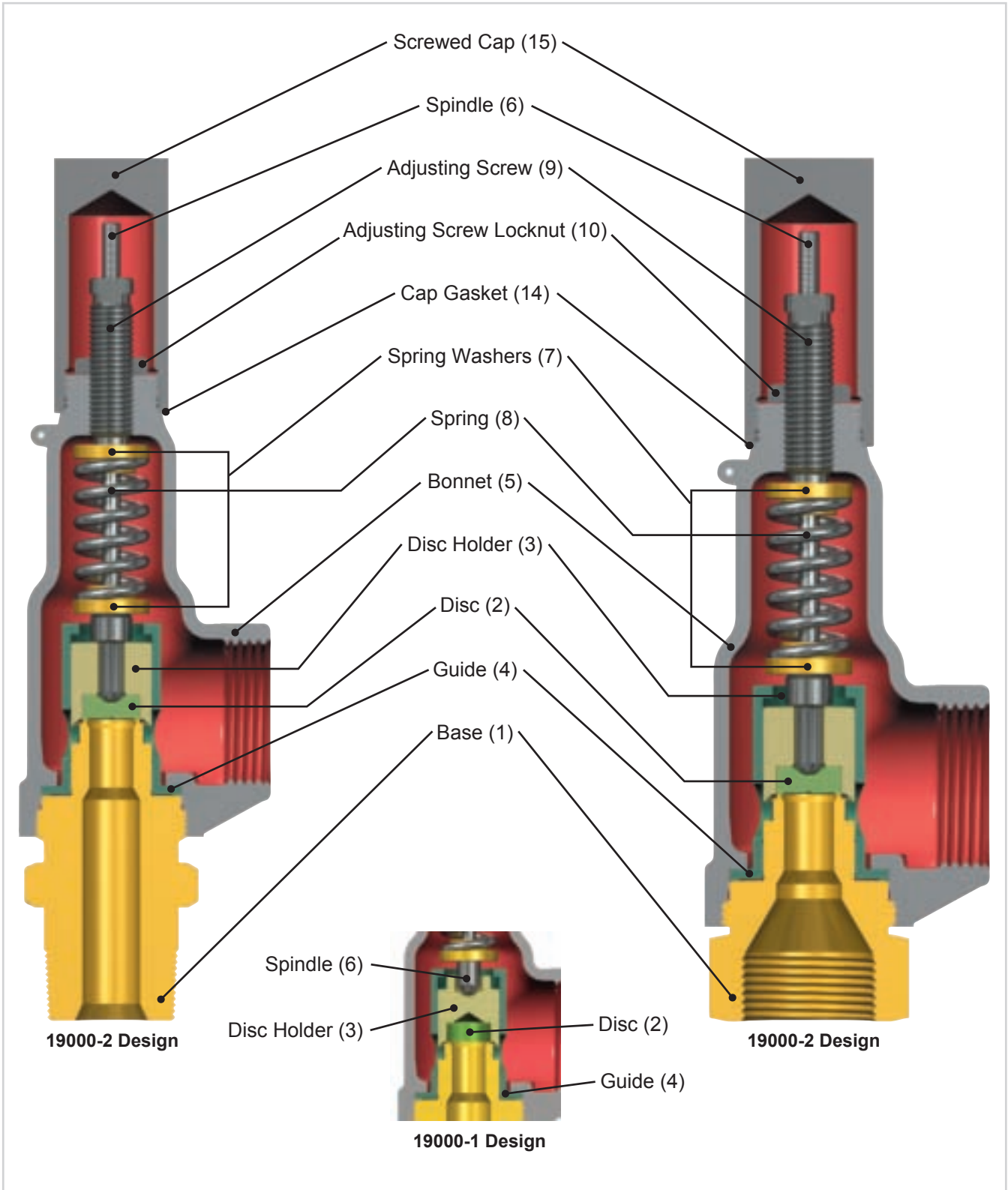


Figure 1 – Metal Seat (MS) Valves (Male NPT Inlet)

19096L, 19110L, 19126L, 19226L, 19096M, 19110M, 19126M and 19226M

Figure 2 – Metal Seat (MS) Valves (Female NPT Inlet)

19096L, 19110L, 19126L, 19226L, 19357L, 19567L, 19096M, 19110M, 19126M, 19226M, 19357M, 19567M, 19096H, 19110H, 19126H and 19226H

Design Features and Nomenclature (continued)

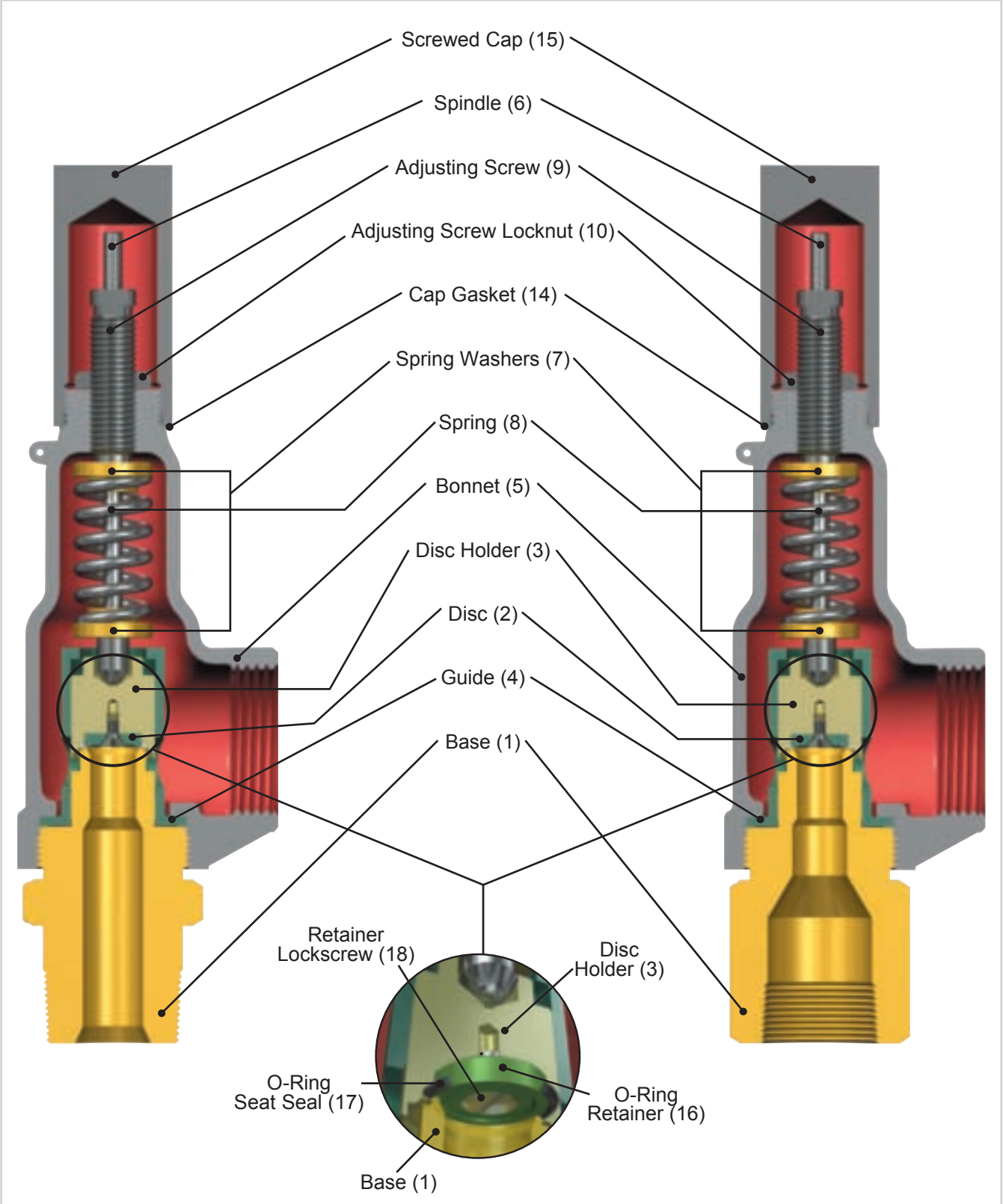


Figure 3 – O-Ring Soft Seat (DA) Valves

Types 19000-DA

Design Features and Nomenclature (continued)

Figure 4
Typical Cap with Gag

Both the standard screwed cap and the optional caps can be provided with a gag, if required.

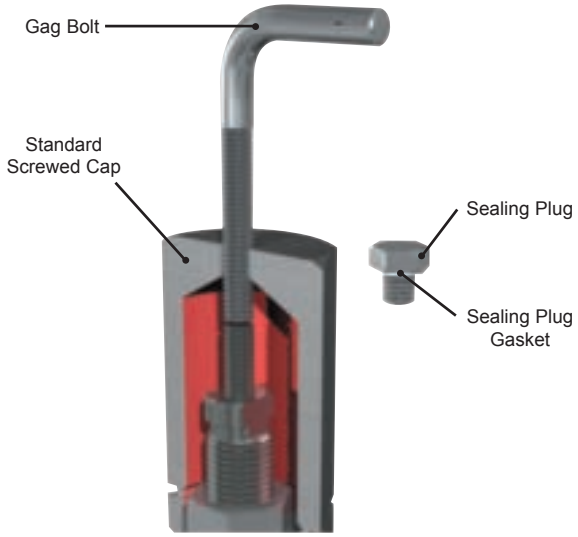


Figure 5
Packed Cap with Lifting Lever*

For types 19096L, 19096M, 19096H, 19110H, 19110L, 19110M, 19126L, 19126M, 19226L and 19226M.

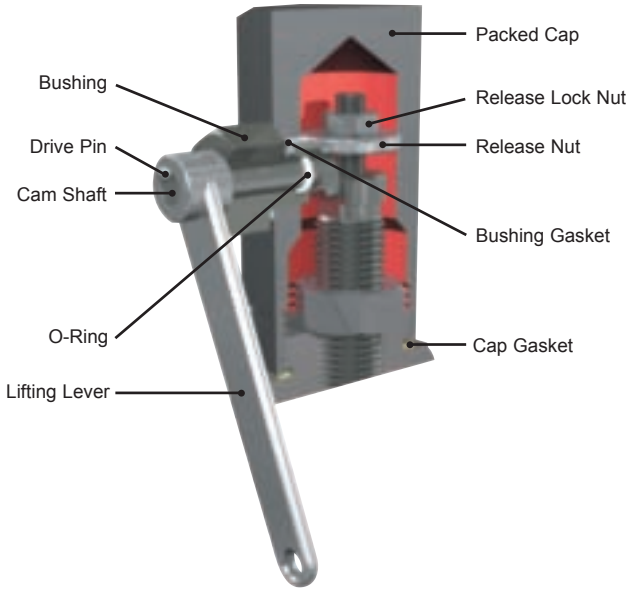


Figure 6
Packed Cap with Lifting Lever*

For types 19126H, 19226H, 19357L, 19357M, 19567L and 19567M.

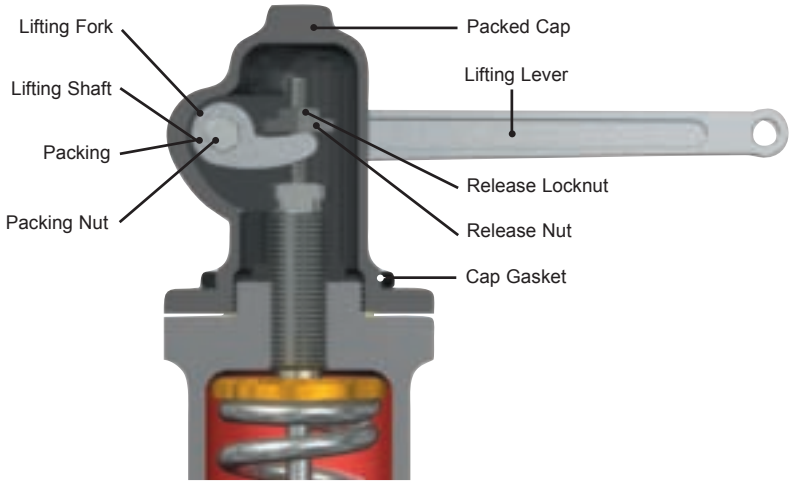
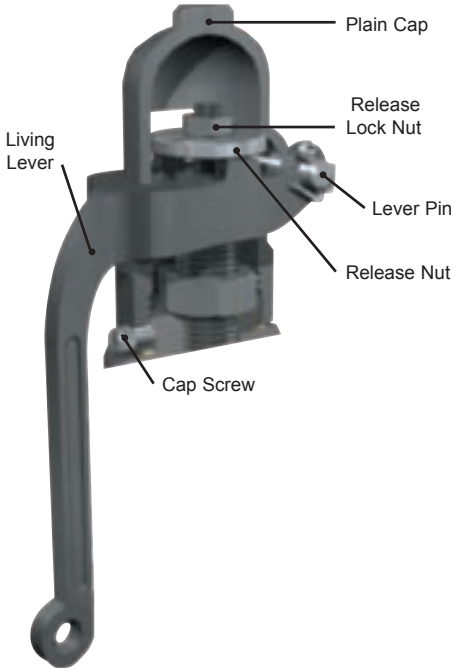


Figure 7
Plain Cap with Lifting Lever*

For all series 19000 valves.



**Can be provided with a gag.*

Handling, Storage and Pre-Installation

Handling

Valves should not be shipped with the inlet flange down. These valves should be kept in their factory foam-filled carton until installation.

ATTENTION!

Never lift the valve by the lifting lever.

ATTENTION!

Handle carefully. Do not drop or strike the valve.

Do not subject SRVs, either crated or uncrated, to sharp impact. Ensure that the valve is not bumped or dropped during loading or unloading. While hoisting the valve, take care to prevent bumping the valve against steel structures and other objects. Particular care needs to be taken when handling screwed/portable valves to avoid damage to external inlet threads.

ATTENTION!

Prevent dust and debris from entering inlet or outlet of the valve.

Storage

Store SRVs in a dry environment and protect them from the weather. Do not remove the valve from the skids or crates until immediately before installation.

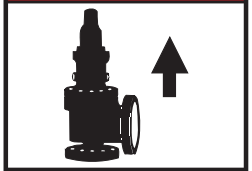
Do not remove flange protectors and seating plugs until the valve is ready to be bolted into place during the installation.

Screwed/portable valves should be kept in their factory foam-filled carton until installation to avoid damage to external inlet threads.

Pre-Installation

When SRVs are uncrated and the flange protectors or sealing plugs are removed, exercise meticulous care to prevent dirt and other foreign materials from entering the inlet and outlet ports while bolting the valve in place.

DANGER



Mount safety relief valves in a vertical, upright position only.

DANGER

Do not mount valve at the end of pipe through which there is normally no flow or near elbows, tees, bends, etc.

CAUTION

Heed all service manual warnings. Read installation instructions before installing valve(s).

Recommended Installation Practices

Mounting Position

Mount SRVs in a vertical (upright) position (in accordance with API RP 530 Part II). Installing a safety relief valve in any position other than vertical (±1 degree) will adversely affect its operation as a result of the induced misalignment of moving parts.

A stop valve may be placed between the pressure vessel and its relief valve only as permitted by code regulations. If a stop valve is located between the pressure vessel and SRV, the stop valve port area should equal or exceed the nominal internal area associated with the pipe size of the SRV inlet. The pressure drop from the vessel to the SRV shall not exceed 3% of the valve's set pressure when flowing at full capacity.

The threaded inlet and outlet ports and sealing faces of the valve and all connecting piping must be free from dirt, sediment and scale.

Ensure all flange bolts are drawn evenly to prevent distortion of the valve body and the inlet nozzle.

In the case of screwed/portable valves, use caution to avoid unscrewing bonnet from the base; if a pipe wrench is used to install or remove the base, ensure that the wrench is placed on the flats of the base and not on the bonnet. If the bonnet/base joint is broken, the valve should be retested to insure proper set pressure and function of the valve.

Position SRVs for easy access and/or removal so that servicing can be properly performed. Ensure sufficient working space is provided around and above the valve.

Inlet Piping

The inlet piping (see Figure 8) to the valve should be short and directly from the vessel or equipment being protected. The radius of the connection to the vessel should permit smooth flow to the valve. Avoid sharp corners. If this is not practical, then the inlet should be at least one additional pipe diameter larger.

The pressure drop from the vessel to the valve shall not exceed 3% of valve set pressure when the valve is allowing full capacity flow. The inlet piping must never be smaller in diameter than the inlet connection of the valve. Excessive pressure drop in gas, vapor or flashing-liquid service at the inlet of the SRV will cause the extremely rapid opening and closing of the valve, which is known as "chattering." Chattering will result in lowered capacity and damage to the seating surfaces. The most desirable installation is that in which the nominal size of the inlet piping is the same as, or greater than, the nominal size of the valve inlet and in which the length does not exceed the face-to-face dimensions of a standard tee of the required pressure class.

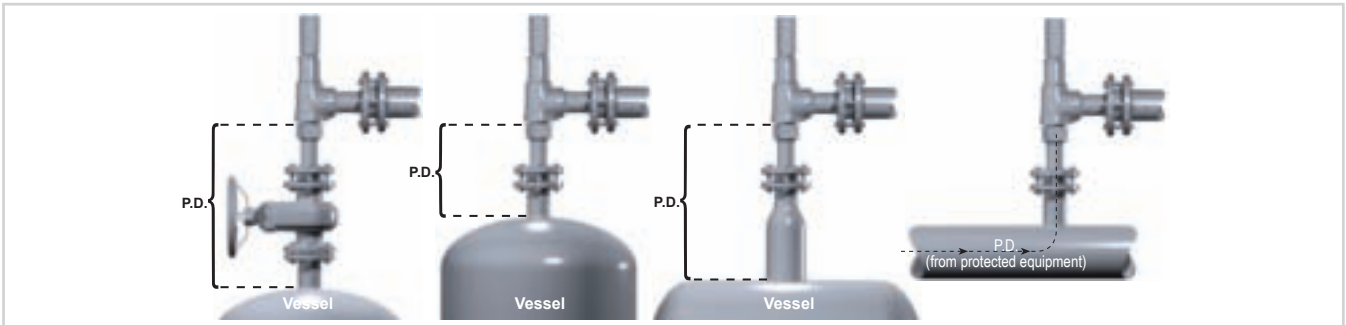


Figure 8

The pressure drop (P.D.) between the source of pressure in the protected equipment and the pressure relief valve inlet is not to exceed 3% of the valve set pressure.

Do not locate SRV inlets where excessive turbulence is present, such as near elbows, tees, bends, orifice plates or throttling valves.

Section VIII of the ASME Boiler and Pressure Vessel Code requires the inlet connection design to consider stress conditions during valve operation caused by external loading, vibration and loads due to thermal expansion of the discharge piping.

The determination of reaction forces during valve discharge is the responsibility of the vessel and/or piping designer. Dresser Consolidated publishes certain technical information about reaction forces under various fluid flow conditions, but assumes no liability for the calculations and design of the inlet piping.

External loading, by poorly designed discharge piping and support systems, and forced alignment of discharge piping can cause excessive stresses and distortions in the valve as well as the inlet piping. The stresses in the valve may cause a malfunction or leak. Therefore, discharge piping must be independently supported and carefully aligned.

Vibrations in the inlet piping systems may cause valve seat leakage and/or fatigue failure. These vibrations may cause the disc seat to slide back and forth across the nozzle seat and may result in damage to the seating surfaces. Also, vibration may cause separation of the seating surfaces and premature wear to valve parts. Low-frequency vibrations are more detrimental to SRV tightness than high-frequency vibrations. This effect can be minimized by providing a larger difference between the operating pressure of the system and the set pressure of the valve, particularly under high frequency conditions.

Temperature changes in the discharge piping may be caused by fluid flowing from the discharge of the valve or by prolonged exposure to the sun or heat radiated from nearby equipment. A change in the discharge piping temperature will cause a change in the length of the piping, which may cause stresses to be transmitted to the SRV and its inlet piping. Proper support, anchoring or provision for flexibility of the discharge piping can prevent stresses caused by thermal changes. Do not use fixed supports.

Outlet Piping

Alignment of the internal parts of the SRV is important to ensure proper operation (see Figure 9). Although the valve body will withstand a considerable mechanical load, unsupported discharge piping consisting of more than a companion flange (for flange outlet valves), long-radius elbow and a short vertical pipe is not recommended. Use spring supports to connect outlet piping to aid in preventing thermal expansion from creating strains on the valve. The discharge piping should be designed to allow for vessel expansion as well as expansion of the discharge pipe itself. These design issues are particularly important on long distance lines.

A continual oscillation of the discharge piping (wind loads) may induce stress distortion in the valve body. The resultant movement of the valve's internal parts may cause leakage.

Where possible, use properly supported drainage piping to prevent the collection of water or corrosive liquid in the valve body.

When two or more valves are piped to discharge into a common header, the built-up backpressure resulting from the opening of one (or more) valve(s) may cause a superimposed backpressure in the remaining valves. Under these conditions, the use of the 19096-DA-BP model is recommended (see page 33).

In every case, the nominal discharge pipe size must be at least as large as the nominal size of the SRV outlet flange. In the case of long discharge piping, the nominal discharge pipe size must sometimes be much larger.

As a final point, the discharge piping size is never less than the size of the valve outlet, nor heavier than schedule 40 pipe size. In addition, the discharge piping must be designed to limit the total backpressure to a maximum of 10% of the valve set pressure, or 400 psi, whichever is smaller.

ATTENTION!

Undersized discharge piping could create built-up backpressure.

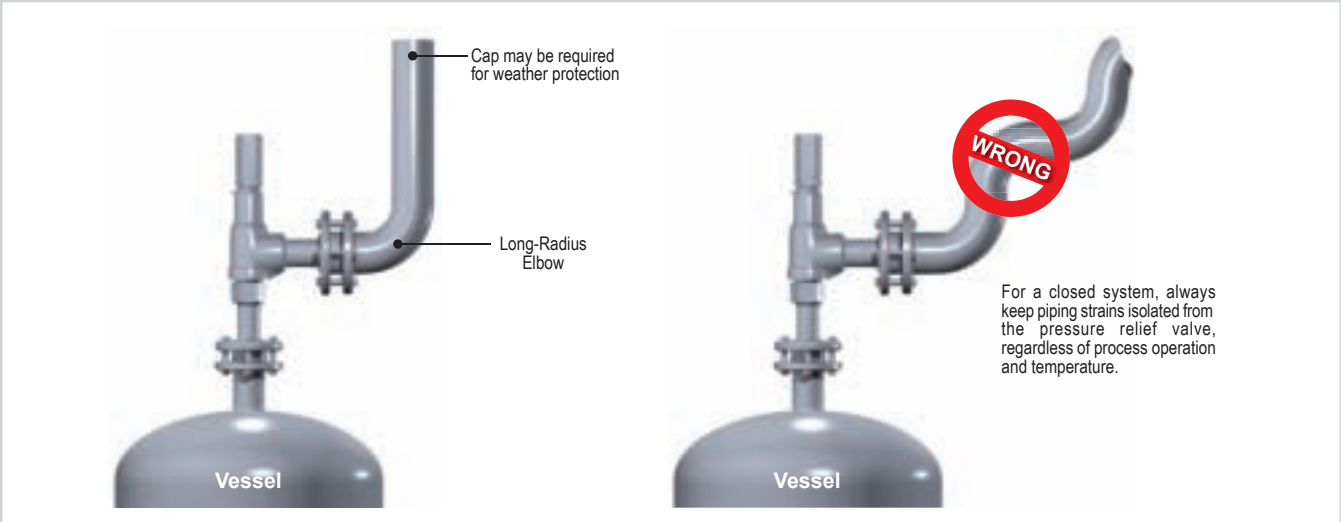


Figure 9 – Outlet Piping Considerations

DANGER

Many pressure vessels protected by Consolidated® Safety Relief Valves contain dangerous materials. Decontaminate and clean the valve inlet, outlet, and all external surfaces in accordance with the cleaning and decontaminating recommendations in the appropriate Material Safety Data Sheet.

DANGER

Before disassembling the valve, ensure there is no media pressure in the vessel.

Disassembly Instructions

General Information

Consolidated Safety Relief Valves can be easily disassembled for inspection, reconditioning seats or replacing internal parts. Appropriate set pressure can be established after reassembly. (Refer to Figures 1 through Figure 7 for Parts Nomenclature.)

CAUTION

Wear necessary protective equipment to prevent possible injury.

CAUTION

Valve caps and bonnets can trap fluids. Use caution when removing to prevent injury or environmental damage.

NOTES:

- *Before starting to disassemble the valve, be sure there is no media pressure in the vessel.*
- *Many pressure vessels that are protected by Consolidated Safety Relief Valves contain dangerous materials.*
- *Decontaminate and clean the valve inlet and outlet and all external surfaces in accordance with the cleaning and decontaminating recommendations in the appropriate Material Safety Data Sheet.*
- *Parts from one valve should not be interchanged with parts from another valve.*

ATTENTION!

Do not interchange parts from one valve with parts from another valve.

SRV Disassembly

Metal Seat Valves (See Figures 1 & 2)

(a) Remove the cap (15) (including lifting gear, if any); then, remove the cap (14) gasket.

(b) Measure the position of the valve adjusting screw (9) and record before removal. Measure from the top of the screw to the adjusting screw locknut (10).

(c) Loosen the adjusting screw locknut (10) and remove the adjusting screw (9) from the bonnet (5).

(d) Unscrew the bonnet (5) from the base (1).

(e) Remove the spindle (6), spring (8), and spring washers (7).

(f) Remove the guide (4), disc holder (3), and disc (2) from the base (1).

O-Ring Seat Seal Valves (DA) (See Figure 3)

Follow steps (a) through (e) for Metal Seat Valves above.

(f) Remove the guide (4) and O-Ring disc holder assembly from the base.

(g) Remove the retainer lockscrew (18) and the O-Ring retainer (16).

(h) Carefully remove the O-Ring Seat Seal (17). Be sure not to damage the O-Ring groove in the disc holder (3).

Cleaning

19000 Series Safety Relief Valve internal parts may be cleaned with industrial solvents, cleaning solutions and wire brushes.

If you are using cleaning solvents, take precautions to protect yourself from potential danger from breathing fumes, chemical burns or explosion. See the solvent's Material Safety Data Sheet for safe handling recommendations and equipment. It is not recommended to "sandblast" internal parts as it can reduce the dimensions of the parts. The base (1), bonnet (5) and cap (15) castings may be sandblasted with care not to erode internal surfaces or damage machined surfaces. If grit blasting is required, the use of glass bead media is recommended.

Parts Inspection

Base (1) – the base should be replaced if:

(a) Seat Surface

(i) Metal Seated-Seat surface “N” (see Figure 12), is scratched, nicked, corroded, leaks or is too wide and cannot be machined (see Table I and c.ii.ii on page 20).

(ii) O-Ring Seat surface “N” (see insert, Figure 12), is scratched, nicked, corroded or leaks.

(b) Threads (all) are torn, stripped or galled.

(c) Guide seating surface “U” is scratched, nicked, corroded or dimension “L” is less than “L” minimum (see Figure 12, Table II, and c.ii.ii on page 20).

(d) Seat step “F” is at or above minimum listed in Table II. “F” can be reestablished by machining as long as “L” stays within tolerance (see c.ii.ii on page 20).

Metal Seat Disc (2) – the metal seat disc should be replaced if:

(a) Seat surface “Y” (see Figure 13), is damaged beyond lapping or machining limits.

(b) Seat relief height “R” is less than “R” minimum and dimension “S” cannot be maintained (see Table III).

(c) Length “S” is less than “S” minimum (see Table III).

O-Ring Seat Seal Assembly – the O-Ring seat seal assembly parts should be replaced as follows:

(a) O-Ring Seat Seal (17) – always replace.

(b) O-Ring retainer (16)

(i) Lapped seat relief height “R” is less than “R” minimum and dimension “S” cannot be maintained (see Figure 13 and Table III).

(ii) Length “S” is less than “S” minimum (see Table III).

(iii) Retainer Lockscrew - Always replace.

Bonnet (5) – the bonnet should be replaced if:

(a) Threads are stripped, torn or galled.

(b) The guide seating surface is scratched, nicked, corroded or leaks.

(c) Condition is porous, corroded or distorted.

Metal Seat Disc Holder (3) – the disc holder should be replaced if:

(a) The outside surface is worn, egged or galled and/or cannot meet “H” dimension.

(b) The spindle pocket bearing surface is galled or pitted.

(c) The disc seating surface “Y” is galled or pitted (see Figure 15).

O-Ring Disc Holder (3) – the O-Ring disc holder should be replaced if:

(a) The outside surface is worn, egged or galled and/or cannot meet “H” dimension (see Figure 15).

(b) The spindle pocket bearing surface is galled or pitted.

(c) The O-Ring groove is nicked, scratched or pitted.

(d) The O-Ring retainer screw threads are torn, stripped or galled.

Guide (4) – replace the guide if:

(a) The inside surface is worn, egged or galled.

(b) Base and bonnet seating surfaces are scratched, nicked, corroded or leaks.

(c) Hole dimension “K” is out of tolerance (see Figure 16 and Table V).

(d) Guide Height Dimension “L” is out of tolerance (see Figure 16 and Table V).

(e) “J” dimension is not within tolerance (see Figure 16 and Table V).

Spindle (6) – replace the spindle if:

(a) The bearing surfaces are galled, pitted or scratched

(b) Threads are torn, stripped or galled.

(c) The stem is bent (see Figure 14).

Spring (8) – replace the spring if:

(1) The ends are not ground flat and parallel.

(2) The coils are bent, pitted or unevenly spaced.

(3) The spring cannot be properly identified (spring chart).

ATTENTION!

19000 Series valve springs do not have sufficient wire diameter to allow permanent spring marking.

Spring Washers (7) – replace the Spring Washers if:

(a) The bearing surface is galled, pitted or scratched.

(b) Corrosion affects the centering of the spring.

Adjusting Screw (9) – replace adjusting screw if:

(a) Threads are torn, stripped or galled.

(b) The bearing surfaces are galled, pitted or scratched.

(c) The adjustment flats are damaged or rounded.

Maintenance Instructions

Metal Seat Valves (MS)

(a) Precautions and Hints for Lapping Seats

Reconditioning of the seat surface may be accomplished by lapping with a flat cast iron ring lap coated with a 1000 grit lapping compound or its equivalent (see Table XIII). The following precautions and hints will enable maintenance personnel to do a "professional" job of lapping seats:

(i) Keep work materials clean.

(ii) Always use a fresh lap. If signs of wearing (out of flatness) are evident, recondition the lap. Reconditioning of laps is accomplished by lapping them on a flat lapping plate. The lapping should be done with a figure-eight motion as indicated in Figure 10. To assure the best results when lapping seats, the laps should be reconditioned after each usage.

(iii) Apply a very thin layer of compound to the lap. This will prevent rounding off the edges of the seat.

(iv) Keep the lap squarely on the flat surface and avoid any tendency to rock the lap which causes rounding of the seat.

(v) When lapping, keep a firm grip on the part to prevent the possibility of dropping it and damaging the seat.

(vi) Lap, using an eccentric, or figure-eight motion, in all directions, while at the same time, applying uniform pressure and rotating the lap slowly (see Figure 10).

(vii) Replace the compound frequently after wiping off the old compound, and apply more pressure to speed the cutting action of the compound.

(viii) To check the seating surfaces, remove all compounds from both the seat and the lap. Then, shine the seat with the same lap using the lapping motion described above. Low sections on the seating surface will show up as a shadow in contrast to the shiny portion.

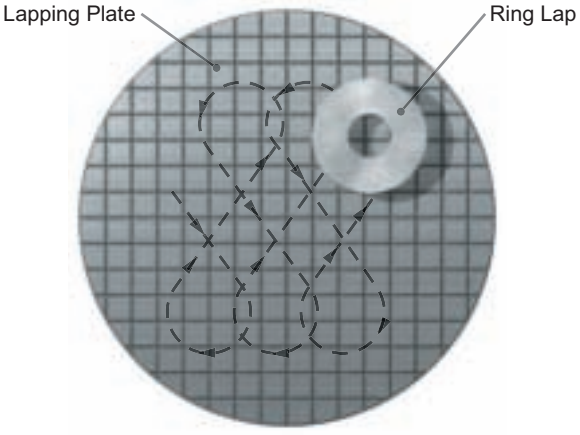


Figure 10 – Lapping Pattern

If shadows are present, further lapping is necessary and only laps known to be flat should now be used. Only a few minutes will be required to remove the shadows.

(ix) When the lapping is completed, any lines appearing as cross scratches can be removed by rotating the lap (which has been wiped clean of compounds) on the seat about its own axis.

(x) The seat should now be thoroughly cleaned using a lint-free cloth and a cleansing fluid.

(b) Lapping the Base Seat

The base seat may be reconditioned using the lapping procedure; however, the dimensions provided in Table I, should be used to determine the seat width.

The seat width can be measured by the use of a "Measuring Magnifier" (see Figure 11.A). Dresser Consolidated recommends the use of Model S1-34-35-37 (Bausch and Lomb Optical Co.) or an equivalent. This is a seven power glass with a ¾ inch scale showing graduations of 0.005 inch. The use of this scale in measuring the seat width is shown in Figure 11.B.

If additional lighting is required for measuring the seat, Dresser Consolidated suggests a goose-neck flashlight similar to the Type A Lamp Assembly Flashlight (Standard Molding Corporation, Dayton, Ohio) or an equivalent.

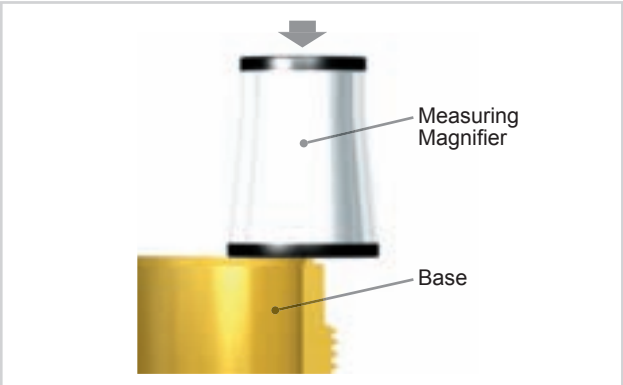


Figure 11.A – Measuring Magnifier

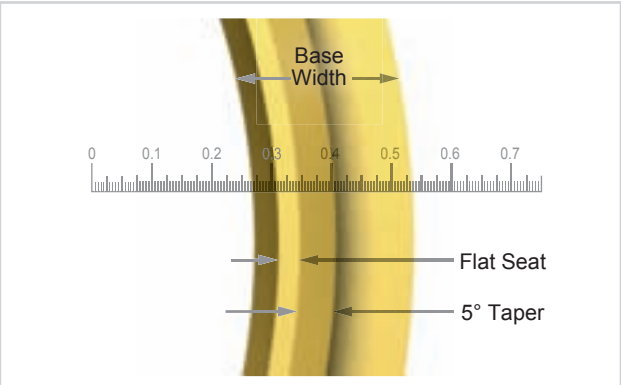


Figure 11.B – Measuring Magnifier Detail

Table I – Dimensions for Determining Seat Width

Set Pressure		Nominal Lapped Seat Width	
psig	barg	inches	mm
21-100	1.448-6.896	0.01-0.013	0.254-0.33
101-300	6.965-20.689	0.014-0.018	0.356-0.457
301-800	20.758-55.172	0.019-0.023	0.483-0.584
801-900	55.269-62.1	0.024-0.028	0.609-0.711
901-1000	62.169-69	0.029-0.033	0.737-0.838
1001-1100	69.069-75.9	0.034-0.038	0.864-0.965
1101-1200	75.969-82.8	0.039-0.043	0.991-1.092
1201-1300	82.869-89.7	0.044-0.048	1.118-1.219
1301-1400	89.769-96.6	0.049-0.053	1.245-1.346
1401-1500	96.669-103.5	0.054-0.058	1.372-1.473
1501-1600	103.569-110.4	0.059-0.063	1.499-1.6
1601-1700	110.469-117.3	0.064-0.07	1.626-1.778
1701+	117.369+	0.07 Maximum	1.778 Maximum

(c) Machining the Base Seat

(i) When the base seat cannot be repaired by lapping, it can be machined as shown in Figure 12, using the dimensions provided in Table II.

(ii) Dresser Consolidated recommends that the following procedure be adhered to when machining the base seat:

(ii.i) Using a four-jaw chuck, align the base so that surfaces marked X and Y run true within .001" on an indicator.

(ii.ii) Take light cuts on the seat surface until all damage is removed. Re-establish dimensions "B", "C", "F", "G", "H" and Angle I. When L (minimum) is obtained, the base should be replaced.

(ii.iii) After all machining has been accomplished, lap the seat using same procedure for base seat.

ATTENTION!

19000H and 19000 DA bases have flat seats (90° angle) across the entire seating surface from B diameter to D diameter.

(d) Machining the Disc Seat

(i) When the disc seat cannot be repaired by lapping, it can be machined as shown in Figure 13, using the dimensions provided in Table III.

(ii) Dresser Consolidated recommends that the following procedure be adhered to when machining the disc seat:

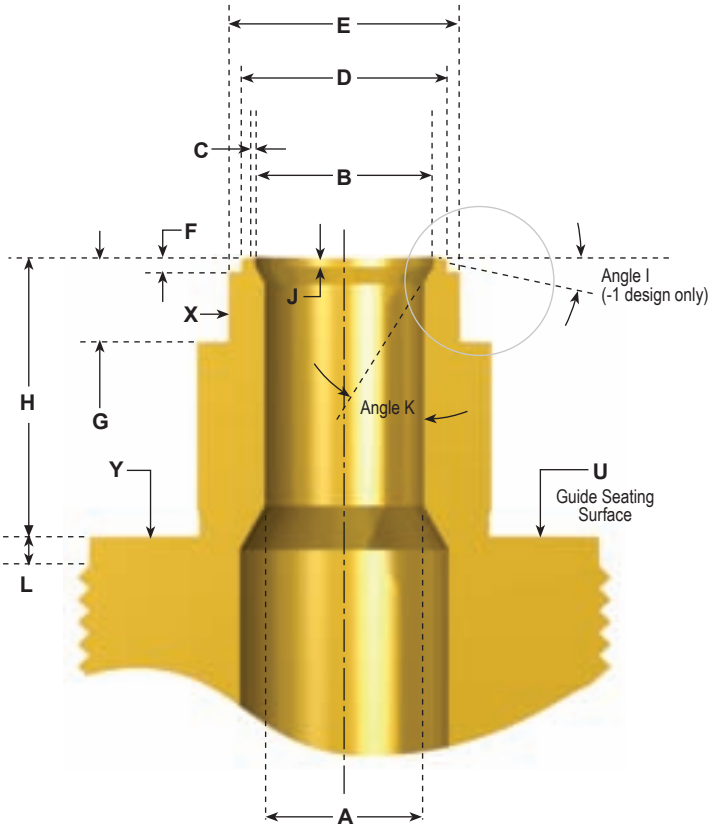
(ii.i) Grip the disc in a collet.

(ii.ii) True up the disc so that surfaces marked X and Y run true within .001" on an indicator.

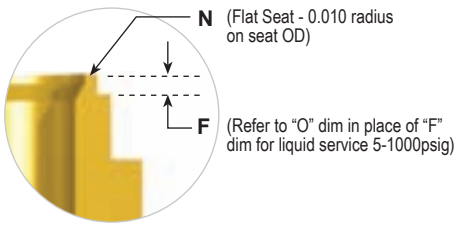
(ii.iii) Take light cuts across the seating surface until the damage is removed. Dimensions "R" and "D", (and 15° angle when applicable) must be maintained.

(ii.iv) The disc is now ready for lapping. (See Table III-A for proper seat width).

(ii.v) When the minimum thickness dimension "S" is reached, the disc should be replaced.



Metal Seat Base



O-Ring Base

Figure 12

Machining the Base Seat

Table II-A: 19000 Series Soft Seat (DA) Base Dimensions

VALVE TYPE	A	B	C	D	E	F	G	H	I	J	K	L	O
	IN. (REF)	IN. (± .002)	(MIN) IN.	IN. (± .002)	IN. (± .003)	IN. (± .005)	IN. (± .005)	IN. (+ .002) (- .003)	ANGLE	IN. (± .005)	ANGLE	IN. (MIN)	Liquid Valve Only IN. (+.003) (- .002)
	MM. (REF)	MM. (± .05)	MM.	MM. (± .08)	MM. (± .13)	MM. (± .13)	MM. (± .13)	MM. (+.05) (-. 08)		MM. (± .13)		MM. (MIN)	MM (+.08) (- .05)
19096L-DA	0.35 8.89	0.395 10.03	FLAT	0.457 11.61	0.503 12.78	.045* 1.143	0.188 4.78	0.784 19.91	FLAT	0.02 0.508	30˚	0.187 4.75	.032* 0.813
19110L-DA	0.375 9.525	0.395 10.03	FLAT	0.457 11.61	0.503 12.78	.045* 1.143	0.188 4.78	0.784 19.91	FLAT	0.02 0.508	30˚	0.187 4.75	.032* 0.813
19126L-DA	0.401 10.19	0.453 11.51	FLAT	0.523 13.28	0.579 14.71	.045* 1.143	0.216 5.49	0.784 19.91	FLAT	0.023 0.584	30˚	0.187 4.75	.032* 0.813
19226L-DA	0.537 13.64	0.606 15.39	FLAT	0.701 17.81	0.781 19.84	.050* 1.27	0.289 7.34	1.034 26.26	FLAT	0.03 0.762	30˚	0.187 4.75	.032* 0.813
19357L-DA	0.675 17.15	0.762 19.35	FLAT	0.881 22.38	0.987 25.07	.060* 1.524	0.363 9.22	1.503 38.18	FLAT	0.038 0.965	30˚	0.25 6.35	.040* 1.016
19567L-DA	0.85 21.59	0.96 24.38	FLAT	1.109 28.17	1.247 31.67	.060* 1.524	0.457 11.61	1.503 38.18	FLAT	0.048 1.219	30˚	0.25 6.35	.050* 1.27
19096M-DA	0.35 8.89	0.395 10.03	FLAT	0.457 11.61	0.503 12.78	0.045 1.143	0.188 4.78	0.789 20.04	FLAT	0.03 0.762	30˚	0.187 4.75	
19110M-DA	0.375 9.525	0.395 10.03	FLAT	0.457 11.61	0.503 12.78	0.045 1.143	0.188 4.78	0.789 20.04	FLAT	0.03 0.762	30˚	0.187 4.75	
19126M-DA	0.401 10.19	0.453 11.51	FLAT	0.523 13.28	0.579 14.71	0.08 2.032	0.216 5.49	0.789 20.04	FLAT	0.03 0.762	30˚	0.187 4.75	
19226M-DA	0.537 13.64	0.606 15.39	FLAT	0.701 17.81	0.781 19.84	0.08 2.032	0.21 5.33	1.034 26.26	FLAT	0.03 0.762	30˚	0.187 4.75	
19357M-DA	0.675 17.15	0.762 19.35	FLAT	0.881 22.38	0.987 25.07	0.09 2.286	0.363 9.22	1.548 39.32	FLAT	0.038 0.965	30˚	250 6.35	
19567M-DA	0.85 21.59	0.96 24.38	FLAT	1.109 28.17	1.247 31.67	0.125 3.175	0.3 7.62	1.526 38.76	FLAT	0.048 1.219	30˚	0.25 6.35	
19096H-DA	0.35 8.89	0.395 10.03	FLAT	0.457 11.61	0.503 12.78	0.045 1.143	0.188 4.78	1.038 26.37	FLAT	0.03 0.762	30˚	0.187 4.75	
19110H-DA	0.375 9.525	0.395 10.03	FLAT	0.457 11.61	0.503 12.78	0.045 1.143	0.188 4.78	1.038 26.37	FLAT	0.03 0.762	30˚	0.187 4.75	
19126H-DA	0.401 10.19	0.453 11.51	FLAT	0.523 13.28	0.579 14.71	0.045 1.143	0.156 3.96	1.502 38.15	FLAT	0.03 0.762	30˚	0.187 4.75	
19226H-DA	0.537 13.64	0.606 15.39	FLAT	0.701 17.81	0.781 19.84	0.05 1.27	0.21 5.33	1.504 38.2	FLAT	0.03 0.762	30˚	0.187 4.75	

** Soft seat (DA) valves for liquid service from 5 - 100 psig require a special base. Refer to Dimension O instead of Dimension F in this case.*

*** Angles in degrees*

Table II-B: 19000-1 Series Metal Seat (MS) Base Dimensions

VALVE TYPE	A	B	C	D	E	F	G	H	I	J	K	L
	IN. (REF)	IN. (± .002)	(MIN) IN.	IN. (± .002)	IN. (± .003)	IN. (± .005)	IN. (± .005)	IN. (+ .002) (- .003)	ANGLE	IN. (± .005)	ANGLE	IN. (MIN)
	MM. (REF)	MM. (± .05)	MM.	MM. (± .08)	MM. (± .13)	MM. (± .13)	MM. (± .13)	MM. (+ .05) (- .08)		MM. (± .13)		MM. (MIN)
19096L-MS-1	0.35	0.395	0.01	0.457	0.503	0.03	0.188	0.784	15°	0.02	30°	0.187
	8.89	10.03	0.25	11.61	12.78	0.762	4.78	19.91		0.508		4.75
19126L-MS-1	0.401	0.453	0.01	0.523	0.579	0.03	0.216	0.784	15°	0.023	30°	0.187
	10.19	11.51	0.025	13.28	14.71	0.762	5.49	19.91		0.584		4.75
19226L-MS-1	0.537	0.606	0.01	0.701	0.781	0.03	0.289	1.034	15°	0.03	30°	0.187
	13.64	15.39	0.025	17.81	19.84	0.762	7.34	26.26		0.762		4.75
19357L-MS-1	0.675	0.762	0.01	0.881	0.987	0.038	0.363	1.503	5°	0.038	30°	0.187
	17.15	19.35	0.025	22.38	25.07	0.965	9.22	38.18		0.965		4.75
19567L-MS-1	0.85	0.96	0.01	1.109	1.247	0.048	0.457	1.503	5°	0.048	30°	0.187
	21.59	24.38	0.025	28.17	31.67	1.219	11.61	38.18		1.219		4.75
19096M-MS-1	0.35	0.395	0.01	0.457	0.503	0.03	0.188	0.784	15°	0.03	30°	0.187
	8.89	10.03	0.025	11.61	12.78	0.762	4.78	19.91		0.762		4.75
19126M-MS-1	0.401	0.453	0.01	0.523	0.579	0.03	0.216	0.784	15°	0.03	30°	0.187
	10.19	11.51	0.025	13.28	14.71	0.762	5.49	19.91		0.762		4.75
19226M-M S-1	0.537	0.606	0.01	0.701	0.781	0.03	0.289	1.034	15°	0.038	30°	0.187
	13.64	15.39	0.025	17.81	19.84	0.762	7.34	26.26		0.965		4.75
19357M-MS-1	0.675	0.762	0.01	0.881	0.987	0.038	0.363	1.503	5°	0.048	30°	0.187
	17.15	19.35	0.025	22.38	25.07	0.965	9.22	38.18		1.219		4.75
19567M-MS-1	0.85	0.96	0.01	1.109	1.247	0.048	0.457	1.503	5°	0.03	30°	0.187
	21.59	24.38	0.025	28.17	31.67	1.219	11.61	38.18		0.762		4.75
19096H-MS-1	0.35	0.395	0.01	0.457	0.503	0.03	0.188	1.034	FLAT	0.03	30°	0.187
	8.89	10.03	0.025	11.61	12.78	0.762	4.78	26.26		0.762		4.75
19126H-MS-1	0.401	0.453	FLAT	0.523	0.579	0.03	0.156	1.524	FLAT	0.03	30°	0.187
	10.19	11.51		13.28	14.71	0.762	3.96	38.71		0.762		4.75
19226H-MS-1	0.537	0.606	FLAT	0.701	0.781	0.03	0.21	1.504	FLAT	0.03	30°	0.187
	13.64	15.39		17.81	19.84	0.762	5.33	38.2		0.762		4.75

Table II-C: 19000-2 Series Metal Seat (MS) Base Dimensions

VALVE TYPE	A	B	C	D	F	G	H	I	J	K	L
	IN. (REF)	IN (± .002)	(MIN) IN	IN (± .002)	IN (± .002)	IN (± .005)	IN (+.002) (-0.003)	ANGLE	IN (± .002)	ANGLE	IN (MIN)
	MM (REF)	MM (± 0.5)	MM	MM (± .05)	MM (± .05)	MM (± .13)	MM (+ 05) (-. 076)		MM (± .05)		MM (MIN)
19096L-MS-2	0.35	0.408	N/A	0.457	0.022	0.19	0.784	FLAT	0.02	30°	0.187
	8.89	10.36		11.61	0.558	4.82	19.91	(90°)	0.508		4.75
19110L-MS-2	0.375	0.408	N/A	0.457	0.022	0.19	0.784	FLAT	0.02	30°	0.187
	9.525	10.36		11.61	0.558	4.82	19.91	(90°)	0.508		4.75
19126L-MS-2	0.401	0.463	N/A	0.523	0.022	0.216	0.784	FLAT	0.023	30°	0.187
	10.19	11.75		13.28	0.558	5.48	19.91	(90°)	0.584		4.75
19226L-MS-2	0.537	0.625	N/A	0.701	0.022	0.289	1.034	FLAT	0.03	30°	0.187
	13.64	15.87		17.81	0.558	7.34	26.26	(90°)	0.762		4.75
19357-MS-2	0.675	0.796	N/A	0.881	0.022	0.363	1.503	FLAT	0.038	30°	0.25
	17.15	19.35		22.38	0.558	9.22	38.18	(90°)	0.965		6.35
19567L-MS-2	0.85	1	N/A	1.109	0.022	0.457	1.503	FLAT	0.048	30°	0.25
	21.59	25.39		28.17	0.558	11.61	38.18	(90°)	1.219		6.35
19096M-MS-2	0.35	0.408	N/A	0.457	0.022	0.12	0.789	FLAT	0.03	30°	0.187
	8.89	10.36		11.61	0.558	3.048	20.04	(90°)	0.762		4.75
19110M-MS-2	0.375	0.408	N/A	0.457	0.022	0.12	0.789	FLAT	0.03	30°	0.187
	9.525	10.36		11.61	0.558	3.048	20.04	(90°)	0.762		4.75
19126M-MS-2	0.401	0.463	N/A	0.523	0.022	0.125	0.789	FLAT	0.03	30°	0.187
	10.19	11.75		13.28	0.558	3.175	20.04	(90°)	0.762		4.75
19226M-MS-2	0.537	0.625	N/A	0.701	0.022	0.21	1.034	FLAT	0.03	30°	0.187
	13.64	15.87		17.81	0.558	5.334	26.26	(90°)	0.762		4.75
19357M-MS-2	0.675	0.796	N/A	0.881	0.022	0.244	1.548	FLAT	0.038	30°	0.25
	17.15	19.35		22.38	0.558	6.19	39.32	(90°)	0.965		6.35
19567M-MS-2	0.85	1	N/A	1.109	0.022	0.3	1.572	FLAT	0.048	30°	0.25
	21.59	25.39		28.17	0.558	7.62	39.92	(90°)	1.219		6.35
19096H-MS-2	0.35	0.395	N/A	0.457	0.022	0.12	1.038	FLAT	0.03	30°	0.187
	8.89	10.013		11.61	0.558	3.048	26.37	-900	0.762		4.75
19110H-MS-2	0.375	0.395	N/A	0.457	0.022	0.12	1.038	FLAT	0.03	30°	0.187
	9.525	10.013		11.61	0.558	3.048	26.37	(90°)	0.762		4.75
19126H-MS-2	0.401	0.444	N/A	0.523	0.022	0.125	1.502	FLAT	0.03	30°	0.187
	10.19	11.255		13.28	0.558	3.175	38.15	(90°)	0.762		4.75
19226H-MS-2	0.537	0.616	N/A	0.701	0.022	0.21	1.504	FLAT	0.03	30°	0.187
	13.64	15.615		17.81	0.558	5.334	38.2	(90°)	0.762		4.75

Table III – Reworking Dimensions of the Disc Seat

VALVE TYPE	Disc (Metal Seat)				"O" Ring Retainer (Soft Seat)		
	Q* IN. (MM)	R (MIN.) IN. (MM)	-1 only S (MIN.) IN. (MM)	-2 only S (MIN.) IN. (MM)	Q* IN. (MM)	R (MIN.) IN. (MM)	S (MIN.) IN. (MM)
19096L, M	0.461 (11.71)	0.025 (0.64)	0.243 (6.17)	0.234 (5.94)	0.426 (10.82)	——	0.156 (3.06)
19096H	0.461 (11.71)	0.025 (0.64)	0.243 (6.17)	0.491 (12.47)	0.426 (10.82)	——	0.156 (3.06)
19110L, M	0.461 (11.71)	0.025 (0.64)	N/A	0.234 (5.94)	0.426 (10.82)	——	0.156 (3.06)
19110H	0.461 (11.71)	0.025 (0.64)	N/A	0.491 (12.47)	0.426 (10.82)	——	0.156 (3.06)
19126L, M	0.527 (13.39)	0.025 (0.64)	0.243 (6.17)	0.234 (5.94)	0.489 (12.42)	——	0.156 (3.06)
19126H	0.527 (13.39)	0.025 (0.64)	0.243 (6.17)	0.491 (12.47)	0.489 (12.42)	——	0.156 (3.06)
19226L*, M*	0.705 (17.91)	0.025 (0.64)	0.301 (7165)	0.272 (6.91)	0.676 (11.43)	0.025	0.204 (5.18)
19226H*	0.705 (17.91)	0.025 (0.64)	0.301 (7165)	0.540 (13.72)	0.676 (11.43)	0.025	0.204 (5.18)
19357L*, M*	.885 (22.48)	0.025 (0.64)	0.493 12.52	.454 (11.53)	.852 (21.64)	0.025	0.249 (6.32)
19567L*, M*	1.113 (28.27)	0.025 (0.64)	0.493 12.52	0.473 (12.01)	1.056 (26.82)	0.025	0.249 (6.32)

** These valves have a 15° angle as shown in Figure 13 (-2 Design).*

Table III-A – Disc Seat Lapping Width (-2 Design Only)

Set Pressure		Disc Seat Width			
PSI	BAR	19096, 19110, 19126 VALVE TYPE		19226, 19357, 19567 VALVE TYPE	
		IN.	(MM)	IN.	(MM)
5-800	0.345.55.158	Flat	Flat	.020	.510
801-Up	55.159-Up	Flat	Flat	*	*

** Add 0.005 In. (0.125mm) per 100 psi (6.896 bar), until disc seat width has reached the maximum available width.*

O-Ring Seat Seal Valves (DA)

(a) Replacing the O-Ring Retainer (16)

If slight damage is present, the O-Ring Retainer can be refurbished by either lapping or machining. O-Ring Retainer should be replaced if severely damaged or if dimension S (minimum) is exceeded (see Figure 13 and Table III).

(b) Polishing the Base Seat

Normally the base seating area on this type of valve is not damaged, since the O-Ring absorbs the impact when foreign material is trapped between the O-Ring and the base seating area. The O-Ring will therefore hold a bubble tight seal with slight indications on the base seating surface. Nevertheless, slight indications on the base seat surface may be removed by lapping the base.

ATTENTION!

The O-Ring always should be replaced to insure seat tightness.

Checking Spindle Concentricity

(a) General Information

It is important that the spindle (6) of a safety relief valve be straight in order to transmit the spring load to the disc without lateral binding. Over-gagging is one of the common causes of bent spindles. To check the essential working surfaces of the spindle, the method stated in the next section is recommended.

(b) V-Block Support Set Up

(i) The ball-pointed spindles should be placed in a piece of material, B, that has been recessed to permit free rotation of the spindle (see Figure 14).

(ii) Support the spindle with a V-block A, placed near the upper end of the spindle, but below the threads.

(iii) Apply a machinist's indicator at approximately 45° to the outer edge of the spring washer seat at "C". Rotate the spindle. The total indicator reading should not exceed .005". Straighten the spindle, if necessary.

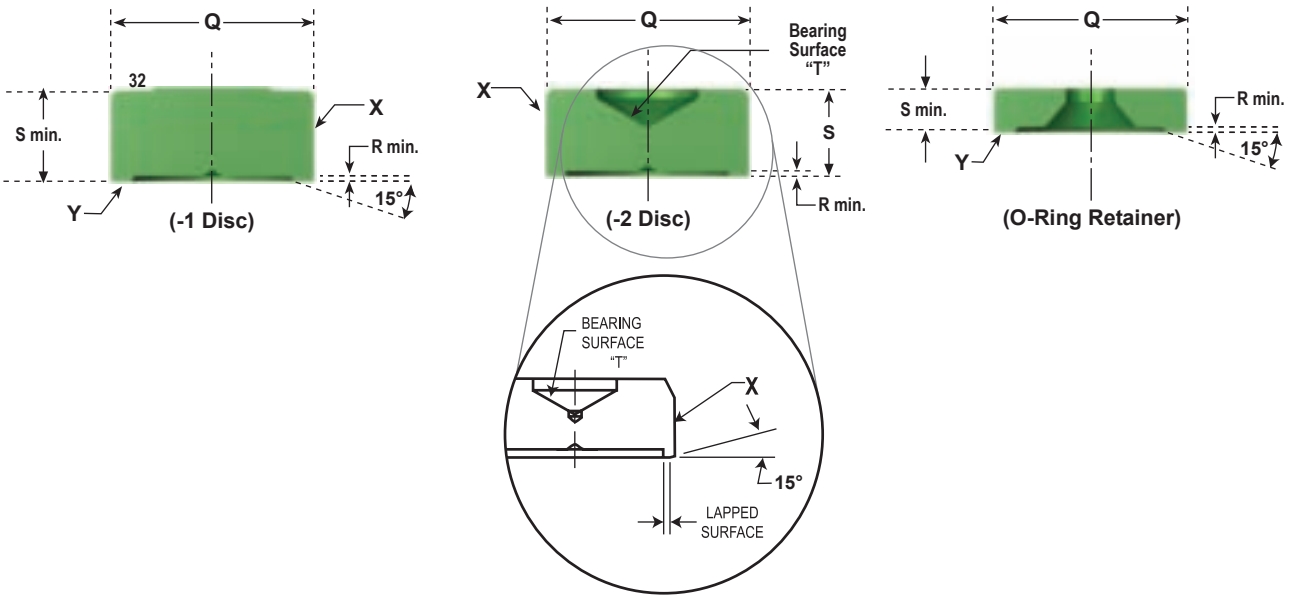


Figure 13

Table IV - Disc Holder Dimensions	
VALVE TYPE	H Diameter IN. (± 0.001) MM. (± 0.03)
19096L, 19096 & 19110L	0.65 16.61
19126L	7.47 18.97
19226L	1.000 25.40
19357L	1.26 31.93
19567L	1.58 40.21
19096M & 19110M	0.65 16.61
19126M	0.75 18.97
19226M	1.000 25.40
19357M	1.26 31.93
19567M & 19110H	1.58 40.21
19096H	0.65 16.61
19126H	0.75 18.97
19226H	1.000 25.40

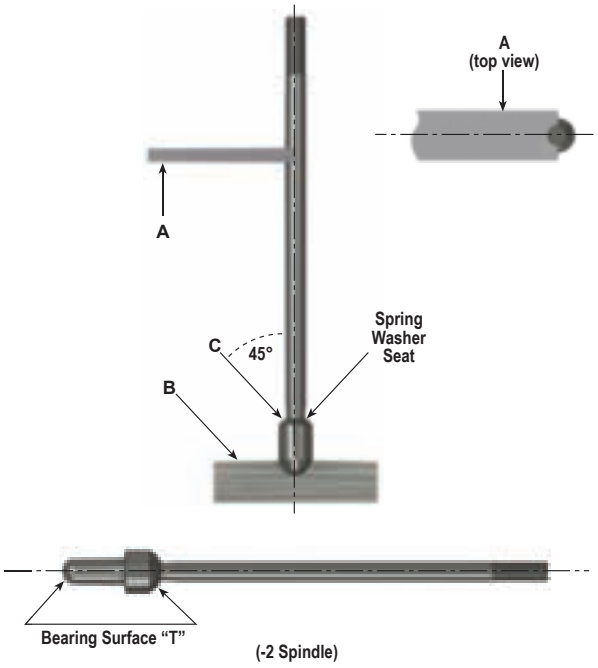


Figure 14 – V-Block Support Set Up

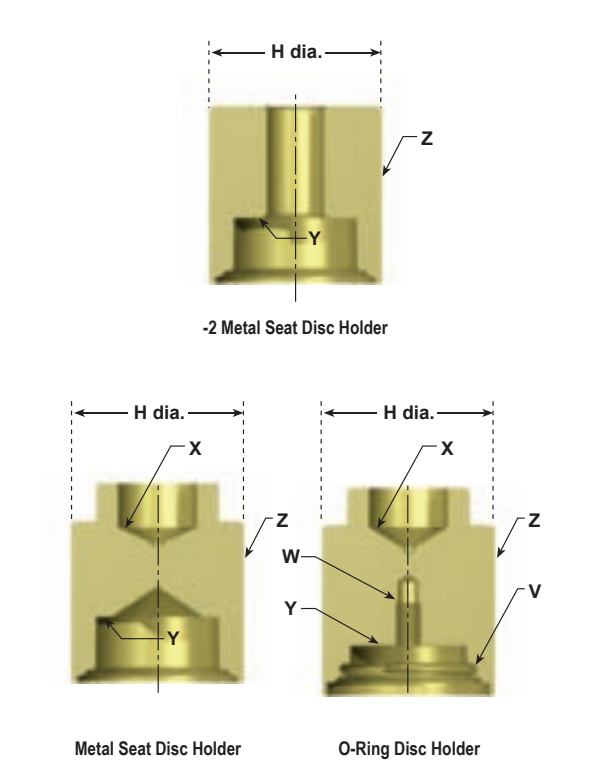
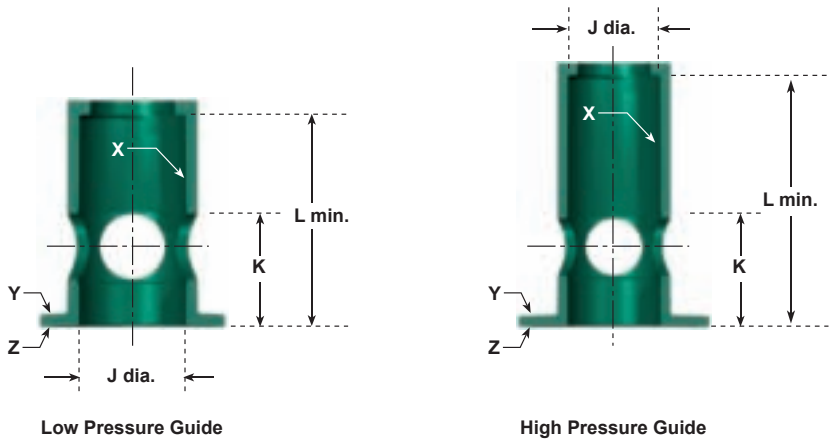


Figure 15 – Disc Holder

Table V - Guide Dimensions					
VALVE TYPE	J Diameter IN. (± 0.001) MM. (± 0.03)	K (MS-Metal Seat) IN. MM.	K (DA-Soft Seat) IN. MM.	L mm (MS-Metal Seat) IN. MM.	L mm (DA-Soft Seat) IN. MM.
19096L & 19110L	0.661 16.79	0.810 ± 0.007 20.57 ± 0.18	0.81 ± 0.007 20.57 ± 0.18	1.701 43.210	1.701 43.210
19126L	0.754 19.15	0.804 ± 0.007 20.42 ± 0.18	0.804 ± 0.007 20.42 ± 0.18	1.717 43.610	1.717 43.610
19226L	1.007 25.58	1.109 ± 0.009 28.17 ± 0.23	1.109 ± 0.009 28.17 ± 0.23	2.267 57.580	2.267 57.580
19357L	1.264 32.11	1.623 ± 0.012 41.22 ± 0.3	1.623 ± 0.012 41.22 ± 0.3	3.105 78.870	3.105 78.870
19567L	1.59 40.39	1.671 ± 0.012 42.44 ± 0.3	1.671 ± 0.012 42.44 ± 0.3	3.159 80.240	3.159 80.240
19096M & 19110M	0.661 16.79	0.81 ± 0.007 20.57 ± 0.18	0.81 ± 0.007 20.57 ± 0.18	1.727 43.870	1.727 43.870
19126M	0.754 19.15	0.804 ± 0.007 20.42 ± 0.18	0.804 ± 0.007 20.42 ± 0.18	1.743 44.270	1.743 44.270
19226M	1.007 25.58	1.109 ± 0.009 28.17 ± 0.23	1.109 ± 0.009 28.17 ± 0.23	2.267 57.580	2.292 58.220
19357M	1.264 32.11	1.623 ± 0.012 41.22 ± 0.3	1.623 ± 0.012 41.22 ± 0.3	3.105 78.870	3.196 81.180
19567M	1.59 40.39	1.671 ± 0.012 42.44 ± 0.3	1.627 ± 0.012 41.33 ± 0.3	3.159 80.240	3.251 82.580
19096H & 19110H	0.661 16.79	1.06 ± 0.007 26.92 ± 0.18	1.06 ± 0.007 26.92 ± 0.18	2.227 56.570	2.227 56.570
19126H	0.754 25.58	1.523 ± 0.007 38.48 ± 0.23	1.523 ± 0.007 38.48 ± 0.23	2.707 68.760	2.707 68.760
19226H	1.007 25.58	1.515 ± 0.009 38.48 ± 0.23	1.515 ± 0.009 38.48 ± 0.23	3.027 76.880	3.027 76.880



Low Pressure Guide

High Pressure Guide

Figure 16 Guide

Reassembly and Lubrication

Metal Seat Valves (MS)

(See Figures 1 and 2)

(a) Bearing surfaces should be ground together using a 320 grit lapping compound (see Table XIII). These surfaces are: (a) the disc holder-spindle pocket and spindle spherical nose radius, (b) the lower spring washer and spindle spring washer radius and (c) the upper spring washer and adjusting screw spherical radius. Clean all parts before assembly.

(b) Apply small amount of non-copper based thread lubricant to the guide-bonnet seating surface and the bonnet and base threads.

(c) Use a clean base (1) lapped for the valve set pressure (see seat width requirement Table II). Place a lapped disc (2) on the base with lapped surfaces facing each other. Place the disc holder (3) onto the disc and base. Place guide (4) over disc holder onto base. Lubricate the disc holder-spindle bearing surface with non copper based thread lubricant

(d) Lubricate the spindle nose with a small amount of non-copper based thread lubricant and insert the spindle (6) into the disc holder-spindle pocket.

(e) Apply a small amount of non-copper based thread lubricant on the bearing surface of the lower spring washer (7) and slip it over the spindle (6). Install the spring (8) and upper spring washer.

(f) Apply a small amount of non-copper based thread lubricant to the bonnet-base threads and guide seating surface. When a stainless steel bonnet (5) and base (1) are used, and/or a standard bonnet for service above 500° temperature, apply non-copper based thread lubricant to the bonnet-base threads and guide (4) seating surface. Before tightening the bonnet completely, adjust the position of the guide so that one of the holes is lined up with the discharge of the valve. Tighten the bonnet using sufficient torque from Base Torque Specification (see Table VI).

(g) Thread the adjusting screw locknut (10) on the adjusting screw (9). Apply a light coat of non-copper based thread lubricant to the adjusting screw threads and spherical radius.

Thread the adjusting screw locknut (10) onto the adjusting screw (9). Apply a small amount of non-copper based thread lubricant to the tip of the adjusting screw. Install the adjusting screw in the bonnet, rotating the number of times required to compress the spring slightly. Use pliers to hold the spindle (6) in position and prevent galling. Adjust the adjusting screw to the measurement recorded during disassembly. (See Metal Seat Valves disassembly instructions, point (b) on page 16.)

(h) The valve is now ready for setting. After the set pressure has been adjusted, tighten the adjusting screw locknut (10). Install the cap (15) and cap gasket (14), or lifting gear, on the valve after applying a small amount of non-copper based thread lubricant to the gasket seal surfaces, as well as to the cap and bonnet threads.

Table VI - Base Torque Specifications

VALVE TYPE	Recommended Torque (ft.- lb.)	Maximum Torque (ft.- lb.)
19096L	125	250
19110L	125	250
19126L	125	250
19226L	200	400
19357L	625	1000
19567L	625	1000
19096M	175	300
19110M	175	300
19126M	175	300
19226M	500	750
19357M	650	1200
19567M	650	1200
19096H	500	750
19110H	500	750
19126H	1000	1500
19226H	1000	1500

O-Ring Seat Seal Valves (DA)

(See Figure 3)

(a) All bases shall be lapped flat enough to remove nicks and burrs.

(b) Bearing surfaces should be ground together using a 320 grit lapping compound (see Table XIII). These surfaces are: (a) the disc holder-spindle pocket and spindle spherical nose radius, (b) the lower spring washer and spindle spring washer radius and (c) the upper spring washer and adjusting screw spherical radius. Clean all parts before assembly.

(c) Carefully insert a new O-Ring seat seal (17) into the disc holder (3). Make sure the O-Ring is the right size, material and hardness for the application. Refer to the valve nameplate for information required when ordering an O-Ring seat seal.

(d) Install the O-Ring retainer (16) and a new retainer lockscrew (18).

(e) Place the disc holder assembly onto the base (1) and place the guide (4) onto base. The guide seating surfaces should be free of any nicks or scratches.

(f) Lubricate the spindle nose with a small amount of non-copper based thread lubricant and insert the spindle (6) into the disc holder-spindle pocket.

(g) Apply a small amount of non-copper based thread lubricant on the bearing surface of the lower spring washer (7) and slip it over the spindle (6). Install the spring (8) and upper spring washer (7).

(h) The guide bonnet seating surfaces should be free of any nicks or scratches, with a 63 rms finish (maximum). Apply non-copper based thread lubricant to the bonnet and base threads and guide seating surfaces. Install the bonnet (5) on the base (1) using torque from Base Torque Specifications (see Table VI). Before tightening the bonnet completely, adjust the position of the guide (4) so that one of the holes in the guide is in line with the discharge of the valve. Tighten the bonnet using sufficient torque from Base Torque Specification (see Table VI).

(i) Thread the adjusting screw locknut (10) onto the adjusting screw (9). Apply a small amount of non-copper based thread lubricant to the tip of the adjusting screw. Install the adjusting screw in the bonnet, rotating the number of times required to compress the spring slightly. Use pliers to hold the spindle (6) in position and prevent galling. Adjust the adjusting screw to the measurement recorded during disassembly. (See O-Ring Seat Seal Valves (DA) disassembly instructions, point (b) on page 16.)

(j) The valve is now ready for setting. After the valve set pressure has been adjusted, tighten the adjusting screw locknut (10). Install the cap gasket (14) and cap (15), or lifting gear, on the valve after applying a small amount of non-copper based thread lubricant to the gasket seal surfaces, as well as to the cap and bonnet threads.

Setting and Testing

General Information

Before putting the reconditioned valve in service, it must be set to open at the required set pressure as shown on the nameplate. Although the valve can be set on the service installation, it is more convenient to set the valve and check seat tightness on a test stand. Any spring replacement shall be in accordance with current Dresser guidelines.

Test Equipment

The test stand used for testing SRVs normally consists of a pressure source supply line with a throttle valve and receiver that have the following features:

- Outlet for attaching the valve to be tested;
- Pressure gauge with a shut-off valve;

- Drain line with a shut-off valve; and
- Adequate receiver volume for the valve to be tested and to achieve proper operation.

Test Media

For best results, valves shall be tested by type as follows:

- Steam valves are tested on saturated steam;
- Air or gas valves are tested on air or gas at ambient temperature; and
- Liquid valves are tested on water at ambient temperature.

Setting the Valve

Set the valve to open at the set pressure as shown on the nameplate. If a cold differential test pressure is indicated on the nameplate, set the valve to open at that pressure on the test stand. (The cold differential test pressure is the set pressure corrected to compensate for backpressure and/or operating temperature.) A new cold differential test pressure may need to be determined if changes are to be made to the set pressure or backpressure or if the service temperature changes.

Table VII – Set Pressure Multipliers for Cold Differential Test Pressure at Ambient Temperature

Operating		Multiplier	Operating		Multiplier
Temp. F	Temp. C		Temp. F	Temp. C	
250	120	1.003	900	498	1.044
300	149	1.006	950	510	1.047
350	177	1.009	1000	538	1.050
400	204	1.013	1050	565	1.053
450	248	1.016	1100	593	1.056
500	260	1.019	1150	621	1.059
550	288	1.022	1200	649	1.063
600	316	1.025	1250	676	1.066
650	343	1.028	1300	704	1.069
700	371	1.031	1350	732	1.072
750	415	1.034	1400	760	1.075
800	427	1.038	1450	788	1.078
850	454	1.041	1500	815	1.081

Set Pressure Compensation

Cold Differential Test Pressure for Temperature Compensation

During production testing, the SRV is often tested at temperatures that are different from the temperatures the SRV will be exposed to in service. Increasing the temperature from ambient temperature causes the set pressure to decrease. The decrease in set pressure is due to thermal expansion of the seating area and spring relaxation. Therefore, it is important to compensate for the difference between production test temperature and service temperature. The service temperature is the normal operating temperature of the SRV. If the operating temperature is unavailable, do not correct the SRV set pressure.

Table VII lists the set pressure multipliers to be used when computing the cold differential test (CDTP) pressure for valves being set on an air or water test stand at ambient temperatures.

Valves to be used in saturated steam service are tested on saturated steam. Therefore, no CDTP is required. However, valves in superheated steam service are tested on saturated steam and require a CDTP.

Table VIII lists the multiplier to be used based on temperature above the saturated temperature (degrees of superheat).

Cold Differential Test Pressure For Back Pressure Compensation

When a conventional Series 19000 valve is to operate with a constant back pressure, the cold differential test pressure is the set pressure minus the constant back pressure.

Table VIII – Set Pressure Multipliers for Cold Differential Test Pressure

Superheat Temperature		
Degrees of Superheat, Temp. above Sat.		Multiplier
Fahrenheit	Celsius	
100	55.6	1.006
200	111.1	1.013
300	166.7	1.019
400	222.2	1.025
500	277.8	1.031
600	333.3	1.038
700	388.9	1.044
800	444.4	1.050

Sample Calculations For Series 19000 Consolidated Safety Relief Valves (refer to Tables VII and VIII)

Set pressure 2500 psig, temperature 500º F, backpressure atmospheric

Set Pressure.....2500 psig
Multiplier (see Table VII)..... X1.019
Cold Differential Set Pressure .....2548 psig

Set pressure 2500 psig, temperature 500º F, constant backpressure 150 psig

Set Pressure.....2500 psig
Minus Constant Back Pressure ..... -150 psig
Differential Pressure .....2350 psig
Multiplier (see Table VII)..... X1.019
Cold Differential Set Pressure .....2395 psig

Set pressure 2500 psig, temperature 100º F, constant backpressure 150 psig

Set Pressure.....2500 psig
Minus Constant Back Pressure ..... -150 psig
Cold Differential Set Pressure .....2350 psig

Set pressure 400 psig on superheated steam, temperature 650º F, backpressure atmospheric

Operating Temperature..... 650º F
Minus Temperature of
Saturated Steam at 400 psig..... -448º F
Degrees of Superheat ..... 202º F
Set Pressure.....400 psig
Multiplier (see Table VIII)..... X1.013
Cold Differential Set Pressure .....405 psig

Blowdown

The blowdown for all series 19000 valves is fixed. Do not attempt to adjust the blowdown on these valves. Typical blowdown is less than 10%.

Simmer

If simmer causes erratic valve opening, refer to the Trouble Shooting Guide in this manual.

Seat Leakage

(a) Air

The air-leakage test shall be performed with all connections and openings in the body and bonnet pressure-tight. The cap, with the gasket which covers the adjusting screw, must be installed. Test the valve for leakage using an API test fixture. The API leakage test procedure is described below:

(i) Per API Standard 527, a standard test fixture consists of a piece of tubing of 5/16" (7.94 mm) x .035" (0.89 mm) wall, one end of which is joined to an adapter on the valve outlet and the other end of which is immersed 1/2" (12.70 mm) below the surface of a reservoir of water.

(ii) The leakage rate for a valve with metal to metal seats shall be determined with the valve mounted vertically and using a standard test fixture, as described above. The leakage rate, in bubbles per minutes, shall be determined with the pressure at the safety relief valve inlet held at 90 percent of the set pressure, immediately after popping, for valves set 51 psig (3.517 bar) and above. On valves set at 50 psig (3.448 bar) and below, test for leakage at 5 psig (0.345 bar) below the set pressure, immediately after popping. The test pressure shall be applied for a maximum of one minute.

(iii) The Tightness Standard is the leakage rate in bubbles per minute and shall not exceed that shown in Table IX for metal seat valves or Table X for O-Ring seat seal valves.

A valve with a seat of resilient material (i.e., an O-Ring valve) shall show no leakage at pressures less than those indicated in Table X when the test medium is either air or water.

(b) Water

When a metal-to-metal seat valve is tested using water as the test medium, there shall be no leakage, as determined by sight when the pressure is held at 90% of set pressure.

For O-Ring seat seal valves use Table X to determine the percentage of set pressure."

(c) Steam

When a metal-to-metal seat valve is checked for tightness using steam as the test medium

Table IX

Max Leakage Rate	Approximate Leakage Rate
(Bubbles per minute)	(Standard cubic ft. per 24 hr.)
40	0.06 (16.99 liters)

Table X

Set Pressure	Min. Leak Point (% of Set Pressure)
15/(1.034 bar) to 30 psig (2.069 bar)	90%
31/(2.138 bar to 50 psig (3.448 bar)	92%
51/(3.517 bar) to 100 psig (6.897 bar)	94%
101/(6.966 bar) psig or greater	97%

(at 90% of the set pressure), there shall be no visual or audible leakage after the interior of the valve is allowed to dry after popping. If there is no visual or audible leakage, the valve is acceptable.

For O-Ring seat seal valves use Table X to determine the percentage of set pressure."

Back Pressure Testing

After the valve has been set for the correct opening pressure, it must be back pressure tested. Testing can be conducted by installing the cap (with gasket) and applying air or nitrogen to the valve outlet. Test pressure should be 30 psig (2 barg) or the actual valve back pressure, whichever is greater. Examine the base (1) to bonnet (5) joint for leakage during back pressure testing:

Note: Leakage is best detected by application of a liquid leak detector. The use of soap or household detergent as a leak detector is not recommended, as it may cover up leaks.

Repair of leaking valve joints may be attempted by tightening the leaking joint while the valve is still on the stand. If this does not stop the leak, disassemble and inspect the leaking joint. The seating surfaces should be better than a 32 rms finish. The valve must be re-tested if disassembly is required. After the valve set pressure has been adjusted, tighten the adjusting screw locknut (10). Install the cap gasket (14) and cap (15) or lifting gear on the valve after applying a small amount of non-copper based thread lubricant to the gasket seal surfaces, and the cap and bonnet threads.

Hydrostatic Testing and Gagging

When hydrostatic tests are required after installation of an SRV, remove the SRV and replace it with a blind flange or pipe plug/cap. If the hydrostatic test pressure will not be greater than the operating pressure of the equipment, a test gag may be used. Very little force, i.e. finger-tight pressure, on the test gag is sufficient to hold hydrostatic pressures. Too much force applied to the gag may bend the spindle and damage the seat. After a hydrostatic test, the gag must be removed and replaced by the sealing plug furnished for this purpose (see Figure 17). (Test gags for Consolidated SRVs can be furnished for all types of caps and lifting gears.)

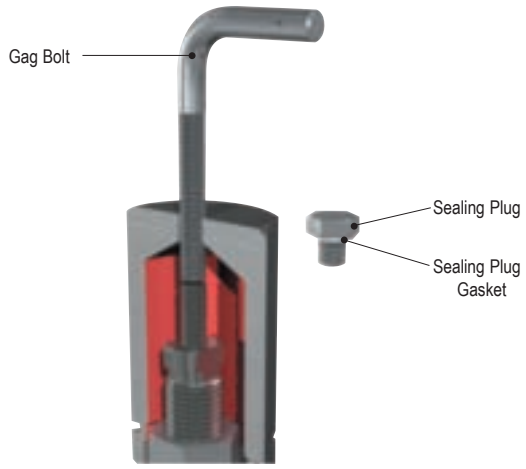


Figure 17

Typical Cap with Gag

Manual Popping of the Valve

Consolidated Safety Relief Valves are furnished, when so ordered, with packed or plain lifting levers for hand popping.

When the valve is to be opened by hand using the lifting lever, the pressure at the valve inlet should be at least 75% of the valve's set pressure. Under flowing conditions, the valve must be fully lifted from its seat, so that dirt, sediment and scale will not become trapped on the seating surfaces. When allowing the valve to close under flowing conditions, completely release the lever from maximum lift to snap the valve back on its seat.

Since, in some cases, the dead weight of the lever may have a tendency to lift the valve disc, the lever should be hung, supported or counter weighted so the lifting fork does not contact the release nut.

Addendum: the 19096M-DA-BP Valve

This is an addendum to the Consolidated 19000 Series portable safety relief valve installation, operation and maintenance manual to incorporate 19096M-DA-BP valve requirements.

This section contains information specific to the 19096M-DA-BP Safety Relief Valve. The safety precautions, warranty information, terminology, handling, storage, pre-installation instructions, recommended installation, disassembly, cleaning, parts inspection, maintenance, reassembly, lubrication, setting, testing, troubleshooting and inventory instructions will be those of the general manual unless they are indicated differently within this section.

Introduction

The 19000 back pressure version is only available in the 0.096 inch orifice with an O-Ring seat. It is available for steam, liquid or gas applications and may be furnished with a plain or screwed cap. The 19096M-DA-BP variation is furnished as a 19096M designation with a pressure range of 50-2000 psig. The standard medium pressure valve is limited to a minimum of 290 psig in the standard 19000 design. The designation will be used since most of the parts are from the 19096M bill of material.

Table XI – Performance Criteria for the 19096M-DA-BP Valve

Typical blowdown as a percent of set pressure (At the low end of the spring range with the maximum allowed back pressure applied, the blowdown is shortest.)	Liquid: 6% – 20% Gas: 3% – 16%
Allowable total back pressure (This is the sum of the variable and constant back pressure, superimposed and built-up.)	Liquid: 70% of set pressure Note: Thermal relief applications may be supplied with back pressures up to 90% of set pressure. Gas: 50% of set pressure Note: Total back pressure for liquid or gas shall not exceed 400 psig (27.58 barg).
Temperature limits (Determined by O-Ring material selection)	Minimum: -20˚F (-28˚C) Maximum: 600˚F (315˚C)
Seat tightness	Set pressure of 50 psig (3.45 barg): 92% 51 psig (3.52 barg) – 100 psig (6.8 barg): 94% 101 psig (6.9 barg) – Maximum Rating: 95%

Note: Refer to this Table for the performance criteria of this valve.
Applications outside of these ranges may cause malfunction of the intended valve operation.

Changes in this Variation (See Figure 18)

In this design, the bonnet and the spindle are different—there are two added parts and two additional O-Rings. The bonnet is a two-piece design rather than a one-piece. The top of the bonnet (7A) is the male piece and it screws into the female bottom bonnet (7B). The bottom bonnet has a machined shelf in the top on which a metal backup plate (12) seats via an O-Ring (13), part number 310XX030. (The "XX" in the part number designates the material and durometer of the O-Ring.) The spindle (8) is modified to have a larger diameter in the lower section to accommodate a 310XX011 O-Ring (9), which slides through the inside diameter of the backup plate (12), providing an area nearly equal to the area of the base which balances the effects of the back pressure.

Disassembly

(a) Remove the cap (20) (including lifting gear, if any); then remove the cap gasket (19)

(b) Measure the position of the valve adjusting screw (14) and record before removal. Measure from the top of the screw to the adjusting screw locknut (15).

(c) Loosen the adjusting screw locknut (15) and remove the adjusting screw (14) from the bonnet top (7A).

(d) Unscrew the bonnet top (7A) from the bonnet bottom (7B)

(e) Remove the spindle (8), backup plate (12), spring (11) and spring washers (10)

(f) Unscrew the bonnet bottom (7B) from the base (1)

(g) Remove the guide (6) and O-Ring retainer (2)

(h) Remove the retainer lockscrew (4) and the O-Ring retainer (2)

(i) Carefully remove the seat O-Ring (3). Be sure not to damage the O-Ring groove in the disc holder (5)

Parts Inspection (See Figure 18)

Bonnet Top (7A) – the bonnet top should be replaced if:

The threads are stripped, torn or galled.

Bonnet Bottom (7B) – the bottom bonnet should be replaced if:

(a) Threads are stripped, torn or galled

(b) The guide seating surface is scratched, nicked, corroded or leaks

(c) The backup plate seating surface is scratched, nicked or corroded

(d) Condition is porous, corroded or distorted

Backup Plate (12) – the backup plate should be replaced if:

(a) Inside circumference "X" is scratched, nicked, pitted or galled

(b) O-Ring groove "W" is scratched, nicked, pitted or galled

(c) Backup plate is distorted

Spindle (8) – the spindle should be replaced if:

(a) The bearing surfaces "V" are galled, pitted or scratched

(b) The threads are torn, stripped or galled

(c) The spindle is bent

(d) The O-Ring groove is nicked, scratched or pitted

Spindle O-Ring (310XX011) (9)

The spindle O-Ring should always be replaced. The material and durometer of the spindle O-Ring should be the same material and durometer as that specified for the seat O-Ring (3).

Backup Plate O-Ring (310XX030) (13)

The backup plate O-Ring should always be replaced. The material and durometer of the backup plate O-Ring should be the same material and durometer as that specified for the seat O-Ring (3).

Seat O-Ring (310XX013) (3)

The seat O-Ring should always be replaced. The material and durometer of the seat O-Ring should be the same material and durometer as that specified on the O-Ring nameplate.

Re-assembly and Lubrication

(a) All base seats shall be lapped flat enough to remove nicks and burrs.

(b) Bearing surfaces should be ground together using a 320 grit lapping compound (see Table XIII).

These surfaces are the following:

(i) the disc holder-spindle pocket and the spindle spherical holder-spindle radius (for O-ring valves or -1 design);

(ii) the lower spring washer and spindle spring washer radius; and

(iii) the upper spring washer and adjusting screw spherical radius.

Note: Clean all parts prior to re-assembly.

(c) Carefully insert a new seat O-Ring seal into the disc holder (5). Make sure the seat O-Ring is the right size, material and hardness for the application. Refer to the valve nameplate for information required when ordering an O-Ring.

(d) Install the O-Ring retainer (2) and the retainer lockscrew (4). Apply thread locker fluid to lock the screw in position.

(e) Place the disc holder assembly onto the base (1) and place the guide (6) onto the base. The guide seating surfaces should be free of any nicks or scratches.

(f) The guide to bonnet bottom seating and the backup plate ring to bonnet bottom seating surfaces should be free of any nicks or scratches. The guide to bottom bonnet (7B) seating surface should have a finish with a maximum of 63 rms. Apply non-copper based thread lubricant or equivalent anti-seize to the bonnet bottom threads on the base and guide seating surfaces. Install the bonnet on the base (1). Tighten the bonnet bottom to the base using sufficient torque from Base Torque Specification (see Table VI).

(g) Place backup plate O-Ring 310XX030 (13) in the O-Ring groove in the backup plate (12) using a small amount of O-Ring lubricant. Verify that the backup plate seating surface on the bonnet bottom and the backup plate ring inside diameter have no more than a 32 rms finish. Insure that they are clean and free from nicks and scratches. Place the backup plate (12), O-Ring side down, into the counterbore in the bonnet bottom.

(h) Place spindle O-Ring 312XX011 (9) into the O-Ring groove on the spindle (8). Lubricate the spindle nose with a small amount of non-copper based thread lubricant and insert the spindle through the backup plate into the disc holder-spindle pocket.

(i) Apply a small amount of non-copper based thread lubricant to the bearing surface of the lower spring washer (10) and slip it over the spindle (8). Install the spring (11) and upper spring washer (10).

(j) Apply non copper-based thread lubricant to the bonnet top threads for the bonnet bottom and cap joints. Install the bonnet top (7A) into the bonnet bottom (7B) carefully, allowing the spindle (8) to line up with the hole in top. Torque bonnet top to bonnet bottom with 133 ft/lb recommended torque (maximum torque not to exceed 500 ft/lb).

ATTENTION!

The top bonnet is vented and the top bonnet vent must not be plugged.

(k) Thread the adjusting screw locknut (15) on the adjusting screw (14). Apply a small amount of non-copper based thread lubricant to the tip of the adjusting screw. Install the adjusting screw in the bonnet top, rotating the number of times required to compress the spring slightly. Use pliers to hold the spindle in position and prevent galling.

Adjust the adjusting screw to the measurement recorded during disassembly (see step (b), “Disassembly”).

(l) The valve is now ready for setting.

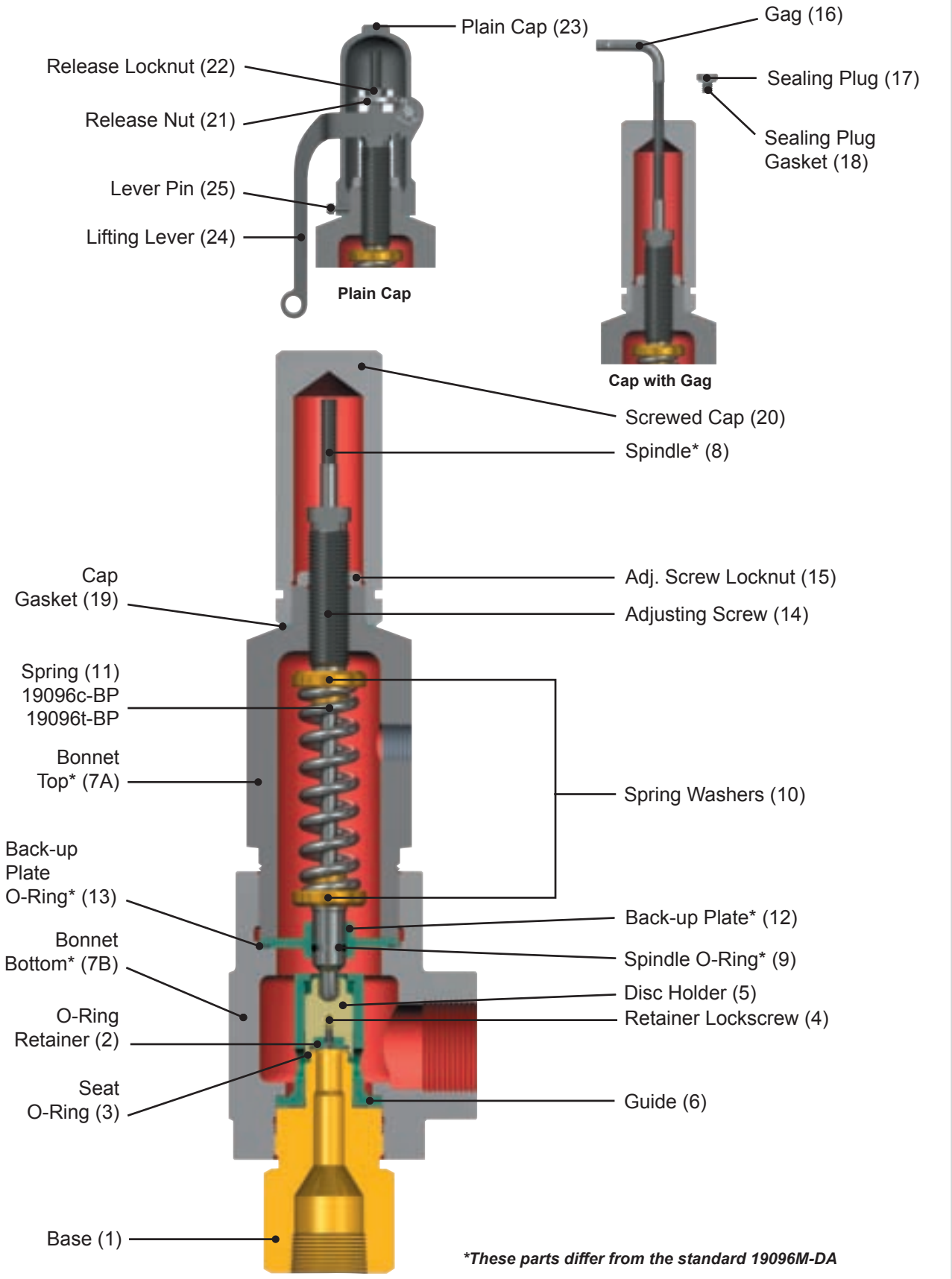


Figure 18 – 19096M-DA-BP Valve Nomenclature

Setting and Testing

General Information

Before putting the reconditioned valve in service, it must be set to open at the required set pressure as shown on the nameplate. Although the valve can be set on the service installation, it is more convenient to set the valve and check seat tightness on a test stand. Any spring replacement shall be in accordance with current Dresser guidelines.

Test Equipment

The test stand used for testing SRVs normally consists of a pressure source supply line with a throttle valve and receiver that have the following features:

- Outlet for attaching the valve to be tested,
- Pressure gauge with a shut-off valve,
- Drain line with a shut-off valve, and
- Adequate receiver volume for the valve to be tested and to achieve proper operation.

Test Media

For best results, valves shall be tested by type as follows:

- Steam valves are tested on saturated steam,
- Air or gas valves are tested on air or gas at ambient temperature, and
- Liquid valves are tested on water at ambient temperature.

Setting the Valve

Set the valve to open at the set pressure as shown on the nameplate. If a cold differential set pressure is indicated on the nameplate, set the valve to open at that pressure. (The cold differential test pressure is the test pressure corrected to compensate for backpressure and/or operating temperature.) A new cold differential test pressure may need to be determined if changes are to be made to the set pressure or backpressure or if the service temperature changes.

(See Set Pressure Compensation)

Note: This design will allow the set pressure to remain constant under superimposed variable back pressure conditions. If changes are to be made to the set pressure or back pressure or the service temperature changes, a new cold differential test pressure may need to be determined.

Blowdown

The blowdown for all series 19000 valves is fixed. Do not attempt to adjust the blowdown on these valves. Typical blowdown is less than 10%. The blowdown under the back pressure conditions will cause a shorter blowdown than when observed with no back pressure.

Seat Leakage

(a) Air

The air-leakage test shall be performed with all connections and openings in the body and bonnet pressure-tight. The cap, with the gasket which covers the adjusting screw, must be installed. Test the valve for leakage using an API test fixture. The API leakage test procedure is described below:

(i) Per API Standard 527 (ANSI B147.1-72), a standard test fixture consists of a piece of tubing of 5/16” (7.94 mm) x .035” (0.89 mm) wall, one end of which is joined to an adapter on the valve outlet and the other end of which is immersed 1/2” (12.70 mm) below the surface of a reservoir of water.

(ii) The leakage rate for a valve with metal to metal seats shall be determined with the valve mounted vertically and using a standard test fixture, as described above. The leakage rate, in bubbles per minutes, shall be determined with the pressure at the safety relief valve inlet held at 90 percent of the set pressure, immediately after popping, for valves set 51 psig (3.517 bar) and above. On valves set at 50 psig (3.448 bar) and below, test for leakage at 5 psig (0.345 bar) below the set pressure, immediately after popping. The test pressure shall be applied for a maximum of one minute.

(iii) The Tightness Standard is the leakage rate in bubbles per minute and shall not exceed that shown in Table IX for metal seat valves or Table X for O-Ring seat seal valves. A valve with a seat of resilient material (i.e., an O-Ring valve) shall show no leakage at pressures less than those indicated in Table X when the test medium is either air or water.

(b) Water

When a metal-to-metal seat valve is tested using water as the test medium, there shall be no leakage, as determined by sight when the pressure is held at 90% of set pressure.

For O-Ring seat seal valves use Table X to determine the percentage of set pressure.

(c) Steam

When a metal-to-metal seat valve is checked for tightness using steam as the test medium (at 90% of the set pressure), there shall be no visual or audible leakage after the interior of the valve is allowed to dry after popping. If there is no visual or audible leakage, the valve is acceptable.

For O-Ring seat seal valves use Table X to determine the percentage of set pressure.

Back Pressure Testing

After the valve has been set for the correct opening pressure, it must be back pressure tested. Testing can be conducted by installing the cap (with gasket) and applying air or nitrogen to the valve outlet. Test pressure should be 30 psig (2 barg) or the actual valve back pressure, whichever is greater. Examine the following components for leakage during back pressure testing:

(a) base (1) to bonnet bottom (7B) joint,

(b) bonnet bottom (7B) to bonnet top (7A) joint, and

(c) the bonnet top vent port.

Note: Leakage is best detected by application of a liquid leak detector. The use of soap or household detergent as a leak detector is not recommended, as it may cover up leaks.

Repair of leaking valve joints may be attempted by tightening the leaking joint while the valve is still on the stand. If this does not stop the leak, disassemble and inspect the leaking joint. If the leak is at the loose bonnet top vent plug, the valve should be disassembled and the backup plate O-Ring and spindle O-Ring must be inspected. The seating surfaces for these O-Rings must also be inspected for nicks, damage or dirt. The seating surfaces should be better than a 32 rms finish. The valve must be re-tested if disassembly is required. After the valve set pressure has been adjusted, tighten the adjusting screw locknut (15). Install the cap gasket (19) and cap (20) or lifting gear on the valve after applying a small amount of non-copper based thread lubricant to the gasket seal surfaces and the cap and bonnet top threads.

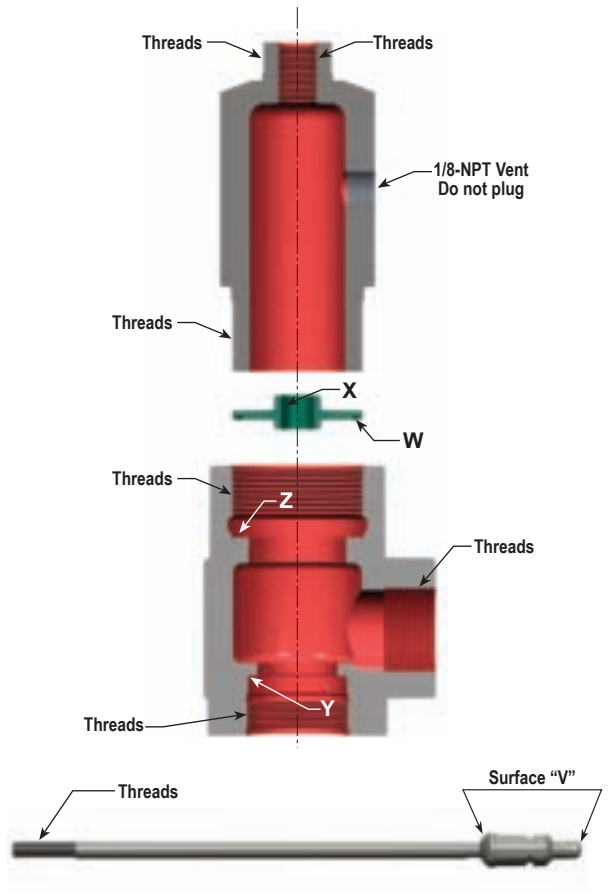


Figure 19 – 19096M-DA-BP Valve Two Piece Bonnet, Spindle, and Back-up Plate

ATTENTION!

Be careful when removing O-Rings to avoid damage to the O-Ring groove.

Trouble Shooting Guide

Problem	Probable Cause	Corrective Action
Valve leaking	(a) Damaged seat or O-Ring (b) Bearing point damage (c) Part misalignment (d) Discharge stack binding on outlet	(a) Disassemble valve, lap seating surfaces, replace disc or O-Ring (if required) as outlined in this manual (b) Grind and polish (c) Disassemble valve, inspect contact area of disc and nozzle, lower spring washer or spindle, compression screw, spindle straightness, etc. as outlined in this manual (d) Correct as required
Simmer	(a) Line vibrations (b) Lapped seat too wide	(a) Investigate and correct cause (b) Rework seat as specified in this manual
Chatter	(a) Improper installation or valve sizing (b) Built-up back pressure	(a) Check for piping instructions; check required capacity (b) Check outlet piping for flow restrictions
No action; valve does not go into full lift; valve does not close from full lift.	(a) Foreign material trapped between disc holder and guide	(a) Disassemble valve and correct any abnormality as outlined in this manual. Inspect system for cleanliness.

Maintenance Tools and Supplies

The laps identified in Table XII, are required for proper maintenance of Dresser Consolidated Series 19000 seats.

NOTE: One set of three laps is recommended for each size to assure ample flat laps are available at all times.

- The Lap Resurfacing Plate is part number 0439003
- Lapping compounds are identified in Table XIII.
- Laps and the lapping plate may be purchased from Dresser Consolidated.

Table XII – Laps

Valve	Part Number
19096L, 19110L, 19126L, 19096M, 19110M, 19126M, 19096H, 19110H, 19126H	1672802
19226L, 19226M, 19226H	1672803
19357L, 19567L, 19357M, 19567M	1672805

Table XIII – Lapping Compounds

Brand	Grade	Grit	Lapping Function	Size Container	Part Number
Clover	1A	320	General	4 oz.	199-3
Clover	3A	500	Finishing	4 oz.	199-4
Kwik-Ak-Shun	–	1000	Polishing	1 lb. 2 oz.	199-11 199-12

Replacement Parts Planning

General Information

The importance of maintenance planning is the key to good plant operations. Part of that planning involves making sure that replacement parts needed to repair valves are available at the jobsite when required. Developing and implementing a standard valve maintenance plan will quickly pay for itself by eliminating costly downtime, unscheduled outages, etc.

Inventory Planning

The basic objectives in formulating a replacement parts plan are:

- Prompt availability,
- Minimum downtime,
- Sensible cost, and
- Source control.

Having parts immediately available from plant storeroom inventory is obviously the best way to accomplish those objectives. Since it is impractical to have every part that might be needed to accomplish a given repair in stock at all times, guidelines for establishing meaningful inventory levels are summarized in Table XIV.

In addition, you can contact your local Green Tag Center or Dresser Consolidated authorized sales representative (contact information can be found at the end of this manual) for assistance in determining inventory levels, pricing and ordering parts.

Replacement Parts List

Consult the Recommended Spare Parts list (see Tables XV.A and XV.B) to determine the parts to include in the inventory plan.

Select the desired parts and determine those required for proper maintenance of the valve population in the plant.

Identification and Ordering Essentials

When ordering service parts, please furnish the following information to insure receiving the correct replacement parts:

(1) Identify valve by the following nameplate data:
  (a) Size 3/4"
  (b) Type 19096LC - 1
  (c) Temperature class (Spring Selection) S/N
  (d) Serial Number TC75834

(2) Specify parts required by:
  (a) Part name
  (b) Part number (if known)
  (c) Quantity

Table XIV – Establishing Inventory Levels

Part Classification	Replacement Frequency	Need Coverage Probability*
Class I	Most frequent	70%
Class II	Less frequent but critical	85%
Class III	Seldom replaced	95%
Class IV	Hardware	99%

** Need Coverage Probability means that percentage of time the user plant will have the right parts to make the proper repair on the product, (i.e. if Class I parts are stocked at the owner's facility, the parts needed to repair valve in question will be immediately available in 70% of all instances).*

Genuine Dresser Parts

Each time replacement parts are needed, keep these points in mind:

- Dresser, Inc. designed the parts.
- Dresser, Inc. guarantees the parts.
- Consolidated® valve products have been in service since 1879.
- Dresser, Inc. has worldwide service.
- Dresser Consolidated has fast response availability for parts with the global Green Tag Center / authorized sales representatives network.

Recommended Spare Parts for Series 19000 Safety Relief Valves

Table XV.A – Metal to Metal Seat Valves			
Class	**Part name**	**Quantity Parts/Size Type & Material Valves in Service**	**Need Coverage Probability**
I	Disc Gaskets, Cap	1/1 1/1	70%
II	Disc Holder Spindle Guide	1/5 1/5 1/5	85%
III	Spring Assembly Compression Screw	1/5* 1/5	95%
IV	Compression Screw Locknut Cap (specify screwed, packed, or plain) Release Nut (used on packed or plain lever only) Release Locknut (used on packed or plain lever only)	1/5 1/5 1/5 1/5	99%

Table XV.B – O-Ring Seat Valves			
Class	**Part name**	**Quantity Parts/Size Type & Material Valves in Service**	**Need Coverage Probability**
I	O-Ring Retainer O-Ring Lock Screw Gaskets, Cap	1/1 1/1 1/1 1/1	70%
II	Disc Holder Spindle Guide	1/5 1/5 1/5	85%
III	Spring Assembly Compression Screw	1/5* 1/5	95%
IV	Compression Screw Locknut Cap (specify screwed, packed, or plain) Release Nut (used on packed or plain lever only) Release Locknut (used on packed or plain lever only)	1/5 1/5 1/5 1/5	99%

*** Consult Spring Selection Chart before ordering springs to determine actual quantities required in view of pressure setting potential in each spring range.**

YOUR SAFETY IS OUR BUSINESS!!!

Dresser, Inc. has not authorized any company or any individual to manufacture replacement parts for its valve products. When ordering replacement valve parts, please specify in your purchase order: ALL PARTS MUST BE DOCUMENTED AS NEW AND SOURCED FROM DRESSER, INC. OR YOUR LOCAL GREEN TAG CENTER / DRESSER CONSOLIDATED AUTHORIZED SALES REPRESENTATIVE.

Manufacturer's Warranty, Field Service, Factory Repair Facilities and Training

Warranty Information

WARRANTY STATEMENT* – Dresser, Inc. warrants that its products and work will meet all applicable specifications and other specific product and work requirements (including those of performance), if any, and will be free from defects in material and workmanship.

Defective and nonconforming items must be held for Dresser Consolidated's inspection and returned to the manufacturer upon request.

INCORRECT SELECTION OR MISAPPLICATION OF PRODUCTS – Dresser, Inc. cannot be responsible for customers' incorrect selection or misapplication of our products.

UNAUTHORIZED REPAIR WORK – Dresser, Inc. has not authorized any non-Dresser-affiliated repair companies, contractors or individuals to perform warranty repair service on new products or field-repaired products of its manufacture. Therefore, customers contracting such repair services from unauthorized sources do so at their own risk.

* Refer to Dresser's Standard Terms of Sale for complete details on warranty and limitation of remedy and liability.

Factory Repair Facilities

The factory at Alexandria, Louisiana, maintains a complete Consolidated repair center. The Repair Department, in conjunction with the manufacturing facilities, is equipped to perform specialized repairs and product modifications, e.g., butt-welding, code welding and pilot replacement.

Contact: Valve Repair Department at +(1) (318) 640-6057.

SRV Maintenance Training

The rising costs of maintenance and repair in the utility and process industries indicate the need for trained maintenance personnel. Dresser Consolidated conducts service seminars that help your maintenance and engineering personnel reduce these costs.

Seminars, conducted either at your site, or at our manufacturing plant in Alexandria, Louisiana, provide participants with an introduction to the basics of preventative maintenance necessary to minimize downtime, reduce unplanned repairs and increase valve safety. While these seminars do not create "instant experts," they do provide the participants with hands-on experience with Consolidated® valves. The seminar also includes valve terminology and nomenclature, component inspection, troubleshooting, setting and testing with emphasis on the ASME Boiler and Pressure Vessel Code.

For further information, contact the Product Training Manager by fax at + (1) (318) 640-6325 or telephone at + (1) (318) 640-6054.

Field Service

Dresser Consolidated provides safe, reliable valve services through our Green Tag certified valve assemblers and repair centers. The first valve repair network of its kind and today's industry leader, our authorized Green Tag Centers have successfully served the valve market for more than 25 years. Our services include:

Valve Survey

- Comprehensive, accurate record of all PRVs
- Interchangeability identified
- Identify forgotten or overlooked valves
- Product upgrades to reduce cost improve performance

Inspection of the Valve & Installation

- Visual evaluation of the installation for compliance to codes and regulations
- Written evaluation highlighting compliance and discrepancies
- Recommendations and corrective actions

Testing

- On-site and in-place testing using Dresser Consolidated's EVT® testing device
- Shop testing on high-capacity testing facilities with steam, air or water by fully trained and certified pressure relief valve technicians
- Baseline history established

Repair

- Dresser Audited Facility
- Using Dresser Consolidated's Inspection Criteria and Critical Dimensions
- By fully trained and certified pressure relief valve technicians
- Using original manufactured parts

Inventory Control

- Global access to spare parts inventories via www.greentag.net with your local Green Tag Center / Dresser Consolidated authorized sales representative
- Parts interchangeability
- Obsolete and excess inventory identified
- Recommend cost effective inventories

ValvKeep®

- Total computer-based valve management system
- Free interchange of information
- Historical data and permanent record of traceability
- Maintenance scheduling and planning
- Repair intervals validated by each valves' maintenance history
- Code compliance
- Accessible via secure password-protected internet connection.
- Downloadable and printable reports

Call 1-800-245-VALV to find your local Dresser Consolidated Certified Green Tag Service Center.

Sales Office Locations

Dresser Consolidated has an extensive worldwide sales and service network. Listed here are Dresser Consolidated offices that can help you locate a representative for your locale.

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Dresser Direct
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Deer Park, TX 77536-6557
Telephone: + (1) 281 884 1000
Fax: + (1) 281 884 1010

Dresser Direct
905A Industrial Road
Clute, TX 77531-5720
Telephone: + (1) 979 265 1309
Fax: + (1) 979 265 2514

Dresser Direct
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Corpus Christi, TX 78408-2621
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FOR YOUR GREEN TAG CENTER IN USA/CANADA CALL 1-800-245-VALV
or contact the locations listed above for international service.

For the most current listings, see www.dresser.com

Notes

Notes

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