

Consolidated™ 1982 Series

Safety Relief Valves

Instruction Manual (Rev. B)



THESE INSTRUCTIONS PROVIDE THE CUSTOMER/OPERATOR WITH IMPORTANT PROJECT-SPECIFIC REFERENCE INFORMATION IN ADDITION TO THE CUSTOMER/OPERATOR'S NORMAL OPERATION AND MAINTENANCE PROCEDURES. SINCE OPERATION AND MAINTENANCE PHILOSOPHIES VARY, BAKER HUGHES (AND ITS SUBSIDIARIES AND AFFILIATES) DOES NOT ATTEMPT TO DICTATE SPECIFIC PROCEDURES, BUT TO PROVIDE BASIC LIMITATIONS AND REQUIREMENTS CREATED BY THE TYPE OF EQUIPMENT PROVIDED.

THESE INSTRUCTIONS ASSUME THAT OPERATORS ALREADY HAVE A GENERAL UNDERSTANDING OF THE REQUIREMENTS FOR SAFE OPERATION OF MECHANICAL AND ELECTRICAL EQUIPMENT IN POTENTIALLY HAZARDOUS ENVIRONMENTS. THEREFORE, THESE INSTRUCTIONS SHOULD BE INTERPRETED AND APPLIED IN CONJUNCTION WITH THE SAFETY RULES AND REGULATIONS APPLICABLE AT THE SITE AND THE PARTICULAR REQUIREMENTS FOR OPERATION OF OTHER EQUIPMENT AT THE SITE.

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Conversion Table

All the USCS values are converted to metric values using the following conversion factors:

USCS Units	Conversion Factor	Metric Unit
in.	25.4	mm
lb.	0.4535924	kg
in ²	6.4516	cm ²
ft ³ /min	0.02831685	m ³ /min
gal/min	3.785412	L/min
lb/hr	0.4535924	kg/hr
psig	0.06894757	barg
ft lb	1.3558181	Nm
°F	5/9 (°F-32)	°C

Note: Multiply USCS value with conversion factor to get metric value.

NOTICE

For any service questions not covered in this manual, please contact your local *Green Tag™* Center (GTC).

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I. Warranty Information

⚠ CAUTION



Defective and nonconforming items must be inspected by Baker Hughes

⚠ CAUTION



Removal or breakage of seal will negate our warranty.

Warranty Statement

Warranty Statement⁽¹⁾ - Baker Hughes warrants that its products and services will meet all applicable specifications and other specific product and service requirements (including those of performance), if any, and will be free from defects in material and workmanship.

CAUTION: Defective and nonconforming items must be held for Baker Hughes's inspection and returned to the original F.O.B point upon request.

Incorrect Selection or Misapplication of Products - Baker Hughes cannot be responsible for customer's incorrect selection or misapplication of our products.

Unauthorized Repair Work - Baker Hughes has not authorized any non-Baker Hughes 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 must do at their own risk.

Unauthorized Removal of Seals - All new valves and valves repaired in the field by Baker Hughes Field Service are sealed to assure the customer of our guarantee against defective workmanship. Unauthorized removal and/or breakage of this seal will negate our warranty.

1. Refer to the Baker Hughes Standard Terms of Sale for complete details on warranty and limitation of remedy and liability.

II. Safety Notice

Proper installation and start-up is essential to the safe and reliable operation of all valve products. The relevant procedures recommended by Baker Hughes, and described in these instructions, are effective methods of performing the required tasks.

It is important to note that these instructions contain various “safety messages” which should be carefully read in order to minimize the risk of personal injury, and/or the possibility that improper procedures will be followed which may damage the involved Baker Hughes product, or render it unsafe. It is also important to understand that these “safety messages” are not exhaustive. Baker Hughes can not possibly know, evaluate, and advise any customer of all of the conceivable ways in which tasks might be performed, or of the possible hazardous consequences of each way. Consequently, Baker Hughes has not undertaken any such broad evaluation and, thus, anyone who uses a procedure and/or tool, which is not recommended by Baker Hughes, or deviates from Baker Hughes recommendations, must be thoroughly satisfied that neither personal safety, nor valve safety, will be jeopardized by the procedure and/or tools selected. If not so satisfied, contact your local Green Tag Center (GTC) if there are any questions relative to procedures and/or tools.

The installation and start-up of valves and valve products may involve proximity to fluids at extremely high pressure and/or temperature. Consequently, every precaution should be taken to prevent injury to personnel during the performance of any procedure. These precautions should consist of, but are not limited to, ear drum protection, eye protection, and the use of protective clothing, (i.e., gloves, etc.) when personnel are in, or around, a valve work area.

It is the responsibility of the purchaser or user of Baker Hughes valves/equipment to adequately train all personnel who will be working with the involved product. For more information on training schedules, please contact your local Green Tag Center (GTC). Prior to working with the involved valves/equipment, personnel who are to perform such work should become thoroughly familiar with the contents of these instructions.



III. Product Safety Sign and Label System

If and when required, appropriate safety labels have been included in the rectangular margin blocks throughout this manual. Safety labels are vertically oriented rectangles as shown in the **representative examples** (below), consisting of three panels encircled by a narrow border. The panels can contain four messages which communicate:

- The level of potential harm from the hazard
- The nature of the hazard
- The consequence of human and/or product interaction with the hazard.
- The instructions, if necessary, on how to avoid the hazard.

The top panel of the format contains a signal word (**DANGER, WARNING, CAUTION** or **ATTENTION**) which communicates the level of potential harm from the hazard.

The center panel contains a pictorial which communicates the nature of the hazard, and the possible consequence of human and/or product interaction with the hazard. In some instances of risk to human health and safety the pictorial may, instead, depict what preventive measures to take, such as wearing wearing the appropriate personal protective equipment (PPE).

The bottom panel may contain instructions on how to avoid the hazard. If there is a risk to human health and safety this message may also contain a more precise definition of the hazard, and the consequences of human and/or product interaction with the hazard, than can be communicated solely by the pictorial.

①

DANGER — Immediate hazards which **WILL LIKELY** result in severe personal injury or death.

②

WARNING — Hazards or unsafe practices which **COULD** result in severe personal injury or death.

③

CAUTION — Hazards or unsafe practices which **COULD** result in minor personal injury.

④

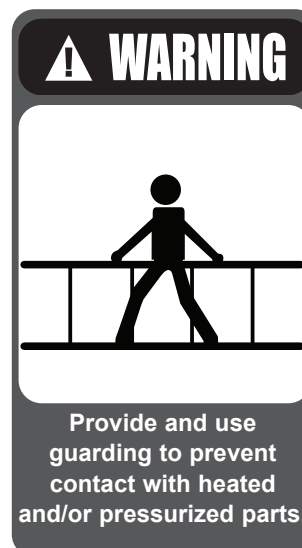
ATTENTION — Hazards or unsafe practices which **COULD** result in product or property damage.



IV. Safety Alerts

Read – Understand – Practice

1. **DANGER:** High temperature/pressure can cause injury. Be sure all system pressure is absent before repairing or removing valves.
2. **DANGER:** Don't stand in front of valve outlet when discharging. **STAND CLEAR OF VALVE** to prevent exposure to potentiality trapped, corrosive media.
3. **DANGER:** When inspecting a pressure relief valve for leakage. **BE VERY CAREFUL!**
1. **WARNING:** Allow the system to cool to room temperature before cleaning, servicing or repairing the system. Hot components or fluids can cause severe personal injury or death.
2. **WARNING:** Always read and comply with safety labels on all containers. Do not remove or deface the container. Do not remove or deface the container labels. Improper handling or misuse could result in severe personal injury or death.
3. **WARNING:** Never use pressurized fluids/gas/air to clean clothing or body parts. Never use body parts to check for leakage and/or discharge rates of valve areas. Pressurized fluids/gas/air injected into or near the body can cause severe personal injury or death.
4. **WARNING:** It is the responsibility of the owner to specify and provide guarding to protect persons from pressurized or heated parts. Contact with pressurized or heated parts can result in severe personal injury or death.
5. **WARNING:** Do not 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 both to themselves and other employees and can cause severe personal injury or death to themselves and/or others.
6. **WARNING:** Incorrect service/repair could result in product/property damage and/or severe personal injury or death.
7. **WARNING:** The misuse of a tool or the use of an improper tool could result in personal injury and/or product/property damage.



IV. Safety Alerts (Cont.)

⚠ WARNING



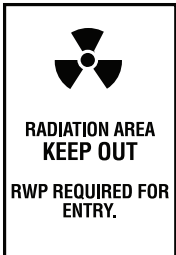
All potential hazards may not be covered in this manual.

⚠ WARNING



Improper tools or improper use of right tools could result in personal injury or product damage.

⚠ WARNING



Know nuclear "health physics" procedures, if applicable, to avoid possible severe personal injury or death.

⚠ CAUTION



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

⚠ CAUTION



Wear necessary protective equipment to prevent possible injury

⚠ CAUTION



Always use appropriate restoration procedures.

1. **CAUTION:** Heed all service manual warnings. Read installation instructions before installing valve(s).
2. **CAUTION:** Wear the appropriate hearing protection when testing or operating valves.
3. **CAUTION:** Wear the appropriate eye and clothing protection.
4. **CAUTION:** Wear the appropriate self-contained breathing apparatus (SCBA) to protect against toxic media.

V. Handling and Storage

Pressure relief valves should be stored in a dry environment and protected from the weather. They should not be removed from the skids or crates until immediately prior to installation. Flange protectors and sealing plugs should remain installed until just prior to installation.

Pressure relief valves, either crated or uncrated, should never be subjected to sharp impact. This would be most likely to occur by bumping or dropping during loading or unloading from a truck or while moving with a power conveyor, such as a fork lift truck. The valve, either crated or uncrated, should always be kept with the inlet down (i.e., never laid on its side), to prevent misalignment and damage to internal components. Crated valves should always be lifted with the inlet down.

Uncrated valves should be moved or hoisted by wrapping a chain or sling around the discharge neck, then around the upper yoke structure, in such manner as will ensure the valve is in a vertical position during lift. Never lift the full weight of the valve by the pilot assembly, tubing, lifting lever or other external device.

VI. Pre-installation and Mounting

When a valve is uncrated and the flange protectors removed, prior to installation, meticulous care should be exercised to prevent dirt from entering the outlet port.

While hoisting a valve to the installation area, care should be exercised to prevent bumping the valve against steel structures and other objects

Pressure relief valves should be mounted in a vertical, upright position. Installing a valve in any other position will adversely affect its operating in varying degrees as a result of induced misalignment of parts.

Flanges and gasket surfaces must be free from dirt and debris when valves are installed. Flange bolts should be tightened evenly to prevent distortion of the valve body and inlet nozzle. Before start-up be sure all threaded points are tight and secure.



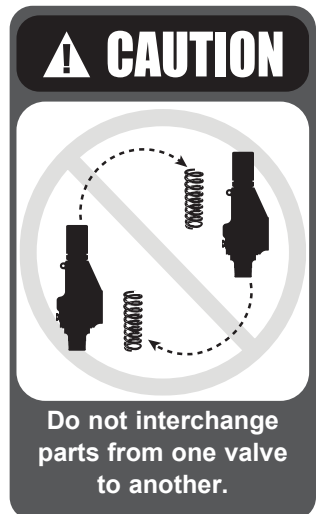
VII. General Planning for Maintenance

A 12-month maintenance interval is recommended for general service conditions. For severe service applications, a 3 to 6 month inspection and testing interim may be more appropriate. The specific plant's operating and service history will better determine this frequency. Baker Hughes encourages preventive maintenance.

Occasionally, remachining may be necessary to extend the service life of a valve. Keep all parts for each valve separated to ensure replacement in the same valve.

DANGER: Insure there is no pressure in the inlet of the valve before attempting to remove it from the piping system.

Note: For maintenance questions not covered in this manual, please contact your local Green Tag Center (GTC).



VIII. Terminology for Pressure Relief Valves

- A. Accumulation:** The pressure increase over the maximum allowable working pressure of the vessel during discharge through the valve, expressed as a percentage of that pressure or in actual pressure units.
- B. Backpressure:** The static pressure existing on the discharge side of a pressure relief valve:
- 1. Built-up Backpressure:** Pressure that develops at the valve outlet as a result of flow, after the valve has opened.
 - 2. Superimposed Backpressure:** Pressure in the discharge header before the valve opens.
 - 3. Constant Backpressure:** Superimposed backpressure that is constant with time.
 - 4. Variable Backpressure:** Superimposed backpressure that will vary with time.
- C. Blowdown:** The difference between set pressure and reseal pressure of a valve, expressed as a percentage of the set pressure or in actual pressure units.
- D. Cold Differential Set Pressure:** The pressure at which the valve is adjusted to open on a test stand. This pressure corrects for backpressure when a pop action pilot's vent is piped to the main valve outlet.
- E. Differential Between Operating and Set Pressures:** Valves in process service 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.
- F. Lift:** The actual travel of the disc away from the closed position when a valve is relieving.
- G. 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 relief valve is set to open.
- H. 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. The suitable margin depends on the type of pressure relief valve in service.
- I. 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.
- J. 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) or kg/hr for vapors, standard cubic feet per minute (SCFM) or m³/min for gases, and in gallons per minute (GPM) or Liter/min (L/min) for liquids.
- K. Set Pressure:** The inlet static pressure at which a pressure relief valve begins to operate under service conditions. In liquid service, the inlet pressure at which a valve starts to discharge determines the set pressure. In gas or vapor service, the inlet pressure at which the valve pops or starts to leak, determines the set pressure.
- L. Simmer:** The audible passage of a gas or vapor across the seating surfaces just before a "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.

IX. Design Features and Nomenclature

Design Simplicity: Consolidated Safety Relief Valves embody a minimum number of component parts, which results in a savings by minimizing spare parts inventory and simplifying valve maintenance. Contact the Parts Marketing organization, P.O. Box 1430, Alexandria, La. for parts inventory planning assistance.

Cap and Lever Interchangeability: Many times it is necessary to change the type of cap or lever in the field after a valve has been installed. Consolidated Safety Relief Valves are supplied so they can be converted to any type of lever or cap desired.

Simple Blowdown Adjustment: The Consolidated single blowdown ring design makes it possible to set and test a valve that has been in service when it cannot be set on line and must be taken to the customer's shop. The ring can be positioned so that the set point can be observed although the volume of the testing media is very low. After the set pressure has been established, proper blowdown can be attained by merely positioning the ring to its original position.

X. Introduction

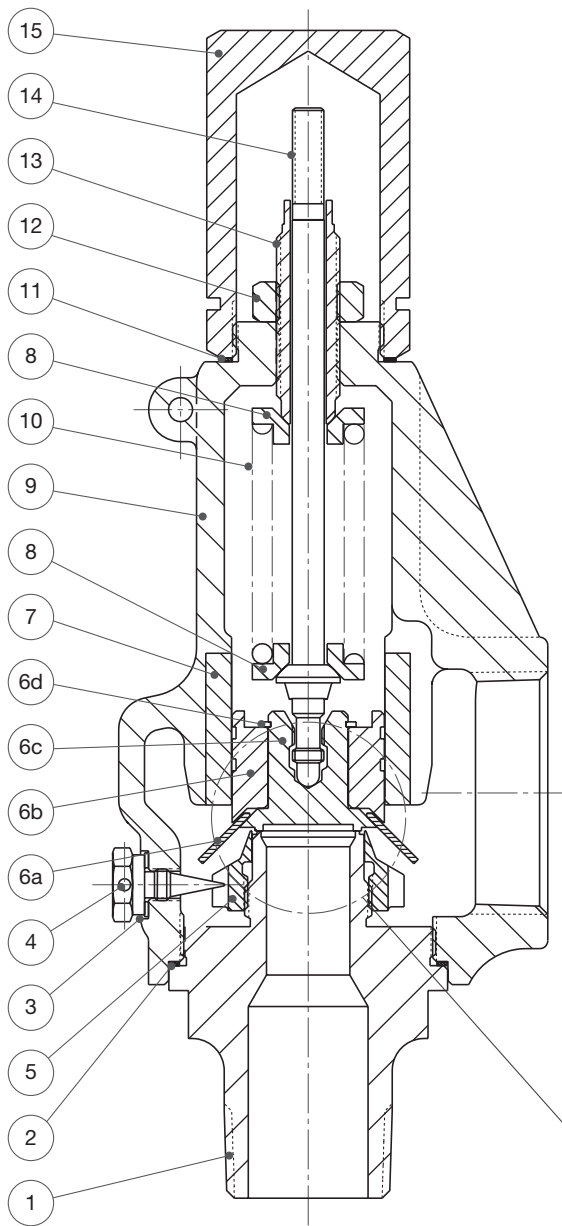
The safety relief valve is an automatic, pressure actuated relieving device suitable for use either as a safety valve or relief valve, depending on application.

Safety relief valves are used on hundreds of different applications, including liquids and hydrocarbons

and therefore, the valve is designed to meet many requirements. However the valve cannot be used on steam boilers or super heaters, but may be used on process steam.

IX. Consolidated 1982 Series Safety Relief Valve

A. Metal Seat Valve



Part No.	Nomenclature
1	Base
1a	Inlet Flange (When Applicable)
2	Bonnet Gasket
3	Adjusting Ring Pin Gasket
4	Adjusting Ring Pin
5	Adjusting Ring
6	Disc Assembly
6a	Disc Collar
6b	Disc Holder
6c	Disc
6d	Disc Retainer
7	Guide
8	Spring Washer
9	Bonnet
10	Spring
11	Cap Gasket
12	Adjusting Screw Locknut
13	Adjusting Screw
14	Spindle Assembly
15	Screwed Cap

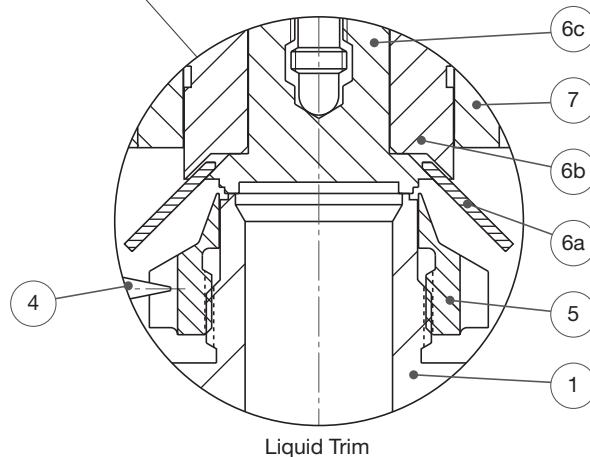


Figure 1: Conventional Metal Seat Valve Construction

IX. Consolidated 1982 Series Safety Relief Valve

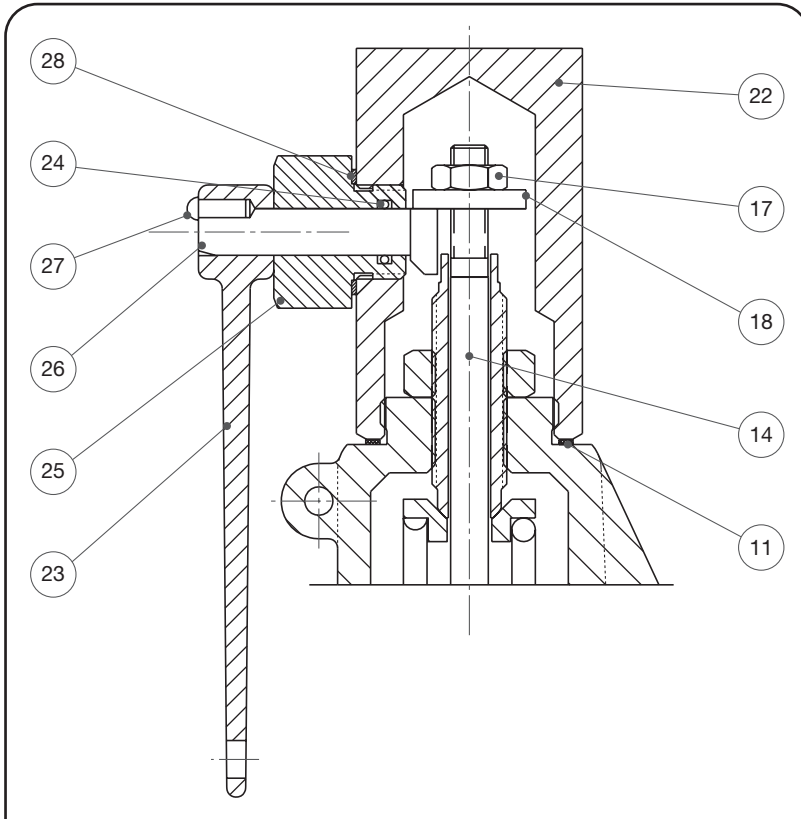


Figure 2: Packed Cap

Part No.	Nomenclature
16	Plain Cap
17	Release Locknut
18	Release Nut
19	Lever Pin
20	Plain Lever
21	Cap Screw
22	Packed Cap
23	Packed Lever
24	O-Ring
25	Bushing
26	Cam Shaft
27	Drive Stud
28	Lever Gasket
29	Gag
30	Sealing Plug
31	Sealing Plug Gasket

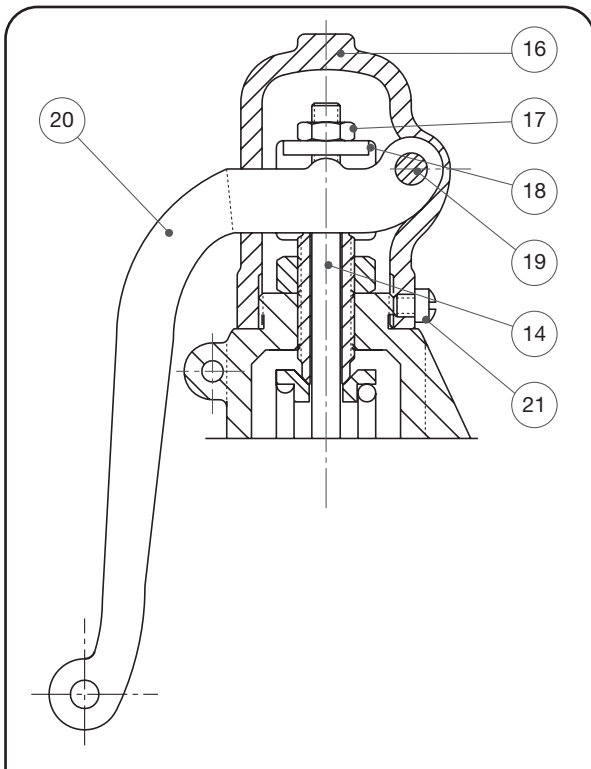


Figure 3: Plain Cap

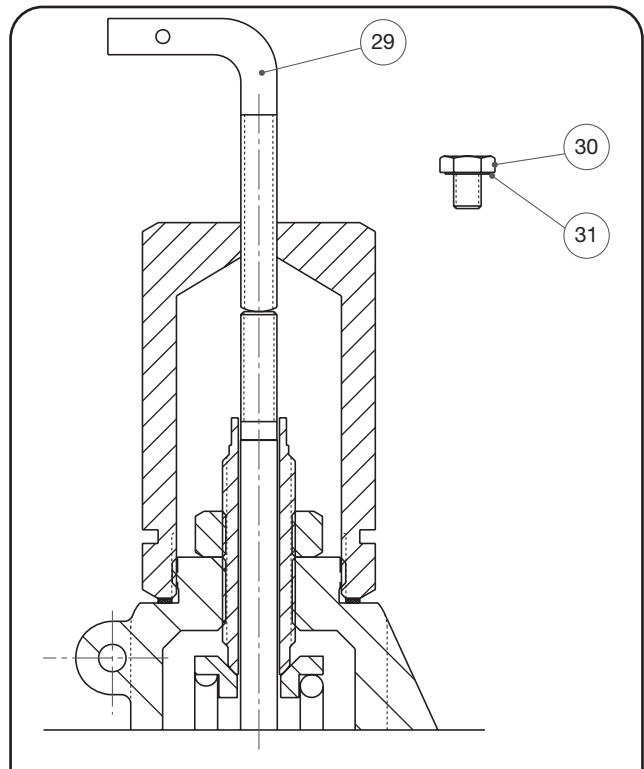


Figure 4: Screwed Cap with Gag

X. Disassembly

(For the parts identification refer to Figures 1 to 4)

1. Remove cap (lifting gear). Remove cap gasket.
2. Remove adjusting ring pin and gasket. If the existing valve action is to be restored, the position of the ring should be determined by turning it counterclockwise until it contacts the roof of the disc recording the number of notches that the ring is moved. Return to the original position below the disc upon reassembly.
3. Loosen adjusting screw locknut. Record the number of turns necessary to barely remove all spring compression. Remove adjusting screw from the bonnet. Return to original position when reassembling.
4. With valve base held in vise, loosen the bonnet to base connection (use strap wrench).

CAUTION: Do not distort base.

5. Remove bonnet, disc assembly, spindle, spring and spring washer assembly from the base, holding the spindle to be sure that the disc does not drop.
6. Remove disc assembly, spindle, spring and spring washers from bonnet.
7. Remove disc from spindle by engaging the drop-out threads and turning the disc counterclockwise.

Seat Repairing and Lapping

Reconditioning of the seating surface of the disc and base is accomplished by lapping with a flat cast iron ring lap coated with Grade No. 1000 KWIK-AK-SHUN™ Silicon-Carbide compound, or equivalent.

Lapping tools are listed in Section XVI (Maintenance Tools and Supplies).

The following method is recommended for lapping seats.

1. Keep the work clean.
2. Always use a fresh lap. If signs of wearing (out of flatness) is evident recondition the lap.
3. Apply a very thin layer of compound to the lap. This will prevent rounding off the edges of the seat.

4. Keep the lap squarely on the flat surface and avoid any tendency to rock the lap which will cause rounding of the seat.
5. When lapping, keep a firm grip on the part to prevent the possibility of dropping it and damaging the seat.
6. Lap using a reciprocating motion in all directions, at the same time apply uniform pressure and rotating the lap slowly.
7. Replace the compound frequently after wiping off the old compound, and apply more pressure to speed the cutting action of the compound.
8. To check the seating surfaces, remove all compound from both the seat and the lap. Then shine up 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. 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.
9. When the lapping is completed, any lines appearing as cross scratches can be removed by rotating the lap, which has been wiped clean of compound, on the seat about its own axis.
10. The seat should now be thoroughly cleaned.

When the seats cannot be repaired by lapping, they can be remachined using dimensions given in Figure 5 and Table 1. The following procedure can be used when machining the base seat:

- a. Using a four-jaw chuck, align the base so that it is running true.
- b. Take light cuts on the seat surface until all damage is removed. Reestablish the .028" (0.71 mm) and B dimension per Figure 6 and Table 2.
- c. Lap the seat.
- d. When minimum dimension "D" is exceeded (Table 2), the base should be discarded.

X. Disassembly (Cont.)

Disc Seat Repair

To recondition the disc seat by lapping, it is necessary to disassemble the disc assembly. This is done in the following manner: The disc is contained in the disc holder by a Truarc retaining ring; the ring may be removed by using a Truarc Plier #4; after removing the Truarc ring, the disc and disc collar can be removed from the disc holder.

The disc can now be lapped using the same procedure as described above.

If the disc is damaged to the extent that machining is necessary, the following procedure can be used:

- Using a four-jaw chuck, align the disc insert so that it is running true.
- Take light cuts on the seat surface until all damage is removed. Reestablish dimensions as shown in Figure 5 and Table 1.
- When "C" dimension has been reduced to .025" (0.64 mm), the disc insert should be replaced.

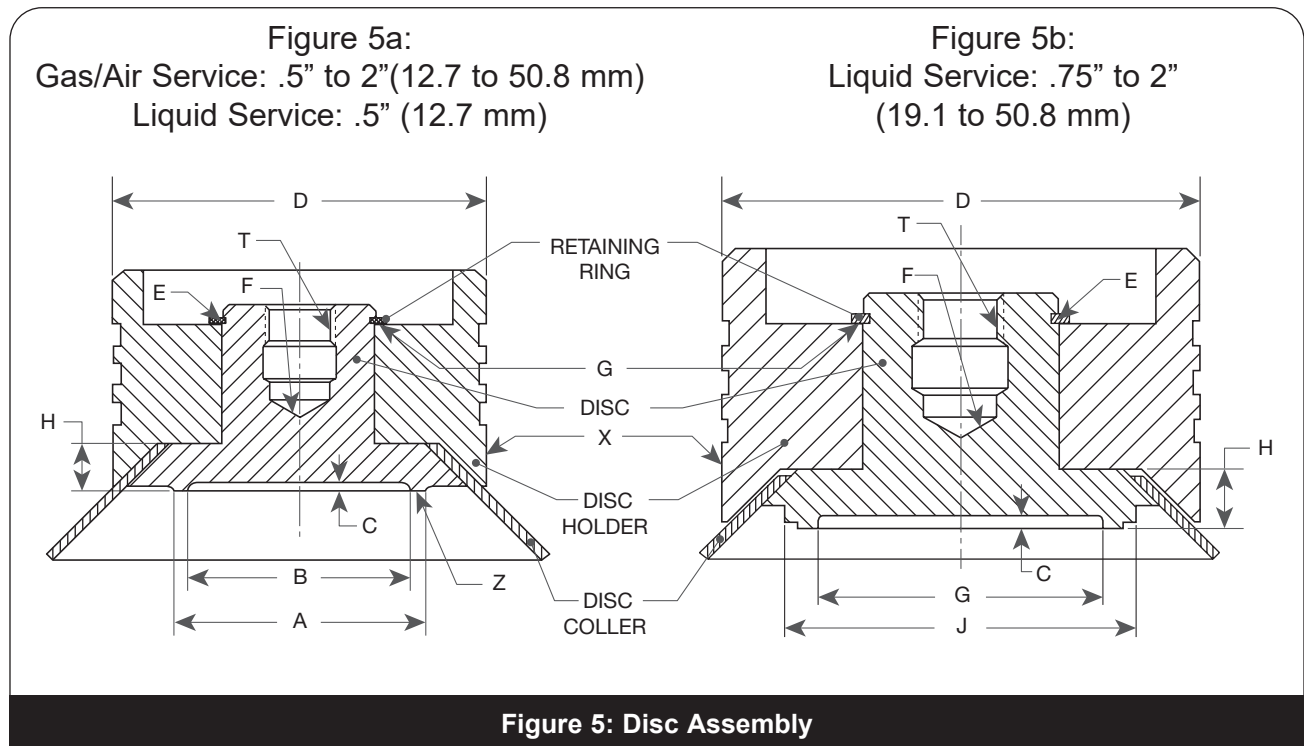


Figure 5: Disc Assembly

Table 1: Disc Assembly Rework Dimensions

Valve Size		A ±.002" (±0.05 mm)		B ±.002" (±0.05 mm)		C min.		D min.		H min.		J +.000"/-.003" (+0.00/-0.08 mm)	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.50	12.70	.518	13.16	.412	10.46	.025	0.64	.715	18.16	.092	2.34	N/A	N/A
.75	19.05	.669	16.99	.561	14.25	.025	0.64	.953	24.21	.117	2.97	.700	17.78
1.00	25.40	.834	21.18	.706	17.93	.025	0.64	1.192	30.28	.147	3.73	.873	22.17
1.50	38.10	1.339	34.01	1.139	28.93	.025	0.64	1.909	48.49	.222	5.64	1.400	35.56
2.00	50.80	1.680	42.67	1.465	37.21	.025	0.64	2.449	62.20	.284	7.21	1.803	45.80

XI. Inspection and Part Replacement

1. Base Replacement Criteria

Base should be replaced if:

- Seat (Surface X) is nicked, or dimension D minimum has been exceeded. (See Table 2).
- Threads (T) are torn, galled or stripped.
- Gasket surface (G) is nicked or experiencing leakage.
- Exceeds other dimensions in Table 2 and Figure 6.

2. Disc Holder Replacement criteria, Figure 5 and Table 1

Disc Holder should be replaced if:

- Outside diameter (D) is galled or exceeds minimum dimension. It requires 32 RMS finish.
- Retainer ring shoulder (G) is worn.
- Exceeds dimensions mentioned in Table 1 and Figure 5.

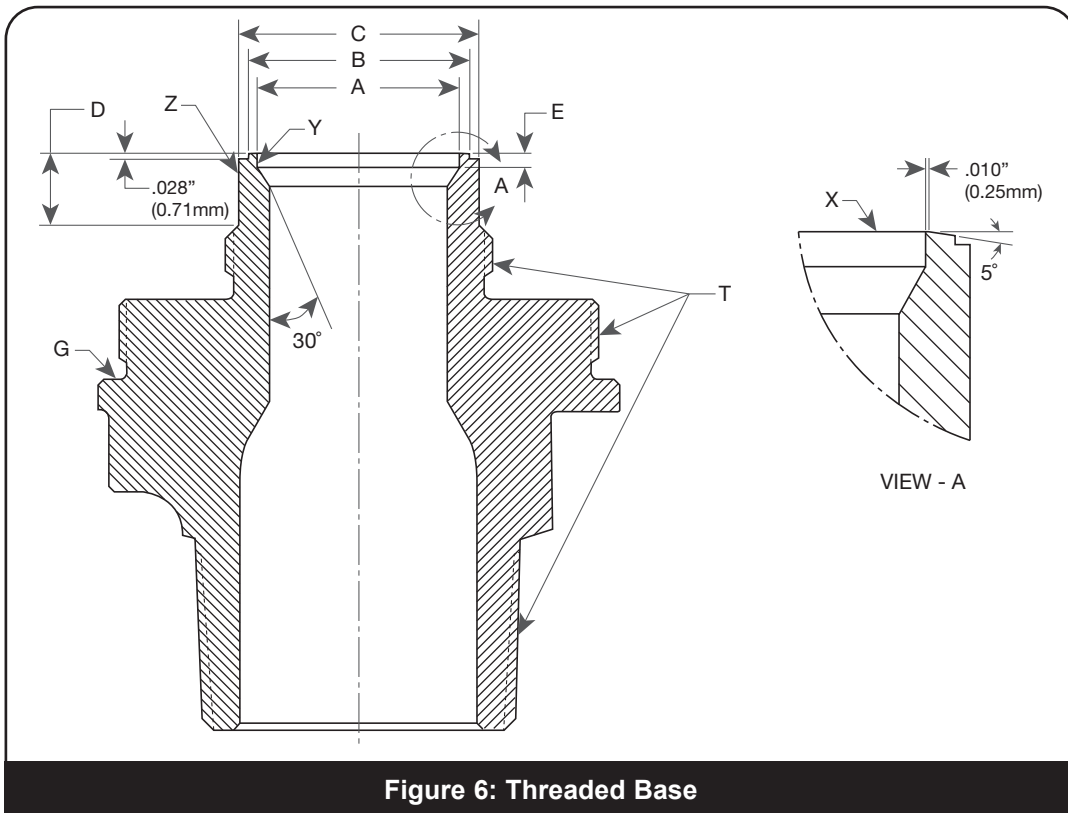


Table 2: Base Rework Dimensions

Valve Size		A +.003"/-.000" (0.08/-0.00 mm)		B +.000"/-.003" (0.00/-0.08 mm)		C +.000"/-.002" (0.00/-0.05 mm)		D min. ⁽¹⁾		E +.005"/-.000" (0.13/-0.00 mm)	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.50	12.7	.442	11.23	.488	12.40	.527	13.39	.219	5.56	.033 ^{+.002} _{-.000}	0.84 ^{+0.05} _{-0.00}
.75	19.1	.589	14.96	.641	16.28	.702	17.83	.219	5.56	.038	0.97
1.00	25.4	.737	18.72	.803	20.40	.875	22.23	.359	9.13	.047	1.19
1.50	38.1	1.179	29.95	1.295	32.89	1.400	35.56	.406	10.32	.076	1.93
2.00	50.8	1.510	38.35	1.635	41.53	1.795 ± .002	45.59 ± 0.05	.484	12.30	.098	2.49

1. Base to be discarded once D minimum is exceeded. Do not reestablish D.

XI. Inspection and Part Replacement (Cont.)

3. Disc Replacement Criteria, Figure 5 and Table 1

Disc should be replaced if:

- a. Seat surface (Z) is nicked, or dimension (C) is reduced to .025" (0.64 mm).
- b. Spindle pocket surface (F) is pitted or galled, it requires 63RMS finish.
- c. Threads (T) are torn, galled or stripped.
- d. Retainer Ring groove (E) is worn.
- e. Disc height (H) exceeds minimum dimension.
- f. Exceeds dimensions mentioned in Table 1 and Figure 5.

4. Disc Retainer Replacement criteria, Figure 5

Disc Retainer should be replaced if:

- a. Overall condition is sprung or signs of corrosion.

5. Guide Replacement Criteria, Figure 7 and Table 3

Guide should be replaced if:

- a. Inside diameter (A) exceeds maximum dimension or galled. It requires 32 RMS finish.
- b. Threads (T) should be replaced if torn, galled or stripped.
- c. Overall condition is distorted or egged.
- d. Guide weld (W) is cracked weld or loose guide.

Note: Guide is tack welded to the bonnet, do not attempt to remove from bonnet.

Table 3: Guide Critical Dimensions			
Valve Size		A max.	
in.	mm	in.	mm
.50	12.70	.722	18.34
.75	19.05	.960	24.38
1.00	25.40	1.200	30.48
1.50	38.10	1.917	48.69
2.00	50.80	2.459	62.46

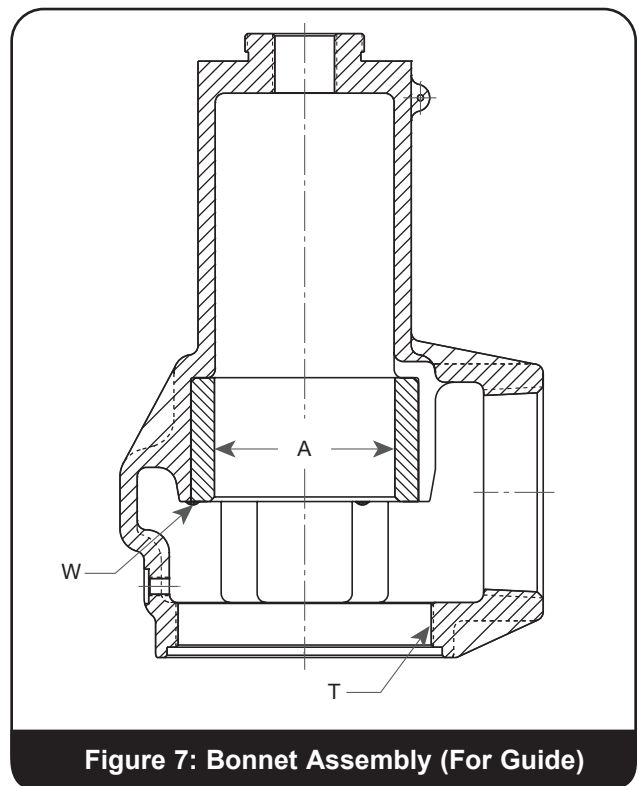


Figure 7: Bonnet Assembly (For Guide)

XI. Inspection and Part Replacement (Cont.)

6. Adjusting Ring Replacement criteria

Adjusting Ring should be replaced if:

- a. Inside diameter (A) exceeds maximum dimension or nicked.
- b. Outside diameter (B) is below minimum dimension or nicked.
- c. Threads (T) should be replaced if torn, galled or stripped.
- d. Adjusting ring notches (N) are worn or missing.
- f. Exceeds dimensions mentioned in Table 4 and Figure 8.

7. Adjusting Screw Replacement criteria

Adjusting Screw should be replaced if:

- a. Threads (T) are torn, galled and stripped.
- b. Bearing surfaces (A) are galled or pitted.

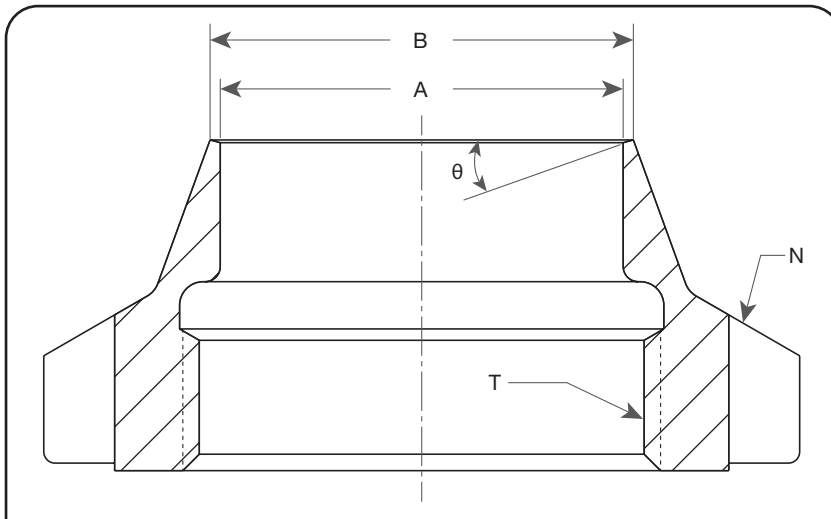


Figure 8: Adjusting Ring

Table 4: Adjusting Ring Critical Dimensions						
Valve Size		A max.		B min.		Angle (θ)
in.	mm	in.	mm	in.	mm	
.50	12.70	.535	13.59	.558	14.17	15°
.75	19.05	.710	18.03	.730	18.54	15°
1.00	25.40	.885	22.48	.902	22.91	0°
1.50	38.10	1.411	35.84	1.458	37.03	15°
2.00	50.80	1.815	46.10	1.871	47.52	0°

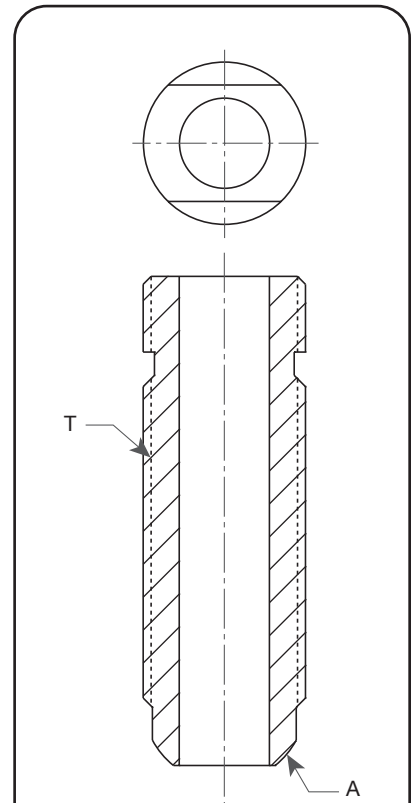


Figure 9: Adjusting Screw

XII. Reassembly

(For parts identification refer to Figures 1 to 4)

1. Before reassembly, all parts should be cleaned. All burrs on guiding surfaces should be carefully removed.
2. Put a small amount of KOPR-Kote™ on the spindle tip and on the lower spring washer bearing. Thread the disc on the spindle and assemble spring and spring washers on the spindle.
3. Insert disc, spindle, spring and spring washer assembly into the bonnet.
4. Assemble adjusting ring to base (top of adjusting ring to be flush with seat). Place a new bonnet gasket on the base.
5. Place a small amount of KOPR-Kote™ on the ball end of the adjusting screw.
6. Holding bonnet and spindle (so that disc will not drop) install bonnet assembly to base. Tighten bonnet on base with strap wrench.
7. Assemble adjusting screw and reestablish spring compression by first turning down the adjusting screw to take out all play and then add the same number of turns that it took to relieve the compression when the valve was disassembled.
8. Reestablish position of adjusting ring as follows:
 - a. Using a pointed tool, turn the adjusting ring to the right slowly, thus raising the ring until it touches the disc.
 - b. Then, counting the notches, turn the adjusting ring to the left, thereby lowering the ring, until the original position is established.
9. Test valve per instructions outlined under "Testing" (Section XIII).

XIII. Setting and Testing

Safety Relief Valve Performance

Satisfactory safety relief valve operation requires that the valve seat shall be satisfactorily tight at the operating pressure (normally about 90% of the set pressure). On gases and vapors, the valve should pop at set pressure after the usual slight warning.

Blowdown Adjustment (Reseating Pressure)

Note: Unless the test stand capacity is equal to or greater than that of the valve, Do not attempt to set blowdown. Simply return the adjusting ring or guide to the original position.

If longer or shorter blowdown is required, it can be obtained as follows:

- a. To increase blowdown (lower reseating pressure), the adjusting ring must be raised by moving the notches from left to right past the ring pin hole.
- b. To decrease blowdown (raise reseating pressure), the adjusting ring must be lowered by moving the notches from right to left past the ring pin hole.

A. Setting and Testing after Reconditioning

Before putting the reconditioned valve in service, it must be set to open at the required set pressure. 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.

When using a test stand, the valve should be set to open at the cold differential set pressure as shown on the nameplate. The cold differential set pressure is the set pressure corrected to compensate for back pressure and/or operating temperature.

B. Setting the Valve

Set the valve on clean air. Before mounting the valve on the test stand, remove all dirt, sediment or scale from the test tank nozzle and the inlet port of the valve. Be sure that the test gauge is accurate and has recently been calibrated on a dead weight gauge tester.

Mount the valve on the test stand. Slowly bring the pressure up in the test tank to the cold differential set pressure. If the valve opens before the desired pressure is reached, additional compression is required on the spring. Hold the spindle to prevent rotation and turn the adjusting screw clockwise. If the valve does not open at the desired pressure, maintain the required pressure in the test tank and slowly release the compression on the spring by turning the adjusting screw counterclockwise until the valve opens. Continue adjustment until the valve opens at the desired pressure. Be sure to hold the spindle when turning the adjusting screw. The spindle should be centrally located within the adjusting screw as hard rubbing of the spindle against the side of the adjusting screw as hard rubbing of the spindle against the side of the adjusting screw may cause poor valve action.

After the required set pressure is obtained, tighten the adjusting screw nut and repeat test. At least two repeat openings at the same pressure should be obtained to be sure that the valve is set accurately.

XIII. Setting and Testing (Cont.)

C. Test Equipment

Test stands (Figure 10) shall consist of a pressure source, a supply line with a throttle valve, and a receiver having the following features:

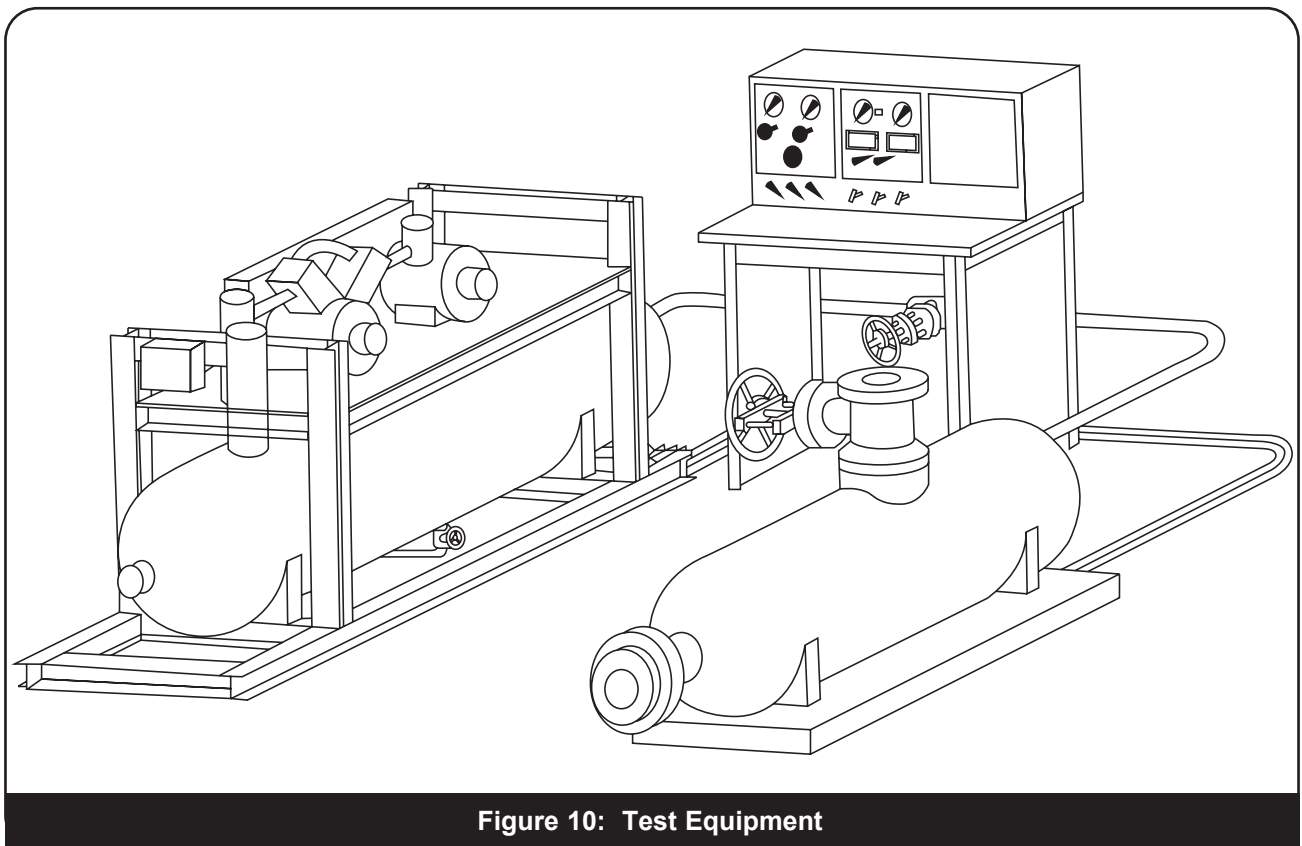
1. Outlet for attaching valve to be tested.
2. Pressure gauge with a shut-off valve.
3. Drain line with a shut-off valve.
4. A volume in receiver adequate for the valve to be tested to achieve adequate operation.

D. Cold Differential Set Pressure

When a Consolidated Safety Relief Valve is to be set on a test stand at room temperature and atmospheric back pressure and is to operate at a higher temperature and/ or a higher back pressure, a set pressure adjustment is required. The adjusted set pressure is designated as the “Cold Differential Set Pressure.”

E. Temperature Adjustment

Safety relief valves set at atmospheric temperatures and are to be used at higher temperatures should have the set pressure adjusted as per the appropriate multiplier listed in Table 5.



XIII. Setting and Testing (Cont.)

Examples of Cold Differential Set Pressure Calculations

(a) Set pressure 255 psig (17.58 barg), temperature 300°F (148.9°C), back pressure atmospheric.

Set Pressure 255 psig (17.58 barg)
 Multiplier (see Table 5)..... X1.006
 Cold Differential Set Pressure.....256.5 psig (17.69)

(b) Set pressure 255 psig (17.58 barg), temperature 300°F (148.9°C), constant pressure 15 psig (1.03 barg).

Set Pressure 255 psig (17.58 barg)
 Minus Constant Back Pressure..... -15 psig (-1.03 barg)
 Differential Pressure..... 240 psig (16.55 barg)
 Multiplier (see Table 5)..... X1.006
 Cold Differential Set Pressure.....241.4 psig (16.64)

(C) Set pressure 255 psig (17.58 barg), temperature 100°F (37.8°C), constant back pressure 15 psig (1.03 barg).

Set Pressure 255 psig (17.58 barg)
 Minus Constant Back Pressure..... -15 psig (-1.03 barg)
 Differential Pressure..... 240 psig (16.55 barg)
 Multiplier (see Table 5)..... X1.003
 Cold Differential Set Pressure240.7 psig (16.60)

The Table 5 can be used for set pressure adjustment of valves with operating temperatures from 251°F (121.7°C) to 800°F (426.7°C).

Table 5: Set Pressure Multipliers for Cold Differential Set Pressure		
Operating Temperature		Multiplier
°F	°C	
250	121.1	1.003
300	148.9	1.006
350	176.7	1.009
400	204.4	1.013
450	232.2	1.016
500	260.0	1.019
550	287.8	1.022
600	315.6	1.025
650	343.3	1.028
700	371.1	1.031
750	398.9	1.034
800	426.7	1.038

XIII. Setting and Testing (Cont.)

F. Seat Leakage

Air

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

Per API Standard 527, (ANSI B142.1-72), a standard test fixture consists of a piece of tubing .313" (7.94mm) x .032" (0.81 mm) wall, one end of which is joined to an adaptor on the valve outlet and the other end of which is immersed .500" (12.70 mm) below the surface of a reservoir of water.

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 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 1 minute."

Tightness Standard: The leakage rate in bubbles per minute shall not exceed the following:

Max. Leakage Rate	Approx. Leakage Rate	
(Bubbles/minutes)	ft ³ / 24 Hr.	Liters/ 24 Hr.
40	0.60	16.99

Water

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

Steam

When a 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. Valve is to be held at test pressure for a minimum of three (3) minutes prior to checking for leakage. If there is no visual or audible leakage, the valve is acceptable.

G. Hydrostatic Testing

When hydrostatic tests are required after installation of the safety relief valve, a test gag must be used. Very little force (fingertight) 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 hydrostatic test the gag must be removed and replaced by the sealing plug furnished for this purpose. Test gags for Consolidated Safety Relief Valves can be furnished for all types of caps and lifting gears.

H. Manual Popping

After the valve has been installed and is in use, it may be necessary to pop it by hand or by pressure to make sure it has not become fouled by chemical action, such as corrosion, and that it continues to function properly. Consolidated Safety Relief Valves are furnished when so ordered with packed or plain lifting gears for hand popping.

XIV. Troubleshooting

Table 6: Troubleshooting		
Malfunction	Cause	Solution
Seat Leakage	<p>A. Damaged seats</p> <p>B. Part Misalignment</p> <p>C. Discharge stack binding on outlet</p>	<p>A. Disassemble valve, lap seating surfaces, replace disc, if required, as outlined in manual.</p> <p>B. Disassemble valve, inspect contact area of disc and nozzle, lower spring washer or spindle, adjusting screw, spindle straightness, etc., as outlined in the manual.</p> <p>C. Correct as required.</p>
Simmer	<p>A. Steam line vibrations</p> <p>B. Lapped seat too wide</p>	<p>A. Investigate and correct cause</p> <p>B. Rework seat</p>
Chatter	<p>A. Improper installation or valve sizing.</p> <p>B. Built-up back pressure.</p>	<p>A. Check for piping restrictions. Check required capacity.</p> <p>B. Check outlet piping for flow restriction</p>
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 manual. Inspect system for cleanliness.

XV. Maintenance Tools And Supplies

A. Lapping Tools

The following tools (Table 7) are required for proper maintenance of Consolidated Safety Valve Seats.

Table 7: Lapping Tools		
Valve Size		Part Number
in.	mm	
.500	12.70	1672801
.750	19.05	1672802
1.000	25.40	1672803
1.500	38.10	1672805
2.000	50.80	1672806

Ring laps and lapping plate may be purchased from Baker Hughes.

B. Lap Resurfacing Plate

P/N 0439003

Note: Ring Laps: One set of three (3) Ring Laps is recommended for each size to assure ample flat laps are available at all times.

C. Lapping Compounds

Table 8: Lapping Compounds					
Brand	Grade	Grit	Lapping Function	Size Container	Part No.
Clover	1A	320	General	4 oz.	199-3
Clover	3A	500	Finishing	4 oz.	199-4
Kwik-Ak-Shun	----	1000	Polishing	1 lb.	199-11
				2 oz.	199-12

D. Lubricant

KOPR-KOTE™

XVI. Replacement Parts Planning

A. Basic Guidelines

The basic objective in formulating a service parts inventory philosophy is to provide prompt service capability, thus preventing maintenance outage time extensions. To accomplish this, it is necessary to have immediate availability of the proper inventory of service parts for optimum valve quantities. This can be achieved at a minimum of cost by defining the inventory on a frequency of need basis.

To assist towards this objective, the Field Service and Repair Organization of Baker Hughes recommends that the following guidelines be utilized to establish meaningful inventory levels.

1. Identify the total number of safety valves in service by size, type number, temperature class, and serial number.
2. Identify the frequency of replacement tendency of specific parts.

Class I Parts Most Frequently Replaced

Class II Parts Less Frequently Replaced, but Critical in the Event of an emergency Requirement

Class III Parts Seldom Replaced

Class IV Hardware (e.g., nuts, bolts, pins, cap components etc.)

Class V - Parts Practically Never Requiring Replacement.

3. "Need Probability Coverage" is defined as the probable percent of total, uninterrupted operational time which can be expected by stocking predetermined valve component classifications.

Determine "need probability coverage" which is compatible with a specific company's operational objectives and service parts inventory investment philosophy. Then relate "need probability coverage" to parts classifications which will satisfy that need. Guidelines are as follows:

Parts Classification	Need Probability Coverage
Class I	70%
Class I & II	85%
Class I, II, & III	95%
Class I, II, III & IV	99%

4. Consult recommended spare parts list by valve type to determine quantity of parts for valves to be covered by the inventory plan.
5. Select parts and specify quantities.

XVI. Replacement Parts Planning (Cont.)

B. Identification And Ordering Essentials

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

Identify valve by:

1. Size
2. Type
3. Temperature Class (Spring Selection)
4. Serial Number:

Example:

3/4"-1982 C-1

S/N TC75834

Specify parts required by:

1. Part Name
2. Part Number (if known)
3. Quantity

The correct part names may be obtained from Figure 1. All other required information will be found stamped on the nameplate attached to the bonnet of the valve. Typical nameplates are shown in Figure 11. Should the nameplate be lost, the valve type and serial number are stamped on the outlet flange.

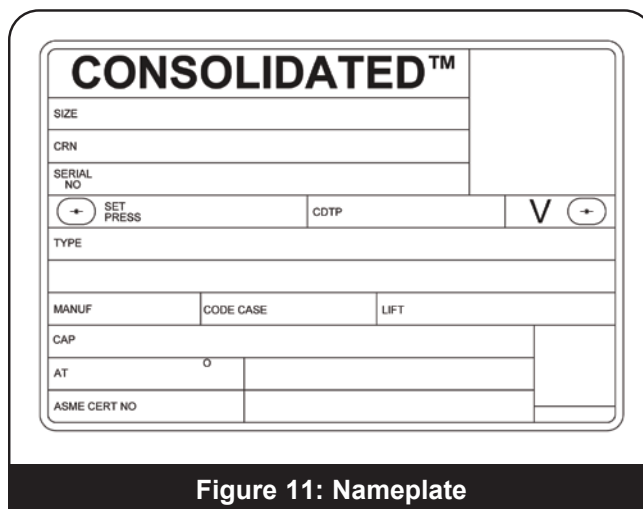


Figure 11: Nameplate

XVII. Genuine Consolidated Parts

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

- Baker Hughes designed the parts
- Baker Hughes guarantees the parts
- Consolidated valve products have been in use since 1879
- Baker Hughes has worldwide service
- Baker Hughes has fast response availability for parts

XVIII. Recommended Spare Parts

Table 9: Recommended Spare Parts			
Class	Part name	Quantity, Parts/Size, Type & Material Valves in Service	Need Coverage Probability
I	Disc	1/1	70%
	Disc Holder	1/1	
	Disc Collar	1/1	
	Bonnet	1/1	
	Disc Retainer Ring	1/1	
	Adjusting Ring Pin	1/1	
	Gaskets	1 Set /1	
	Cap		
	Adjusting Ring		
	Bonnet		
	O-Ring (Packed Cap)	1/1	
II	Guide	1/5	85%
	Spindle	1/5	
III	Spring Assembly	1/5 ⁽¹⁾	95%
	Adjusting Screw	1/5	
	Adjusting Ring		
IV	Adjusting Screw Locknut	1/5	99%
	Cap (specify screwed, packed or plain)	1/5	
	Release Nut (used on packed or plain lever only)	1/5	
	Release Locknut (used on packed or plain lever only)	1/5	

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

XIX. Manufacturer's Service, Repair and Training Program

A. Field Service

Baker Hughes maintains one of the largest and most competent network of field service technicians in the industry. Service technicians are located at strategic points throughout the United States to respond to customer's requirements for service, even in the event of extreme off-hour emergency situations. Each service technician is trained and experienced in servicing Consolidated products.

It is highly recommended that the professional expertise of a field service technician be employed to make final field adjustments during the initial setting of all Consolidated valves.

For further information, please contact your local Green Tag Center (GTC).

B. Repair Facilities

The Consolidated repair department, in conjunction with the manufacturing facilities, are equipped to perform specialized repairs and product modifications, e.g. bushing replacements, hydroset calibrations, electromatic relief valve repairs, code welding, pilot replacement, etc.

For further information, please contact your local Green Tag Center (GTC).

C. Maintenance Training

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

Seminars, conducted either at your site, or at the Consolidated training facility, provide participants with an introduction to the basics of preventative maintenance. These seminars help to reduce downtime, reduce unplanned repairs, and increase valve safety. While they do not make "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, please contact your local Green Tag Center (GTC).

Direct Sales Office Locations

Australia

Brisbane
Phone: +61-7-3001-4319

Perth
Phone: +61-8-6595-7018

Melbourne
Phone: +61-3-8807-6002

Brazil

Phone: +55-19-2104-6900

China

Phone: +86-10-5738-8888

France

Courbevoie
Phone: +33-1-4904-9000

India

Mumbai
Phone: +91-22-8354790

New Delhi

Phone: +91-11-2-6164175

Italy

Phone: +39-081-7892-111

Japan

Tokyo
Phone: +81-03-6871-9008

Korea

Phone: +82-2-2274-0748

Malaysia

Phone: +60-3-2161-03228

Mexico

Phone: +52-55-3640-5060

Russia

Veliky Novgorod
Phone: +7-8162-55-7898

Moscow

Phone: +7-495-585-1276

Saudi Arabia

Phone: +966-3-341-0278

Singapore

Phone: +65-6861-6100

South Africa

Phone: +27-11-452-1550

**South & Central
America and the Caribbean**

Phone: +55-12-2134-1201

Spain

Phone: +34-935-877-605

United Arab Emirates

Phone: +971-4-8991-777

United Kingdom

Phone: +44-7919-382-156

United States

Houston, Texas
Phone: +1-713-966-3600

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valvesupport@bakerhughes.com

valves.bakerhughes.com

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