Consolidated®

INSTALLATION & MAINTENANCE MANUAL

Bronze Safety Valves
Types
1541, 1543, 1541-3, 1543-3, 2471

Industrial Valves | DRESSER

Industrial Valve Operation
Dresser Valve and Controls Division
Alexandria, Louisiana 71309-1430

SAFETY NOTICE

PROPER SERVICE AND REPAIR IS IMPORTANT TO THE SAFE, RELIABLE OPERATION OF ALL VALVE PRODUCTS. THE SERVICE PROCEDURES RECOMMENDED BY DRESSER INDUSTRIAL VALVE OPERATION (DIVO) AND DESCRIBED IN THIS MAINTENANCE AND SERVICE MANUAL ARE EFFECTIVE METHODS OF PERFORMING THE REQUIRED MAINTENANCE OPERATIONS. SOME OF THESE SERVICE OPERATIONS REQUIRE THE USE OF TOOLS SPECIFICALLY DESIGNED FOR THE PURPOSE. THESE SPECIAL TOOLS SHOULD BE USED WHEN AND AS RECOMMENDED.

IT IS IMPORTANT TO NOTE THAT THIS SERVICE MANUAL CONTAINS VARIOUS WARNINGS AND CAUTIONS WHICH SHOULD BE CAREFULLY READ IN ORDER TO MINIMIZE THE RISK OF PERSONAL INJURY OR THE POSSIBILITY THAT IMPROPER SERVICE METHODS WILL BE FOLLOWED WHICH MAY DAMAGE THE VALVE OR RENDER IT UNSAFE. IT IS ALSO IMPORTANT TO UNDERSTAND THAT THESE WARNINGS AND CAUTIONS ARE NOT EXHAUSTIVE. DIVO COULD NOT POSSIBLY KNOW, EVALUATE, AND ADVISE THE CUSTOMER OR UTILITY OF ALL CONCEIVABLE WAYS IN WHICH SERVICE MIGHT BE DONE, OR OF THE POSSIBLE HAZARDOUS CONSEQUENCES OF EACH WAY. CONSEQUENTLY, DIVO HAS NOT UNDERTAKEN ANY SUCH BROAD EVALUATION. ACCORDINGLY, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY DIVO MUST SATISFY HIMSELF THOROUGHLY THAT NEITHER HIS OR OTHER PERSONNEL'S SAFETY NOR VALVE SAFETY AND PROPER OPERATION WILL BE JEOPARDIZED BY THE SERVICE METHOD HE SELECTS. CONTACT DIVO IF THERE IS ANY QUESTION ON THE METHOD.

THE TESTING, INSTALLATION, AND REMOVAL OF VALVE AND VALVE PRODUCTS MAY INVOLVE THE USE OF FLUIDS AT EXTREMELY HIGH PRESSURE AND TEMPERATURE AND/OR ARE CORROSIVE OR EROSIVE. CONSEQUENTLY, EVERY PRECAUTION SHOULD BE TAKEN TO PREVENT INJURY TO PERSONNEL DURING THE PERFORMANCE OF ANY TEST, INSTALLATION OR REMOVAL SUCH AS, BUT NOT LIMITED TO, EAR DRUM PROTECTION, EYE PROTECTION, AND PROTECTIVE CLOTHING SUCH AS GLOVES, ETC., IN AND AROUND THE TESTING, INSTALLATION, OR REMOVAL AREA. DUE TO THE VARIOUS CIRCUMSTANCES AND CONDITIONS IN WHICH THESE OPERATIONS MAY BE PERFORMED ON OUR PRODUCTS, OR THE POSSIBLE HAZARDOUS CONSEQUENCES OF EACH WAY, DIVO COULD NOT POSSIBLY EVALUATE ALL CONDITIONS THAT COULD INJURE PERSONNEL OR EQUIPMENT, BUT DOES OFFER THESE SAFETY PRECAUTIONS AS AN ASSISTANCE ONLY.

SAFETY PRECAUTIONS

1. DO NOT STAND IN FRONT OF THE DISCHARGE SIDE OF A PRESSURE RELIEF VALVE WHEN TESTING OR OPERATING.
2. HEARING PROTECTION SHOULD BE USED WHEN TESTING OR OPERATING VALVE.
3. EXERCISE CAUTION WHEN EXAMINING A PRESSURE RELIEF VALVE FOR VISIBLE LEAKAGE.
4. NEVER INSTALL A PRESSURE RELIEF VALVE IN A HORIZONTAL POSITION. PRESSURE RELIEF VALVE INTERNALS ARE DESIGNED TO MOVE VERTICALLY, WHEN INSTALLED HORIZONTALLY, MISALIGNMENT AND GALLING OR HANG-UP MAY PREVENT THE VALVE FROM OPENING OR CLOSING PROPERLY.
5. PRESSURE RELIEF VALVES SHOULD BE MOUNTED TO PROVIDE ADEQUATE ACCESS, 360° AROUND THE VALVE PLUS OVERHEAD TO PERMIT REMOVAL FOR TESTING AND MAINTENANCE.
6. WHEN REMOVING THE PRESSURE RELIEF VALVE DURING DISASSEMBLY, STAND CLEAR AND/OR WEAR PROTECTIVE CLOTHING TO PREVENT EXPOSURE TO SPLATTER OF ANY CORROSIVE PROCESS MEDIUM WHICH MAY HAVE BEEN TRAPPED INSIDE. ENSURE VALVE IS ISOLATED FROM SYSTEM PRESSURE BEFORE VALVE IS REMOVED.
7. WHEN A VALVE IS EQUIPPED WITH A LIFTING LEVER, THE LEVER SHOULD BE POSITIONED TO AVOID ACCIDENTAL CONTACT BY OTHER EQUIPMENT OR PERSONNEL, WHICH MIGHT CAUSE VALVE TO LIFT ACCIDENTALLY.

TABLE OF CONTENTS

I. TERMINOLOGY FOR SAFETY VALVES

1. **Back Pressure**
   Back pressure is the static pressure existing at the outlet of a safety device due to pressure in the discharge system.

2. **Blowdown**
   Blowdown is the difference between actual popping pressure of a safety valve and actual reseating pressure expressed as a percentage of set pressure or in pressure units.

3. **Bore Area**
   Bore area is the minimum cross-sectional area of the nozzle.

4. **Bore Diameter**
   Bore diameter is the minimum diameter of the nozzle.

5. **Closing Pressure**
   Closing pressure is the value of decreasing inlet static pressure at which the valve disc reestablishes contact with the seat or at which lift become zero.

6. **Disc**
   A disc is the pressure containing moveable element of a pressure safety valve which effects closure.

7. **Inlet Size**
   Inlet size is the nominal pipe size of the inlet of a pressure relief valve, unless otherwise designated.

8. **Lift**
   Lift is the actual travel of the disc away from closed position when a valve is relieving.

9. **Lifting Device**
   A lifting device is a device for manually opening a safety device by the application of external force to lessen the spring loading which holds the valve closed.

10. **Nozzle**
    A nozzle is the pressure containing element which constitutes the inlet flow passage and includes the fixed portion of the seat closure.

11. **Outlet Size**
    Outlet size is the nominal pipe size of the outlet of a safety valve, unless otherwise designated.

12. **Overpressure**
    Overpressure is a pressure increase over the set pressure of a safety valve, usually expressed as a percentage of set pressure.

13. **Rated Lift**
    Rated lift is the design lift at which a valve attains its rated relieving capacity.

14. **Set Pressure**
    Set pressure is the value of increasing inlet static pressure at which the disc moves in the opening direction.

15. **Seat**
    A seat is the pressure containing contact between the fixed and moving portions of the pressure containing elements of a valve.

16. **Seat Diameter**
    Seat diameter is the smallest diameter of contact betwen the fixed and moving portions of the pressure containing elements of a valve.

17. **Simmer**
    Simmer is the audible or visible escape of fluid between the seat and disc at an inlet static pressure below the popping pressure and at no measurable capacity. It applies to safety or safety relief valves on compressible fluid service.

18. **Warn**
    See "Simmer"

II. INTRODUCTION

A safety valve is a key safety device that protects against catastrophic pressure vessel failure. However, if it is not properly installed, maintained, operated and repaired, the pressure vessel is like a potential bomb. For example; a 30-gallon hot water tank at 90 psig has 3,138,400 ft-lb of energy to flash its water into steam at 330°F if liberated by rupture. Energy of a pound of three common explosives is:

Black powder	906 ft-lb
Smokeless powder	1260 ft-lb
Nitroglycerin	2,000,000 ft-lb

On this basis, the 30-gallon tank is equivalent to about 1½ lb of nitroglycerin. Catastrophes, of course, are not the only loss exposure from improper safety-valve operation. Overpressure can rupture tubing and blow

out packing. Improperly maintained safety valves, at times, may relieve at too low a pressure or may leak, so the boiler never reaches the desired pressure or full efficiency. The result of these problems is unscheduled downtime. In summary, proper installation, maintenance and repair is as important as buying of a reliable valve. This manual therefore provides instructions for installation, maintenance and repair of Consolidated® Bronze Safety Valves.

III. CONSOLIDATED®BRONZE SAFETY VALVES

Consolidated®Bronze Safety Valves represent nearly a century of design, development and production experience. These valves are intended for overpressure protection of watertube boilers, firetube boilers, air tanks, other air systems and non-corrosive gases. For more detailed information on valve applications and features, see Bulletin SV-3. Manufacturing and testing of Consolidated® Bronze Safety valves are controlled in accordance with Dresser Industrial Valve Division's Quality Control Program. Consolidated® safety valves are approved by ASME B&PV Codes, Section I, IV and VIII. Rigid Dresser quality control provides the user assurance that Consolidated® Bronze valves are a quality product that has been designed, manufactured and tested to provide many years of consistent, dependable service.

Evidence of this quality is a GREEN TAG* certification attached to the valve following final test and inspection.

Our Green Tag serves as a reminder that each Consolidated® valve meets or exceeds the stringent performance and overpressure protection requirements set forth by the ASME, and backed by Dresser Industries' Industrial Valve Division. In addition, the symbol also represents our Green Tag Center located across the U.S. These centers are fully certified by Dresser as Consolidated® valve assembly and repair facilities. They also meet or exceed the standards of ASME and the National Board. For more information on the Green Tag Program, consult our factory.

*Trademark of Dresser Industries, Inc.

IV. PARTS AND MATERIAL

See Page 6 and 7.

V. HANDLING, STORAGE AND PREINSTALLATION

1. The valves should be stored in a dry environment to protect them from the weather.

2. The valves 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.

3. Meticulous care should be exercised to prevent dirt and other foreign materials from entering the inlet and outlet ports during storage as well as in installation.

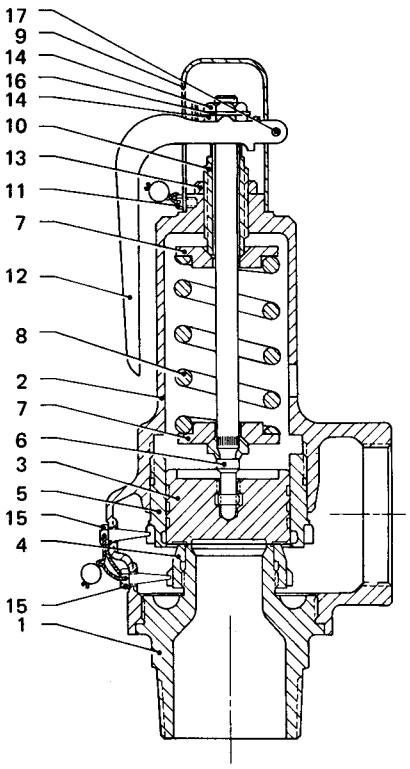
VI. INSTALLATION

The safety valves must be connected in an upright vertical position directly to any equipment to be protected on equal size fittings no larger than the face-to-face dimension of an American extra heavy standard iron tee. Under no condition should a stop valve or other obstruction be placed between equipment and the safety valve.

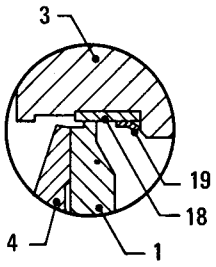
Thoroughly clean the inlet of the valve before installation and be sure that no pipe thread compound gets into the bore of the valve during installation. Do not use excessive wrenching force that may distort the hex on the valve base. The valve **must not** be tightened by means of a pipe screwed into the outlet.

Each valve should have its own independent discharge piping system, which in no case should be smaller than the valve outlet. If the discharge piping from one or more valves is manifolded together, in no case may the cross-section area of the discharge be less than the combined area of the valve outlets to which they are connected. As required, drainage should be provided for the discharge piping to prevent the accumulation of condensate in the valve body above the seat. The effect of discharge pipe length can be evaluated by any standard fluid flow calculations. Any discharge piping that appears excessive should be reviewed by calculation. The valve at all times should be free from external stresses transmitted from discharge piping. No alterations to discharge should be made without expert advice.

IV. PARTS AND MATERIAL



Ref. No.	Nomenclature	Material
1	Base	Brass (Stainless Steel on -3 design)
2	Bonnet	Iron (Phosphate Coated) or Bronze
3	Disc	Brass (Stainless Steel on -3 design)
4	Lower Adjusting Ring	Brass
5	Upper Adjusting Ring	Brass
6	Spindle (D & E Orifice)	Carbon Steel
	Spindle Assembly (F, H & J Orifice)	
	Spindle	Carbon Steel
	Collar	Stainless Steel
	Spindle Assembly (G Orifice)	
	Spindle	Carbon Steel
7	Collar	Carbon Steel
8	Spring Washer	Carbon Steel
9	Spring	Carbon Steel (Cadmium Plated)
10	Cap	Brass
11	Compression Screw	Brass
12	Cap Screw	Carbon Steel (Zinc Plated)
13	Lever	Brass
14	Compression Screw Nut	Carbon Steel
15	Lifting Washer Nuts	Carbon Steel
16	Adjusting Ring Pin	Brass
17	Lifting Washer	Carbon Steel (Zinc Plated)
18	Lever Pin	Brass
19	Soft Seat	See Below
	Seat Retainer Ring	Stainless Steel



SOFT SEAT DESIGN

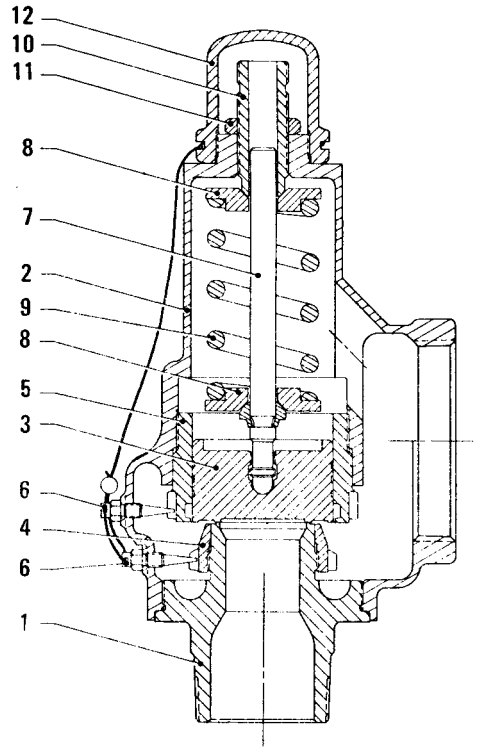
Soft Seat Selection		
Material	Temperature Range	Pressure Range
	°F	PSI
	°C	Bars
Viton A	-10 to 400 -23.3 to 204.4	0 to 300
Silicone	-75 to 400 -59.4 to 204.4	(0 to 20.7)
Teflon	-325 to 406 -59.4 to 207.8	151 to 300 (10.4 to 20.7)

Ordering Information

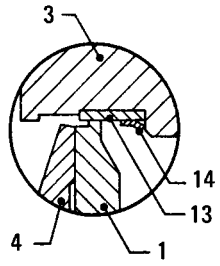
1/2 - 1543 - D -

- Inlet Size
- Type Designation
- Orifice Designation
- –3 stainless steel disc and base
- XDAI Cast iron bonnet, Bronze trim, Soft seat
- XMYI Bronze bonnet, Bronze trim
- XDBI Bronze bonnet, Bronze trim, Soft seat

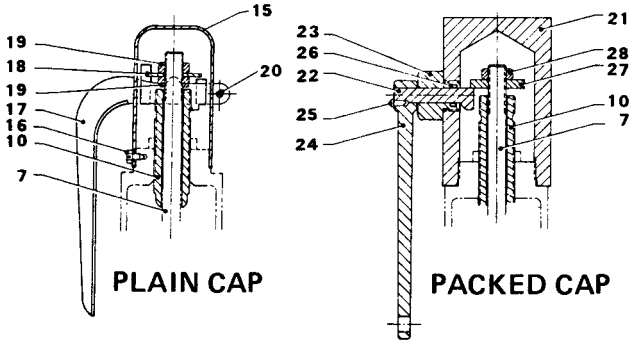
IV. PARTS AND MATERIAL



TYPE 2471



SOFT SEAT DESIGN



PLAIN CAP PACKED CAP

Ref. No.	Nomenclature	Material
1	Base	Brass
2	Bonnet	Bronze
3	Disc	Brass
4	Lower Adjusting Ring	Brass
5	Upper Adjusting Ring	Brass
6	Adjusting Ring Pin	Brass
7	Spindle (D & E Orifice)	Carbon Steel
7	Spindle Assembly (F, H & J Orifice)	
	Spindle	Carbon Steel
	Collar	Stainless Steel
7	Spindle Assembly (G Orifice)	
	Spindle	Carbon Steel
	Collar	Stainless Steel
8	Spring Washer	Carbon Steel
9	Spring	Carbon Steel, Stainless Steel*
10	Compression Screw	Brass
11	Compression Screw Locknut	Carbon Steel
12	Screwed Cap	Thermoplastic
13	Soft Seat	See Below**
14	Seat Retainer Ring	Stainless Steel

*Stainless steel spring is specified for steam applications, below —20°F and cryogenic applications.

**Soft Seat Selection		
Material	Temperature Range	Pressure Range
	°F	PSI
	°C	Bars
Viton A	-10 to 400 -23.3 to 204.4	0 to 300 (0 to 20.7)
Silicone	-75 to 400 -59.4 to 204.4	
Teflon	-325 to 406 -59.4 to 207.8	151 to 300 (10.4 to 20.7)

Ref No.	Nomenclature	Material
15	Plain Cap	Brass
16	Cap Screw	Carbon Steel
17	Lifting Lever	Brass
18	Lifting Washer	Carbon Steel
19	Lifting Washer Nut	Carbon Steel
20	Lever Pin	Brass
21	Packed Cap	Brass
22	Cam Shaft	Stainless Steel
23	Bushing	Stainless Steel
24	Lever	Iron
25	Drive Screw	Stainless Steel
26	"O" Ring	Buna N (70)
27	Release Nut	Stainless Steel
28	Release Locknut	Carbon Steel

Ordering Information

1-1/2 - 2471 H

Inlet Size — Type Designation — Orifice Designation

NOTE: XDA represents soft seat design. Also specify cap required.

VII. SET PRESSURE VERSUS SYSTEM OPERATING PRESSURE

If a safety valve is subjected to pressure at or near its set pressure, it will tend to weep or simmer and deposits can accumulate in the seat and disc area. Eventually, this can cause the valve to freeze closed and thereafter the valve could fail to open at the set pressure.

To help prevent valve from weeping or simmering, it is important that the pressure differential between the valve set pressure and the boiler or pressure vessel operating pressure is sufficiently large to prevent the valve from weeping or simmering.

To minimize operational problems, the user must consider not only normal operating conditions of the fluids (liquids or gases), pressures and temperatures, but also startup and shutdown conditions, process upsets and anticipated ambient conditions, instrument response time, pressure surges due to quick-closing valves, etc. When such conditions are not considered, the safety valve may become, in effect, a pressure controller, a duty for which it was not designed. Additional consideration should be given to the hazard and pollution associated with the release of the fluid. Large differentials may be appropriate for fluids which are toxic, corrosive, or exceptionally valuable.

VIII. SETTING, TESTING AND ADJUSTMENT

Testing of safety valves is a necessary step, along with the maintenance and inspection. Set pressure, closing pressure (blowdown), lift are the three most important criteria. The three fundamental times when a safety valve should get a thorough test of the three operating characteristics mentioned are: when newly installed, so that operating characteristics can be properly adjusted; before planned maintenance, so that maintenance needs can be found; and after major maintenance involving machining or changing of parts.

To change the popping pressure of the valve, remove cap/cap-lever assembly. Loosen the locknut and turn the compression screw clockwise to increase pressure or counter-clockwise to decrease pressure.

Raising the popping pressure will increase the blowdown and likewise, lowering the popping pressure will decrease the blowdown. To correct or change the amount of blowdown, remove the upper ring pin and using a pointed tool turn the upper adjusting ring 5 notches at a time. Turning the upper ring to the right will raise the ring and decrease the blowdown. Turning the upper ring to the left will lower the upper ring and increase the blowdown.

All blowdown adjustments should be made with the upper adjusting ring. If the upper ring is difficult to move, due to dirt being trapped between the ring and bonnet threads the ring can be freed by tapping lightly on the valve bonnet near the upper ring.

The lower adjusting ring should be adjusted one notch at a time. After putting adjusting ring pins, the adjusting rings should be free to move within one notch. If the pins are too long, they will bend or break under thermal expansion. Furthermore, they could also cause misalignment and leakage. If they are too short the rings will move up and down. Check the relative contact of ring and ring pin after each adjustment.

It is possible that the first blow of a safety valve on steam may be a few pounds higher than after the valve is completely heated. Therefore, the valve should be popped a few times before any adjustments are changed.

The latest edition of the Code requires that all valves to be used for steam service must be tested on steam and not air or other media. In addition, all external adjustments must be sealed after testing and adjustment of set pressure. Seals shall be installed by the manufacturer at the time of initial shipment and after field adjustment or repair of the valves by either the manufacturer, his authorized representative, repairer, or the user. Seals shall be installed in such a manner as to prevent changing the adjustment without breaking the seal, and in addition, shall serve as a means of identifying the manufacturer, assembler, repairer, or user making the adjustment.

All safety valves for steam service are adjusted on steam at the factory, and all safety valves for air or gas service are adjusted on air. However, adjustments are necessary on the actual installation in order for the valves to have proper action and blowdown. This condition is due to the variations in size between the actual installation and the factory test drums and in outlet piping conditions.

All springs have factory established pressure ranges and must be changed if their pressure limits are exceeded. When it is desired to change the set pressure, the correct pressure-limit of the spring should be obtained from the factory.

IX. MAINTENANCE

Safety valves require periodic inspection and tests by qualified persons to keep them working properly. There is a natural relunctance to test valve while boilers are in operation. Yet, this is the best way to be sure the valves will function properly. The most positive test is to gradually increase boiler pressure until the valve or valves pop or until the maximum allowable working pressure is reached (pressure test).

The testing frequencies of safety valves will vary from plant to plant due to operating conditions. However, under normal conditions, the following schedule is recommended:

- Low pressure heating boilers: Manually tested not less than once each month, pressure tested once each year.

- Power boilers when the maximum allowable working pressure is up to 400 psi: Manually tested not less than once each month, pressure tested once each year.

When they are tested manually, the levers should be lifted so as to raise the disc as high as possible to help flush out any deposits or foreign material that may accumulate in the seats or disc areas.

This is especially important on new installations because the boiler and piping systems may not have been thoroughly cleaned before the boiler was put into operation. Do not attempt to lift the lever unless there is pressure in the boiler at least equal to 75% of the stamped opening pressure of the safety valve.

When manually lifting the valve disc, just cracking it open slightly to permit the flow of steam or water is not advisable. If this is done, the seat may be damaged, causing the valve to leak when it is closed.

Problems encountered during visual inspection can be noted on the valve maintenance record to help with planned-outage maintenance. The valve record should include: nameplate data; date of last visual inspection, with results; date of operation, with results; date of testing, with results; date of last maintenance, repairs, and nature of repair work. The safety valve is part of the boiler system and must function as an integral part of it. **ASME Boiler Code Section VII, recommended rules for care of power boilers, gives sound fundamentals on the coordination of all boiler devices.**

X. DISASSEMBLING VALVES FOR REPAIR

1. Remove Cap or Cap-Lever Assembly.

2. Remove Lifting Washer and Lifting Washer-Locknuts if applicable

3. Remove Lower Adjusting Ring Pin (Do not remove Upper Ring Pin).

4. Turn Lower Adjusting Ring to right slowly counting the number of notches moved until ring touches disc (note this location as lower adjusting ring should be set in same position on assembly).

5. Release Compression Screw Lock Nut and release spring compression by turning Compression Screw counter-clockwise and count number of turns to just relieve the compression.

6. With valve Base held in vise loosen Bonnet to Base connection (use strap wrench, do not use pipe wrench as this may crush the bonnet).

7. Remove Bonnet, Upper Adjusting Ring, Disc, Spindle, Spring and Spring Washer assembly from Base, holding Spindle to be sure Disc does not drop.

8. Remove Disc, Spindle, and Spring and Spring Washer from Bonnet.

9. The Upper Adjusting Ring need not be removed from Bonnet. However, if it is removed for cleaning or inspection, its position should be recorded. This can be done as follows:

   a. Record position of Upper Adjusting Ring while ring pin is still engaged by measuring from bottom face of Ring to bottom face of Bonnet (see Figure 3).

   b. Remove Upper Adjusting Ring Pin and remove Upper Adjusting Ring from Bonnet by turning ring in counter-clockwise direction.

10. Remove Disc from Spindle by engaging the threads and turning the Disc counter-clockwise.

11. If the Disc is soft seated and damaged, remove Retaining Ring with a sharp tool. Subsequently, remove soft Seat. Retaining Ring and soft Seat should not be used again, instead new Retaining Ring and soft Seat should be used.

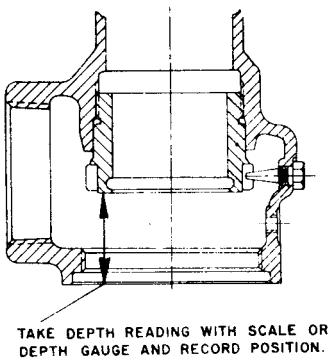


FIGURE 3

XI. REPAIR AND REPLACEMENT

When a defective safety valve is encountered, immediate steps should be taken to have it replaced or repaired. These valves are delicate devices and they must be treated as such. It is a dangerous practice and false economy to have repairs carried out by persons who are not competent.

Remember that close tolerances are provided inside these valves for guides, disc, and seat. Anything that disturbs these tolerances can cause a malfunction of the valve. For instance, a wrench should never be used on the valve body; use the flat surfaces provided for this purpose. This will help avoid distorting the valve body, which could interfere with the clearances and tolerances of the internals.

If the repair causes any deviation from the original design, the valve may no longer be considered as being of the original type, since such changes could adversely affect the valve capacity and operation.

Seating surfaces could be restored by lapping. This can be accomplished by lapping with a flat cast iron ring lap coated with Grade No. 1000 KWIK-AK-SHUN Silicon-Carbide compound, or equivalent.

Lapping a flat seat is extremely simple. No special skill is required and the technique is readily apparent after a few minutes of actual lapping.

The following precautions and hints will enable anyone to do a "Professional" job of lapping seats.

1. Keep the work clean.

2. Always use a fresh lap. If signs of wearing (out of flatness) are 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 the base keep a firm grip on the lap or 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 applying uniform pressure and rotating the lap or the part slowly. If reconditioning necessitates removing more than .010, replace the base.

7. When lapping the disc seat, the lap should be held stationary and the disc moved as above. If recondition necessitates removing more than .010, replace the disc.

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

9. 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. Alternatively, use polishing paper to shine up seating surface. Place polishing paper on a flat metallic surface. Rub part gently with rotating/reciprocating motion to shine-up. 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 be used. Only a few minutes will be required to remove the shadows.

10. 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.

11. The seat should now be thoroughly cleaned with kerosene, light oil, or carbon tetrachloride, using a lint-free cloth or tissue paper.

XII. REASSEMBLING

1. Clean seats and all parts.

2. Assemble Lower Adjusting Ring to Base (top of Lower Adjusting Ring to be flush with seat).

3. Assemble Upper Adjusting Ring to Bonnet and reset Upper Adjusting Ring to its original position and assemble Upper Adjusting Ring Pin.

4. Lubricate Spindle Bearing with powdered graphite mixed with penetrating oil and thread disc on Spindle and assemble Spring and Spring Washers.

5. Insert Disc, Spindle, Spring and Spring Washer Assembly to Bonnet. If soft seated disc, see Step 11.

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 Compression Screw and re-establish spring compression by turning down the compression screw.

8. Re-establish position of Lower Adjusting Ring as follows:

   a. Using a pointed tool turn the Lower Adjusting Ring to the right slowly, thus raising the ring until it touches disc.

   b. Then counting the notches turn the lower adjusting ring to the left, thereby lowering the ring, until the original position is established.

9. Test valve per instructions outlined under SET TING, TESTING AND ADJUSTMENT.

10. Install Lifting Washer and Locknuts, Cap and Lever. Make sure that Lifting Washer clears Lever by at least 1/16" when Lifting Lever is in free position. If screwed cap or packed lever construction, perform their installation.

11. Utilize following steps to assemble soft seated disc:

   a. Clean disc, put it on a metallic plate (see Figure 4). Disc surface having spindle pocket will lie on the metal plate.

   b. Pick up an appropriate washer of the specified material. Clean this with lint free cloth. Inspect it for nicks, cuts, dents, concentric hole, etc. (defective part should be rejected). Put Washer on the Disc (see Figure 4).

   c. Pick-up an appropriate Retaining Ring and tool assembly (see Table 1). Place Retaining Ring on the Disc. Subsequently put tool assembly in the mechanical press (not shown in Figure 4). Provide slight force to position Retaining Ring over the post. After removing force and inspecting proper positioning of Retaining Ring, press the Retaining Ring again, hard enough, to move Retaining Ring down to hold the seat washer tightly. A properly assembled soft seat will be somewhat compressed by Retaining Ring.

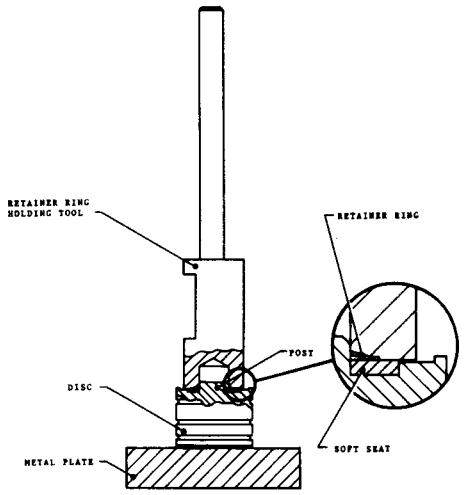


FIGURE 4
SOFT SEAT ASSEMBLY FOR 1541, 1543 & 2471

TABLE 1
SOFT SEAT ASSEMBLY TOOL
FOR 1541, 1543, & 2471 BRONZE VALVE

Orifice Size	Retaining Ring	Assembly Tool No.
D	2091156	7530141
E	2091157	7530142
F	2091158	7530143
G	2091159	7530144
H	2091161	7530145
J	2091163	7530146

XIII. TROUBLE-SHOOTING

Certain troubles may develop through use or damage to working parts. The most common are simmering, leaking, chattering, and hang-up. See Table 2 for a summary of probable causes and corrective actions.

Simmering is defined as an audible escape of steam as pressure is raised to near the popping point. A slight simmer is not objectionable and only indicates slight irregularity of the seating surface. Larger amounts of simmer indicate seat damage, or that the Lower Adjusting Ring is too low. If an attempt is made to eliminate simmer by adjustment of the Lower Adjusting Ring, it should be turned to the right one notch at a time, thereby raising the ring.

Leaking is the constant escape of steam at normal operating pressure below the closing pressure of the valve. It is caused by either damage to the seating surfaces or due to foreign matter being trapped. In the case of soft seated disc, leakage may occur due to nicks, cuts or dents on the soft seat. Furthermore, occasionally soft seat may get blown out during popping and relieving action. If hand lifting, wide open, does not give relief, the valve should be repaired at the first opportunity. Other causes of leakage are interference of the lifting lever, such as the Lifting Washer riding on the Lever, and improper installation of the discharge piping so as to introduce undue strain upon the valve.

Chattering is a hammering action of a vibratory nature of the Disc on the Seat and must be stopped immediately or the seats will be ruined. To stop chattering, hold the valve open with the Lever until the steam pressure has been reduced several pounds. Chattering is caused by the valve: (1) not having sufficient blowdown; (2) excessive back pressure from undersize discharge piping; (3) insufficient steam flow to the valve; (4) closing off of the vent hole in Bonnet.

Hang-up occurs upon closing and is defined as leakage from the valve failing to shut off tightly. Incorrect blowdown or mechanical interference are the two principal causes. However, if the valve should hang-up, turning the Lower Adjusting Ring to the left one or two notches thereby lowering the ring should eliminate the trouble.

TABLE 2
VALVE FUNCTIONAL PROBLEMS AND CORRECTIVE ACTIONS

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
No action, valve does not go into full lift	A. Upper ring too high	A. Increase blowdown
	B. Foreign material trapped between disc and guide	B. Disassemble valve and correct condition Inspect system for cleanliness.
Hangup or failure to close from full lift	A. Lower ring too high	A. Move lower ring to left one notch per adjustment until problem is eliminated
	B. Foreign material between disc and nozzle.	B. Disassemble valve and correct condition. Inspect system for cleanliness
Excessive blowdown	A. Upper ring too low	A. Decrease blowdown
	B. Exhaust pressure too high	B. Decrease exhaust pressure by increasing discharge area.
Valve leaks and/or exhibits erratic popping action	A. Damaged seat	A. Disassemble valve, tap seating surfaces, replace disc if required.
	B. Part misalignment	B. Disassemble valve, inspect contact area of disc and nozzle, lower spring washer or spindle, compression screw, spindle straightness, etc.
	C. Disc has insufficient rock	C. Disassemble valve and check disc rock.
	D. Discharge pipe binding on outlet	D. Correct as required.
	E. Soft seat damage	E. Replace soft seat and retaining ring if damaged.
Simmer	A. Lower ring too low	A. Adjust lower ring.
	B. Steamline vibrations	B. Investigate and correct cause.

XIV. REPLACEMENT PARTS, TOOLS AND SUPPLIES

The recommended spare parts/tools are spring, disc, soft seat, retaining ring and retaining ring assembly tools. When ordering replacement or spare parts, state type, size, and set pressure of the valve, and whether used with steam or air. Refer to current Consolidated® Safety and Relief Valve catalog for more detailed information on parts descriptions and nomenclatures.

Component: Disc

VALVE TYPE	VWW816	VTT816	VRR816	WPP815A	WQQ815A	WRR815A	4266101	4266201	4266301	4266401	4266001	4266501
1541D	X											
1541E		X										
1541F			X									
1541G				X								
1541H					X							
1541J						X						
1543D	X											
1543E		X										
1543F			X									
1543G				X								
1543H					X							
1543J						X						
2471D	X											
2471E		X										
2471F			X									
2471G				X								
2471H					X							
2471J						X						
2478D							X					
2478E								X				
2478F									X			
2478G										X		
2478H											X	
2478J												X

Component: Soft Seat Disc

VALVE TYPE	4263701	4264701	4264801	4264901	4265001	4265101	4266601	4266701	4266801	4266901	4267001	4267101
1541D	X											
1541E		X										
1541F			X									
1541G				X								
1541H					X							
1541J						X						
1543D	X											
1543E		X										
1543F			X									
1543G				X								
1543H					X							
1543J						X						
2471D	X											
2471E		X										
2471F			X									
2471G				X								
2471H					X							
2471J						X						
2478D							X					
2478E								X				
2478F									X			
2478G										X		
2478H											X	
2478J												X

Component: Retainer Ring

VALVE TYPE	2091156	2091157	2091158	2091159	2091161	2091163	2091155	2091160	2091162			
1541D	X											
1541E		X										
1541F			X									
1541G				X								
1541H					X							
1541J						X						
1543D	X											
1543E		X										
1543F			X									
1543G				X								
1543H					X							
1543J						X						
2471D	X											
2471E		X										
2471F			X									
2471G				X								
2471H					X							
2471J						X						
2478D							X					
2478E	X											
2478F		X										
2478G			X									
2478H								X				
2478J									X			

Component: Adjusting Ring Pin (2)

VALVE TYPE	4040703	4040701	4040704	4040705	4040702							
1541D	X											
1541E	X											
1541F		X										
1541G			X									
1541H				X								
1541J					X							
1543D	X											
1543E	X											
1543F		X										
1543G			X									
1543H				X								
1543J					X							
2471D		X										
2471E	X											
2471F	X											
2471G					X							
2471H				X								
2471J					X							
2478D		NONE										
2478E		NONE										
2478F		NONE										
2478G		NONE										
2478H		NONE										
2478J		NONE										

Component: Spring

VALVE TYPE	
1541D	
1541E	
1541F	
1541G	SELECT
1541H	SPRING
1541J	FROM BRONZE
1543D	SPRING CHART
1543E	S-1 PAGE S1-21
1543F	THROUGH PAGE
1543G	S1-35
1543H	
1543J	
2471D	
2471E	
2471F	
2471G	
2471H	
2471J	
2478D	
2478E	
2478F	
2478G	
2478H	
2478J	

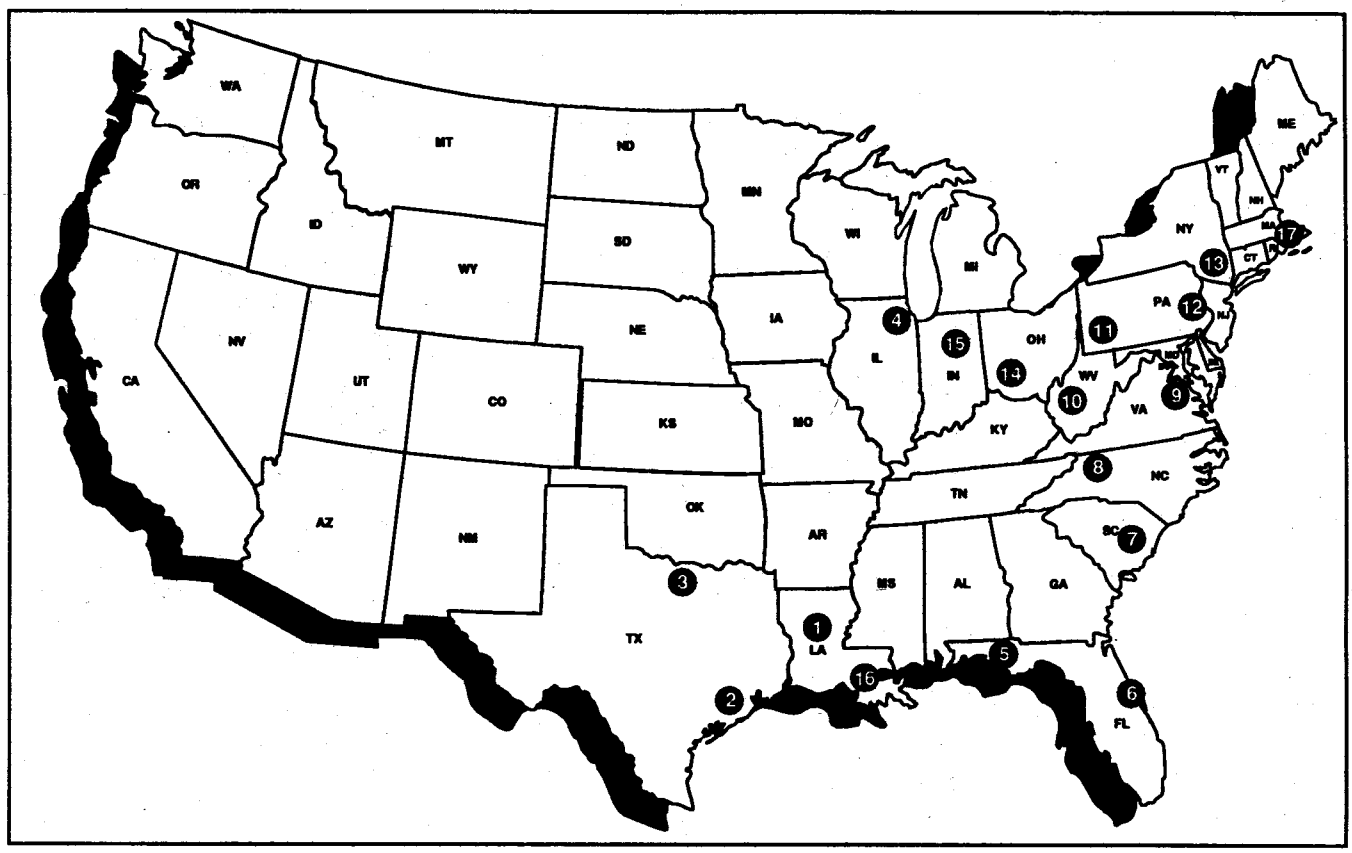
Component: Spring Washers (2)

VALVE TYPE	VBG906	VBA906A	VAW906A	VBH906A	VAU906A	VBF906A	VBG906B	VBG906	VBA906	VAW906	VBH906	VAU906	VBF906
1541D	X												
1541E		X											
1541F			X										
1541G				X									
1541H					X								
1541J						X							
1543D	X												
1543E		X											
1543F			X										
1543G				X									
1543H													
1543J						X							
2471D	X												
2471E		X											
2471F			X										
2471G				X									
2471H					X								
2471J						X							
2478D							X	X	(1)				
2478E										X			
2478F											X		
2478G												X	
2478H													X
2478J													

NOTE (1): 2478D-1 SIZE ¾"

Notes

SERVICE DEPARTMENT



THE DRESSER FIELD SERVICE ORGANIZATION IS UNEQUALED.

For prompt field service, please call Dresser Industrial Valve
Operation Service Department, Alexandria, Louisiana.
Normal Working Hours - (318) 640-6055
After Hours, Weekends, Holidays - (318) 640-2250

LOCATION OF SERVICE ENGINEERS

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Sales Office

UNITED STATES
Alexandria Operations
Highway 3225 at 167 North
P.O. Box 1430
Alexandria, La. 71309-1430
Telex 586423
Rapifax (318) 640-6222

Northern Region
3201 North Wolf Road
Franklin Park, Illinois 60131
Telephone (312) 451-3913
Rapifax (312) 451-3997

Pacific Region
3931 MacArthur Blvd., Suite 202
Newport Beach, California 92660
Telephone (714) 752-0455
Rapifax (714) 752-2561

Southern Region
16503 Park Row
Houston, Texas 77084
Telephone (713) 579-8720
Telex 762770
Rapifax (713) 579-7844

CANADA
Dresser Canada, Inc.
Valve & Controls - Canadian Operations
5010 North Service Road
Burlington, Ontario
L7L 5R5 Canada
Telephone (416) 335-3529
Telex (389) 061 8941
Rapifax (416) 336-7628

JAPAN
Dresser Japan, Ltd.
Industrial Valve Operations
Room 405, Maersk Bldg.,
18, Nihon-Odori, Naka-Ku.
Yokohama 231 Japan
Telephone (011-81) 45-651-5601
Telex (781) 3822665
Rapifax (011-81) 45-651-5606

MEXICO
Maxoneilan Internacional y Compania, S, en N.C.
Av. Henry Ford No. 114
Tlalnepantla, Estada de Mexico
C. P. 54030, Apartado Postal 572
Mexico
Telephone (011-525) 565-4696
Telex (383) 172645
Rapifax (011-525) 565-4631

SAUDI ARABIA
Dresser Al Rushaid Valve & Instrument Co., Ltd.
P.O. Box 10145
Jubail Industrial City 31961
Kingdom of Saudi Arabia
Telephone (011-966) 3-341-0278
Telex (928) 832108
Rapifax (011-966) 3-341-7624

SOUTH AFRICA
Dresser Limited
Valve & Controls Division
P.O. Box 2234
16 Edendale Road
Eastleigh, Edenvale 1610
South Africa
Telephone (011-27) 11-452-1550/1-7
Telex (960) 740852
Teletex (960) 750057
Rapifax (011-27) 11-452-2903

SPAIN
Maxoneilan S.A.
Zona Franca
Sector M., Calle Y
08004 Barcelona,'
Spain
Telephone (011-343) 335-4200
Telex (831) 52775
Rapifax (011-343) 336-6858

SWITZERLAND
Dresser Europe, S.A.
Industrial Valve Operations
Badenerstrasse 156
P.O. Box 369
CH-8021 Zurich
Switzerland
Telephone (011-411) 241-0533
Telex (845) 812429
Rapifax (011-411) 241-4218

UNITED KINGDOM
Dewrance Division Dresser U.K., Ltd.
Trevithick Works
Gillibrands Estate
Skelmersdale, Lancashire
WN8 9TU England
Telephone (011-44) 695-24234
Telex (851) 627039
Rapifax (011-44) 695-20175

Masoneilan Division Dresser UK, Ltd.
Controls House
Riverside Way
Uxbridge, Middlesex
U8 2YF England
Telephone (011-44) 895-58161
Telex (851) 935174
Rapifax (011-44) 895-34318

VENEZUELA
RIESE & CIA S.A.
Apartado 372
Caracas, Venezuela
Telephone (011-582) 541-1311/541-3812
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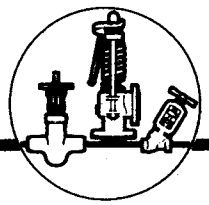

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Dresser Valve and Controls Division
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