

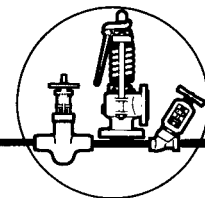
MANUAL 1700-S

S1 Design

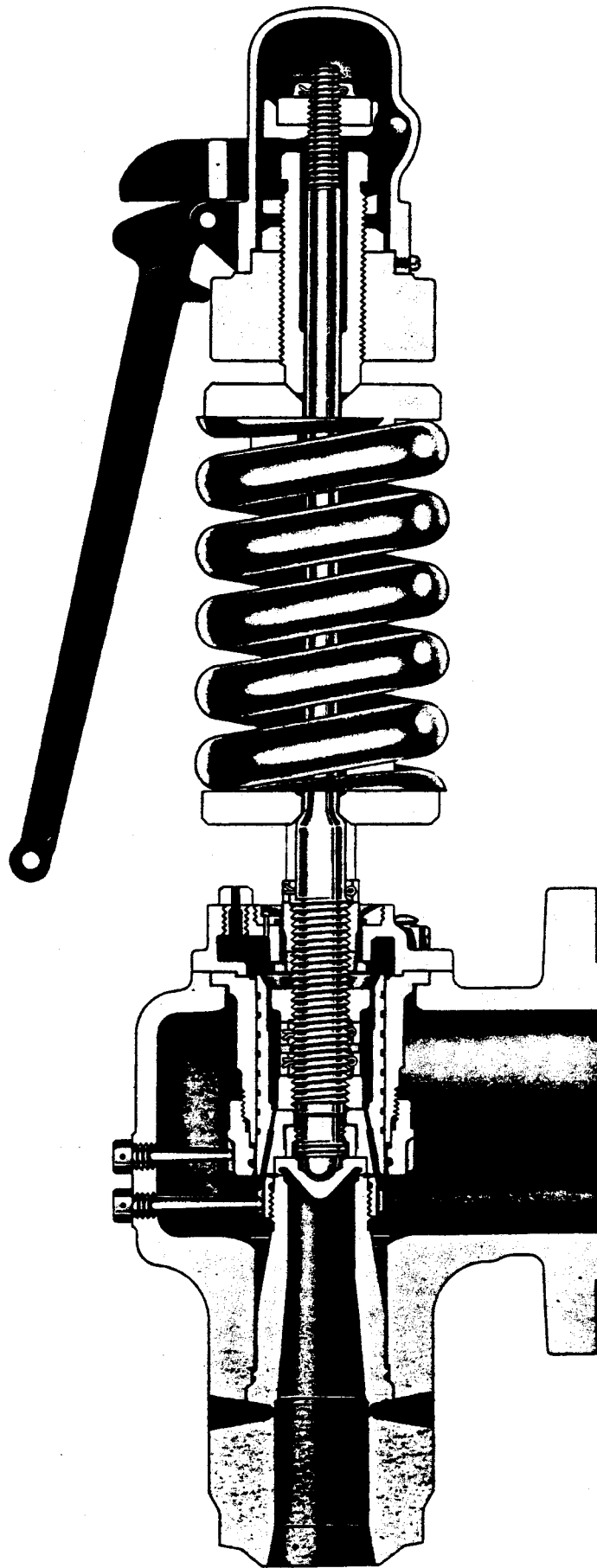
INSTRUCTION FOR INSTALLATION AND MAINTENANCE of the CONSOLIDATED MAXIFLOW SAFETY VALVE WITH COMPENSATED BACK PRESSURE CLOSING



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**CONSOLIDATED MAXIFLOW SAFETY VALVE
WITH COMPENSATED BACK PRESSURE CLOSING**

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INTRODUCTION, ADJUSTMENT

In line with the Consolidated policy of improvement of products, the Maxiflow Safety Valve has undergone a number of changes since 1960. This represents the sum of experience gained on hundreds of field installations at steam pressures as high as 5500 psig and temperatures to 1150°F. The rapid increase in steam pressures and temperatures in the past years has required both the selection of better materials and more rigid control of manufacturing practices. Every effort has been made to provide a design which can readily be serviced in the field. Knowledge of the following design's features will assist the Service Engineer in explaining the construction of the Maxiflow Safety Valve to those persons involved in its use and maintenance. We will endeavor to set forth in this Manual instructions to cover the maintenance of change of design since 1960 to the present.

1. BODY AND NECK MATERIALS

All pressure retaining parts, with the exception of reheat valves rated to 900 psi and lower, are made of forged materials. Welded inlet valves have the Three-piece weld construction; flanged inlet valves have a Top-inserted seal-welded bushing.

2. SERVICE LIFE

For most service conditions, pressure retaining part and parts subject to mechanical stresses, such as valve necks, yoke rods, etc., are designed for a service life of thirty-five years, equivalent to the boiler and well in excess of the requirements of the Power Boiler Code. The use of ferritic materials in valves for high pressure, high temperature superheater service limits the designed service life under these conditions to the minimum specified by Power Boiler Code.

3. THERMAL COMPENSATION

The yoke rod design, together with proper selection of yoke rod and spindle materials, renders the valve relatively free from changes in setting due to temperature variations.

4. THERMODISC

The Thermodisc design in providing for the rapid equalization of temperature around the valve seat, provides a degree of Tightness far above that offered by competitive valves. Better selection of materials and minor changes providing "Thermal Flexibility" rather than "Mechanical Flexibility" have reduced or eliminated inherent weakness. Thermodiscs are now giving excellent results at 5500 psi and 1150° F.

5. BLOWDOWN

The Consolidated Maxiflow Safety Valve is the only valve with 3% blowdown certified by the National Board of Boiler and Pressure Vessel Inspectors. See Blowdown Adjustment on Page 6.

INSTALLATION INLET AND EXHAUST PIPING

The details of the installation of any safety valve are governed to a large extent by the ASME Power Boiler Code. Pertinent paragraphs are:

"P-277 — The safety valve or valves shall be connected to the boiler independent of any other steam connection and attached as close as possible to the boiler, without any unnecessary intervening pipe or fitting. Such intervening pipe or fitting shall be no longer than the face-to-face dimension of the corresponding tee fitting of the same diameter and pressure under the corresponding American Standard as given in Tables A-6, A-7 and A-8, and shall also comply with Pars. P-12(b) and P-286. Every safety valve shall be connected so as to stand in an upright position, with spindle vertical."

"P-278 — The opening or connection between the boiler and the safety valve shall have at least the area of the valve inlet. No valve of any description shall be placed between the required safety valve or valves and the boiler, nor on the discharge pipe between the safety valve and atmosphere. When a discharge pipe is used, the cross-sectional area shall be not less than the full area of the valve outlet or of the total of the areas of the valve outlets discharging thereto and shall be as short and straight as possible, and so arranged as to avoid undue stresses on the valve or valves.

"All safety-valve discharges shall be so located or piped as to be carried clear from running boards or platforms. Ample provision for gravity drain shall be made in the discharge pipe at or near each safety valve, and where water of condensation may collect. Each valve shall have an open gravity drain through the casing below the level of the valve seat. For iron and steel-bodied valves exceeding 2-inch size, the drain hole shall be tapped not less than 3/8-inch pipe size."

"P-279 — If a muffler is used on a safety valve it shall have sufficient outlet area to prevent back pressure from interfering with the proper operation and discharge capacity of the valve. The muffler or plates or other devices shall be so constructed as to avoid any possibility of restriction of the steam passages due to deposit.

"When a safety valve is exposed to outdoor elements which may affect operation of the valve, it is permissible to shield the valve with a satisfactory cover. The shield or cover shall be properly vented and arranged to permit servicing and normal operation of the valve."

Exhaust piping must be installed so that it will not impose undue stress on the Safety Valve, as noted in P-278. Stresses set up in the valve body from any source will cause distortion and leakage at pressures below the setpoint. If standard drip pans are used, see Fig. 1, sufficient clearance must be provided to allow for movement of the valve due to expansion and contraction of the drum or header on which it is installed. If blow back around the drip pan occurs, the vent piping is inadequate and its design should be investigated.

Flexible metal hoses, if used to connect safety valve outlets to discharge stacks, must have sufficient length and must be designed and installed in such a manner that they will not become "solid" in any position of the valve. Better results are obtained if the hoses are installed so that they will

permit movement by bending, rather than by stretching and compressing along their length.

Steam flowing vertically out of the discharge elbow produces a downward reaction on the elbow, depending on the quantity of steam flowing and its velocity.

In large, high capacity valves this force can equal several thousand pounds and can produce severe stresses in the valve necks. The bending stresses are determined by the amount of the reactive force, combined with the movement arm, or horizontal distance between the vertical centerline of the valve and the vertical centerline of the outlet elbow. Maxiflow Safety Valves are designed so that the neck stresses will not exceed ASME Code limits as long as this moment arm does not exceed 24-inches in length from centerline of the valve to the centerline of the vent piping. (See Figure 1.)

When installing flanged inlet valve, the flange bolts must be pulled down evenly in order to prevent body distortion and consequent misalignment and leakage.

OPERATION

The 1700-S series Maxiflow valves operate during closing with a back pressure principle, that is, the force of trapped steam on the upper side of the disc holder is utilized to assist the spring in forcing the disc back down on its seat.

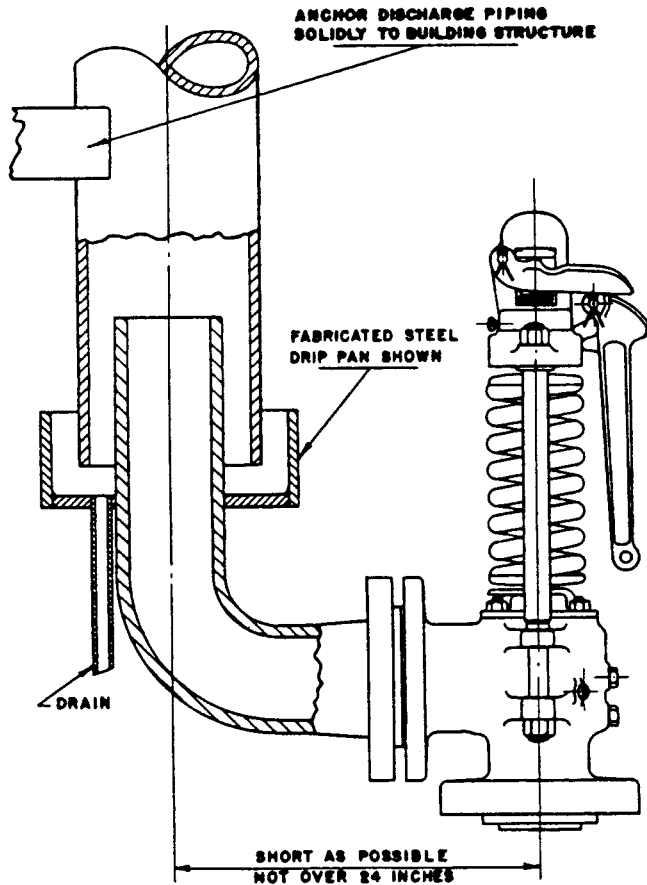


Figure 1 — Vent Pipe Installation

Referring to Fig. 2 it will be seen that when the valve is blowing, a small amount of steam is bled from the huddle chamber (A) through holes (B) into chamber (C) and escapes to the atmosphere between floating washer (D) and overlap shoulder (E) and, also, through orifice in (F).

As the steam pressure drops, the overlap shoulder (E) upon reaching the top of the floating washer (D) traps steam in chamber (C), sets up pressure on top of the disc holder, and assists the spring in closing the valve.

The distance from the top of the floating washer (D) to overlap shoulder (E) is therefore, an important function in the operation of the valve and must be correct in dimension.

Table I gives the correct overlap corresponding to bore size.

The orifice plug (F) Fig. 2, regulates the pressure in the back pressure chamber and is installed at the factory and must not be removed.

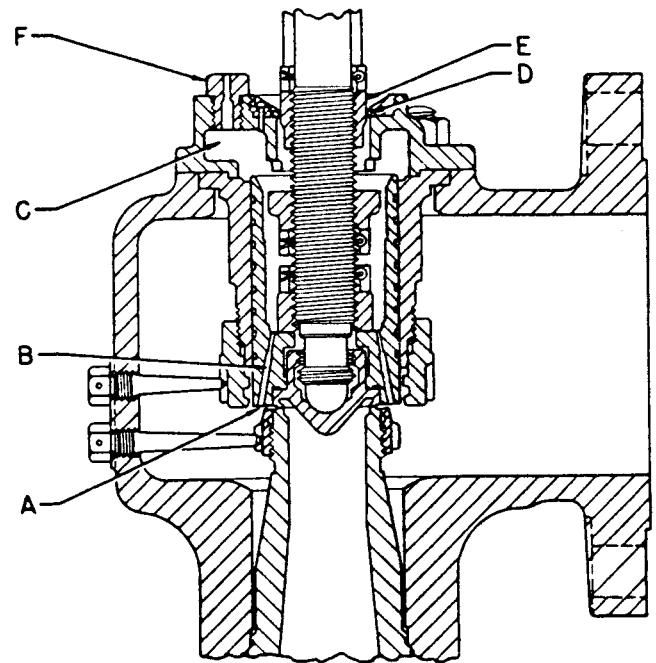


Figure 2
Section Illustrating Overlap & Back Pressure System

ADJUSTMENT

All Maxiflow Safety Valves are steam tested at the factory. Every valve is set to have a clean popping action and to reseat tightly. However, because the boiler used in setting the valves has a small capacity compared to the capacities of the Maxiflow type of valves, slight adjustments on the actual installation are necessary to maintain proper action and blowdown.

Popping Point and Adjustment

To change the popping pressure of the valve remove the cap and lever assembly, loosen the lock nut and turn the compression screw clock-wise to increase pressure, or counter clock-wise to decrease pressure. After each adjustment of the compression screw the locknut should be tightened. The arm on top of spring washer should always be free

BLOWDOWN, DISASSEMBLY

from bearing against the yoke rod. This can be accomplished by holding a screwdriver between the arm and the rod to prevent any movement of the top spring washer while adjusting the compression screw.

Ring Adjustment

Always gag the Safety Valve for protection, in case boiler pressure rises while making ring adjustments (See instructions for gagging.)

The positions of the upper adjusting ring and the lower adjusting ring are locked by means of the upper adjusting ring pin and the lower ring pin respectively. These pins are threaded into the valve body and engage notches which are cut into the rings. To adjust either ring the corresponding ring pin must be removed. A screwdriver can be used to turn the rings.

The lower ring is used to obtain a clean popping action and to cushion the closing action of the valve. (DO NOT ATTEMPT TO ADJUST BLOWDOWN WITH THE LOWER RING.)

In detail, the rings should be set as follows in adjusting the valve. The lower ring should be set initially at about one notch below the seat level for every 300 psi of set pressure (7 notches for a 2100 psi valve). The upper ring should be set at seat level, regardless of pressure. The method of setting both rings is described in the Maintenance Section of this manual.

The lower ring should be moved upward slowly, one notch at a time to remove simmer. The most ideal position for the lower ring is the lowest position that does not introduce simmer or buzzing. In this connection, it is imperative that extreme care be used in conditioning the seat surfaces, insuring correct alignment, and establishing the proper clearance, so that mechanical causes of simmer will be reduced to a minimum.

Check the ring pins to see that they engage the ring grooves, but without touching the bottom. The pins should not bear against the rings.

BLOWDOWN ADJUSTMENT

In arriving at proper blowdown adjustment of this design of Maxiflow Safety Valve it is almost imperative that a lift indicator be used. Fig. 3. The correct method of obtaining proper blowdown adjustment can be best explained by reference to Fig. 4.

The upper ring is used to obtain full lift at the popping pressure. However, its position also determines the point at which the valve begins to drop out of full lift and starts the closing portion of its cycle. For example, if the upper ring is in such a position that the valve barely attains full lift at the popping pressure and starts to drop out of full lift at a slight reduction of boiler pressure, the first portion of the valve cycle will be represented by the line ABF. If it were not for the lift stop, the action of the valve would be represented by the line ABCF. If the upper ring is in a more positive position (lower setting), the action of the valve would be represented by the line ABG and if it were not for the lift stop, the line ABDG. If the upper ring is in a still lower position, the action of the valve is represented by the line ABH and if it were not for the lift stop ABEH. From this it can

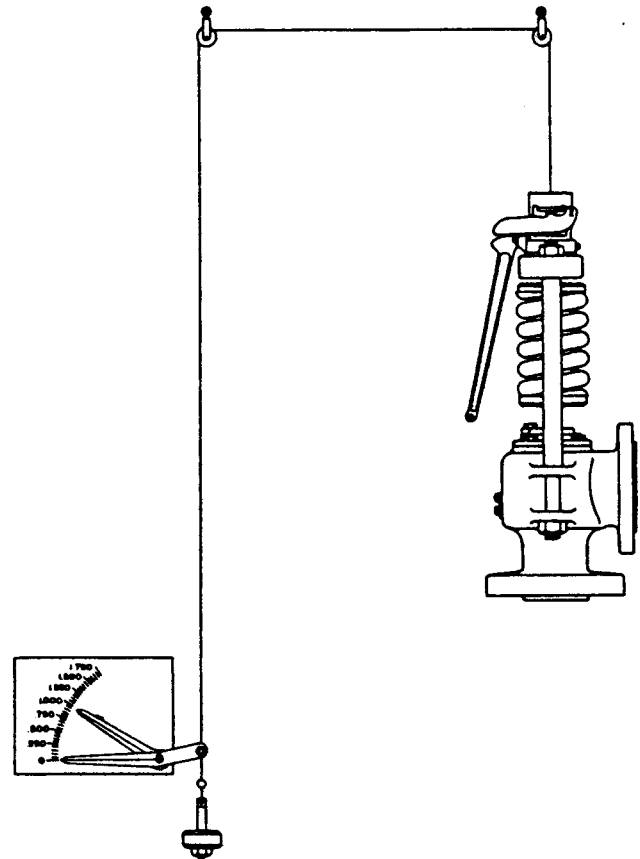


Figure 3 — Lift Indicator Illustration

be seen that a lower position of the upper ring causes that valve to remain in full lift for a longer period of time and over a greater period of pressure reduction. Fig. 4A.

It will further be noted that there is a distinct difference between the actual overlap setting on the valve and the point at which the overlap begins to take effect. This can be understood since the area in the overlap vent begins to reduce considerably ahead of the point where upper corner of the overlap bevel actually enters the floating washer. Fig. 4B. This has the effect of rounding off the corners of the diagram at points J, K & L. If the upper ring is in a position to produce the line ABH, the overlap will have to be set considerably higher to obtain a short blowdown than if the upper ring is set at such a position as to produce the line ABF. Excessively high overlap settings are liable to cause seat damage when the valve closes. It is therefore desirable to set the upper ring in such a position as to cause the valve to stay in full lift for as short a time as possible. The most desirous complete cycle is represented by the line ABFJM.

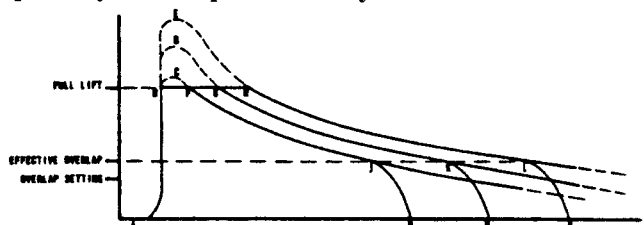


Figure 4 — Lift Diagram as Explained In Blowdown Adjustment

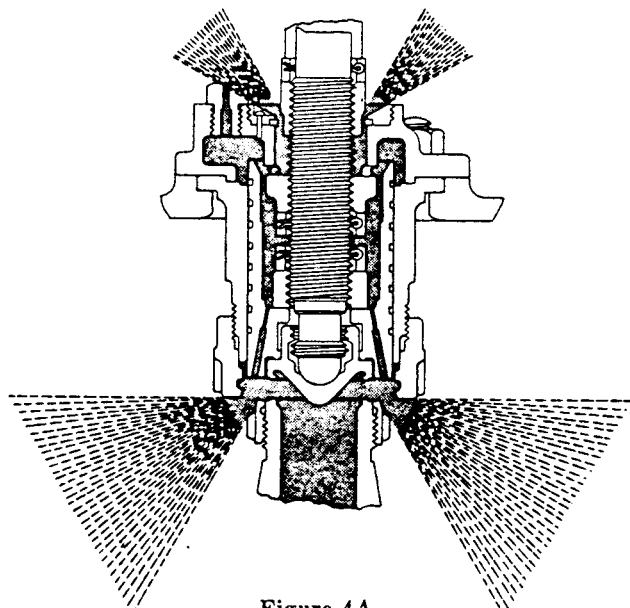


Figure 4A
Valve in Full Lift. Overlap in Full Open Position.

If a superheater valve is set with low temperature steam, it is advisable to increase the blow-down to compensate for the change in density and other thermal effects taking place when the steam is brought up to working temperature. An approximate rule is to add $\frac{1}{2}$ of 1% of set pressure to the blowdown for each 100°F of steam temperature below the final temperature.

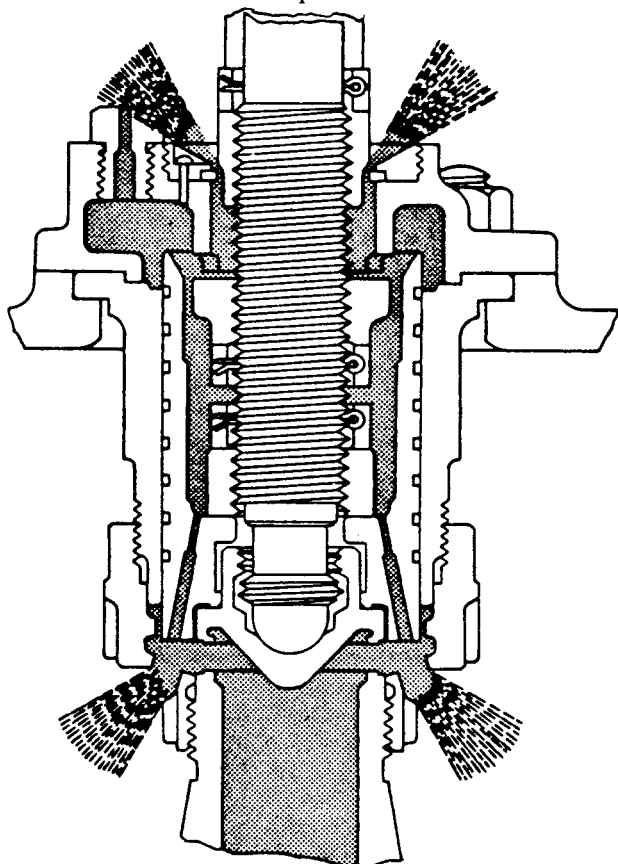


Figure 4B — Valve in Intermediate Lift.
Overlap Slightly Above Floating Washer.

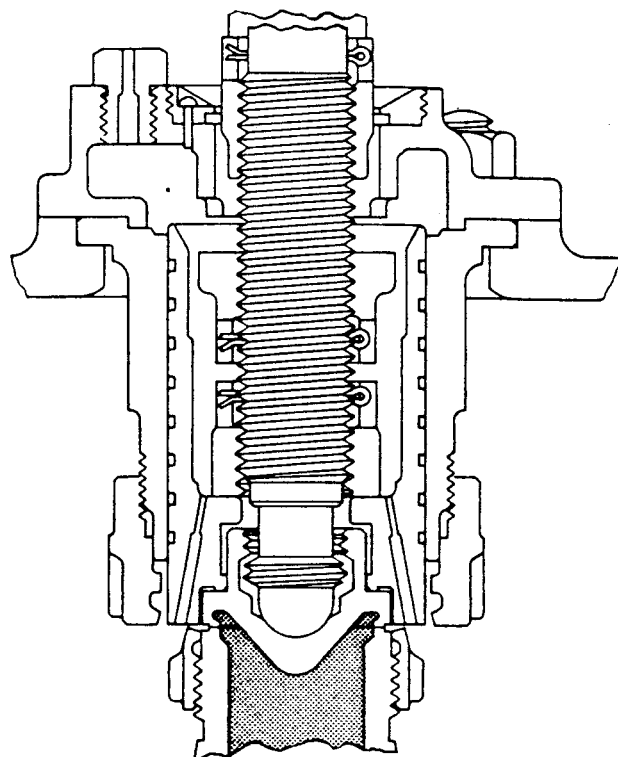


Figure 4C— Valve in Closed Position.
Overlap Fully Engaged in Floating Washer.

DISASSEMBLY

The Maxiflow Safety Valve can be easily disassembled for inspection, reconditioning seats, or replacing internal parts and the spring load can be maintained after reassembly. Refer to Fig. II, Section II for nomenclature.

Before starting to disassemble the valve, be sure that there is no steam pressure in the drum or header, then proceed as follows:

Remove the Top Lever Pin and Top Lever. Loosen Cap Set Screw and lift off Cap and Drop Lever assembly. Remove Release Nut. Remove the two top Yoke Nuts, The Yoke & Compression Screw Assembly. Then lift the spring and spring washers from the spindle.

Unscrew the four Stud Nuts and remove the guide retaining plate.

Before removing spindle, disc-holder and disc assembly, the overlap dimension should be checked and recorded. SEE Figure 5.

This can be done by placing a measuring collar over the overlap collar and lowering it until the bottom of the measuring collar rests on the floating washer. The measuring collar is then locked in position with the locking screw.

Lift the Spindle, Disc and Disc Holder out of the valve.

Remove the disc by unscrewing it from the coarse right hand thread on the spindle and remove the disc holder.

Measure the overlap from the bottom of the measuring collar to the overlap shoulder. Fig. 5 shows the measuring collar in position. Table I indicates the proper dimension for a particular orifice.

MAINTENANCE

The Disc Guide and Adjusting Ring Assembly can now be removed from the Base by lifting it straight up. In order that the blowdown of the valve will be unchanged, the position of the Upper Adjusting Ring should be marked for reassembly. Make punch marks in an axial line on a tooth of the Upper Adjusting Ring and the outside barrel of the Disc Guide. Then measure the overall height of the Disc Guide, and Upper Adjusting Ring assembly and record this information.

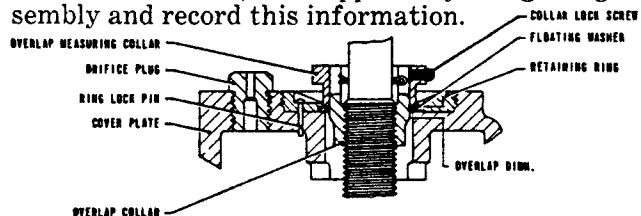


Figure 5 — Method of Measuring Overlap

Mark the Lower Ring in line with the Lower Ring Pin. Now place a straight edge or a Ring lap across the top of the seat and count the number of notches that the ring is below the seat. Record this information for reassembly.

NOTE: To retain the spring setting of the valve when, and only when, a disc is to be replaced or the seating surfaces are to be touched up, the following procedure should be followed. Remove the Top Lever Pin and Top Lever. Loosen Cap Set Screw and lift off Cap and Drop Lever Assembly. Remove the Cotter Pin and turn the Release Nut down until it is tight against the top of the Compression Screw, then back off $\frac{1}{4}$ turn. Remove the two Top Yoke Rod Nuts and the four Guide Retaining Plate Stud Nuts, and lift the Spindle, Spring, Spring Washers, Guide Retaining Plate, Disc and Disc Holder assembly out of the valve. See Fig. 6.

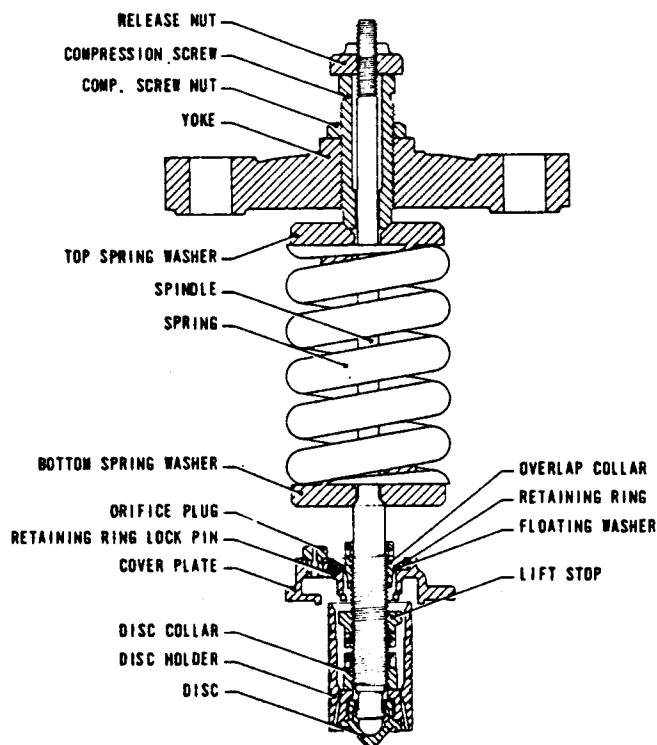


Figure 6 — Parts Removed When Retaining Setting

MAINTENANCE

It is not necessary to remove Maxiflow flanged or welded valves from the boiler for any maintenance. The actual maintenance required is generally confined to touching up seats and occasionally replacing the disc.

The following tools are recommended for this work:

- A. Three-ring-laps per valve.
- B. Flat lapping plate.
- C. Grinding compounds (Kwik-Ak-Shun Grade No. 1000).
- D. High temperature lubricant.

All of these tools can be procured from the factory, prices on application. It may not be necessary to use all of the ring-laps at any one time, but having a sufficient supply on hand will save the time of reconditioning them during a boiler outage. After the boiler is back on the line, the ring-laps should be reconditioned on the flat lapping plate, or returned to the factory for reconditioning at a nominal cost, on a special lapping machine. A lap should not be used on more than one valve without being reconditioned.

Valves that have been leaking should be disassembled in accordance with prior instructions. Since the position of the adjusting rings has been recorded, the rings can be disassembled for cleaning if necessary. Parts for each valve should be kept together or marked, to make sure that they are replaced in the same valve.

Reconditioning of the seat surfaces of the disc and seat bushing 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 Procedure

The following precautions and hints will enable anyone to do a "Professional Job of Lapping" seats:

- A. Keep work clean.
- B. A lap should not be used on more than one valve without being reconditioned.
- C. Apply a very thin layer of compound to the lap, this will prevent rounding off the edges of the seat.
- D. Lap using a reciprocating motion in all directions at the same time applying uniform pressure and rotating the Lap slowly. Care should be used not to run off the seating surface with the lap as this will cause the seat to become uneven. When lapping the disc seat the Lap should be held stationary and the disc moved as above with care taken not to strike the cone of the disc as this would cause the seat to be high on the inside.
- E. Replace the compound frequently after wiping off the old compound. Greater pressure put on the lap will speed up the cutting action of the lapping compound.
- F. To check the seat, remove all compound from the seat and lap. Then using a dry lap and the same lapping motion as above described the low sections of the seating

surface will show up as a shadow in contrast to the shiny portion. If shadows are present, further lapping is necessary. Only laps known to be flat should be used, as only a few minutes will be required to remove the shadows.

- G. 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.
- H. To check ring laps for flatness, wipe all compound off the lapping plate and ring lap. Then use a figure 8 motion of the ring lap on the lapping plate. If the lap is flat there will be no shadow; if there is a shadow, coat the lapping plate with compound and lap the ring lap with a figure 8 motion covering the lapping plate to remove the shadow.
- I. The seat now shall be thoroughly cleaned, using a lint free cloth or tissue paper.

If extensive lapping of the bushing seat is required, a great deal of time will be saved if a Roto-Lap is used. See instructions for assembling and operating the Consolidated Maxiflow Roto-Lap Machine. Section III.

Referring to Fig. 7 it will be noted that the seat step is .025. If this step is reduced to .010 due to lapping, it should be remachined to the proper dimensions. For this purpose there is available for use by the Consolidated Service Department a "Reseating Machine" which eliminates the need to remove the valve from the unit. This machine is mounted in place of the guide retaining plate and cuts the top face, inside diameter and outside diameter of the bushing to establish the correct height relationships and angles.

In re-machining the bushing seat, the length of the disc holder extending above the disc guide will decrease.

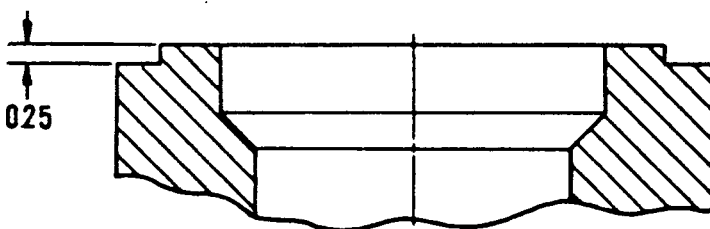


Figure 7 — Bushing Seat Step Dimension

Referring to Fig. 8 the top of the disc guide should be kept to a distance of at least $\frac{1}{16}$ " below the top of the disc holder to facilitate freeing the disc holder in case a deposit of dirt forms in the pocket between the two parts. This dimension is obtained by machining the top of the disc guide.

Spindle Runout

It is important that the spindle be kept very straight in order to transmit the spring force to the disc without lateral binding. Overgagging is one of the common causes of bent spindles. A method to check the essential working surfaces of the spindle is illustrated in Figure 9.

Clamp a V block (A) made of wood, fiber or

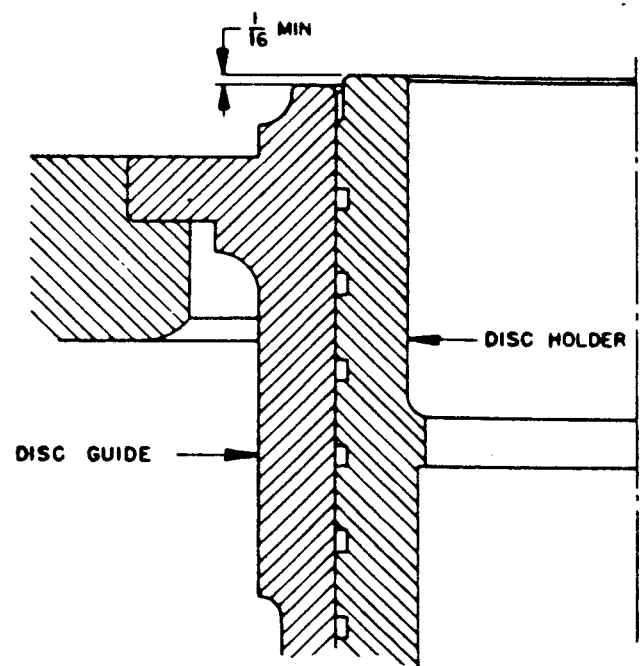


Figure 8 — Height of Holder Above Guide

other suitable material onto the platform railing. Imbed the ball end of the spindle in a piece of soft wood (B) and place Top of Spindle below the threads, in V block (A). Clamp a dial indicator onto the railing and locate at point (C). The total indicator reading should not exceed .003 when the spindle is rotated.

Other parts of the spindle not used as working surfaces may run out considerably more than .003 but this should not be regarded as an indication of crookedness or faulty manufacture.

On new installations, during initial setting of safety valves, there is a possibility of damaging the superheater valve seat due to foreign matter, such as mill scale, weld spatter and beads, etc., being drawn into the steam flow.

This foreign matter batters and cuts the seats of the valve although damage to the bushing seat is usually considerably less than to the disc seat. This type of damage causes the valve to leak quite badly and generally requires that the disc be replaced and the bushing seat relapped.

However, before bringing the boiler down, the leaking valve should be hand-blown at least ten times and held open for a period of one minute each time. This should clean any remaining foreign material out of the superheater and minimize the possibility of damage to the seats after overhaul, although this particular trouble sometimes persists until the boiler has been operating for a considerable period of time.

Drum safety valves do not, generally, draw foreign matter into the steam flow, and no difficulty of this type is to be expected.

To replace the disc, disassemble the valve in accordance with the prior instructions. Then proceed as follows.

NOTE: The bushing seat can be reconditioned by hand lapping as explained under "Lapping Procedure".

OVERLAP ADJUSTMENT, RESTRICTED LIFT VALVES, SUPERCRITICAL VALVES

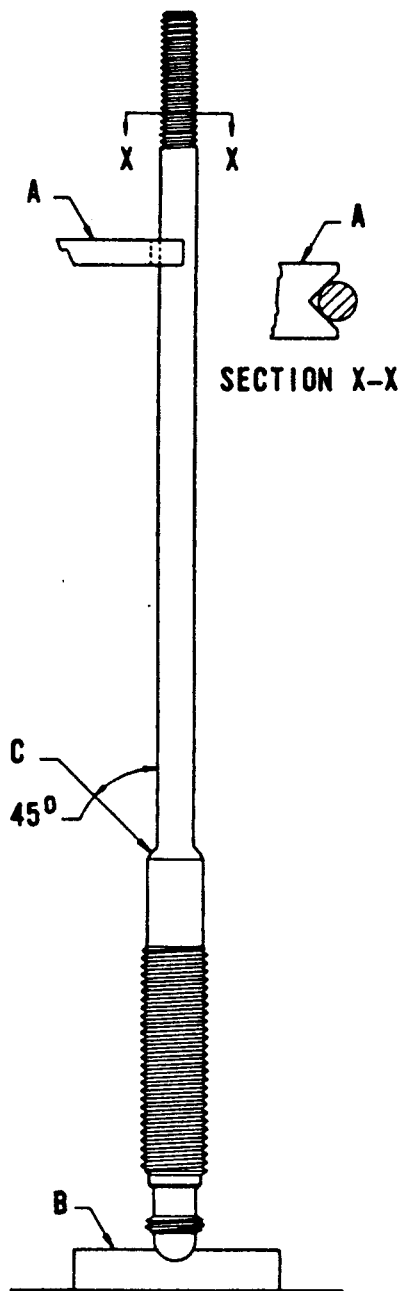


Figure 9 — Checking Spindle Concentricity

The replacement disc has been lapped on our special lapping machine and requires only that the seat be touched up. However, the spindle tip bearing should be re-established by grinding the spindle tip into the disc. This can be done with the removable assembly propped up on the compression screw end. Then remove the old disc by unscrewing it from the coarse right hand thread on the spindle. Remove the disc holder, apply a layer of grinding compound to the ball end of the spindle and screw the new disc on. Grind the bearing using a rotary motion. When the bearing is re-established, clean both surfaces with kerosene or light oil. Then apply some Molykote to the spherical surface of the spindle tip and work it into the pores by rotating the disc on the spindle.

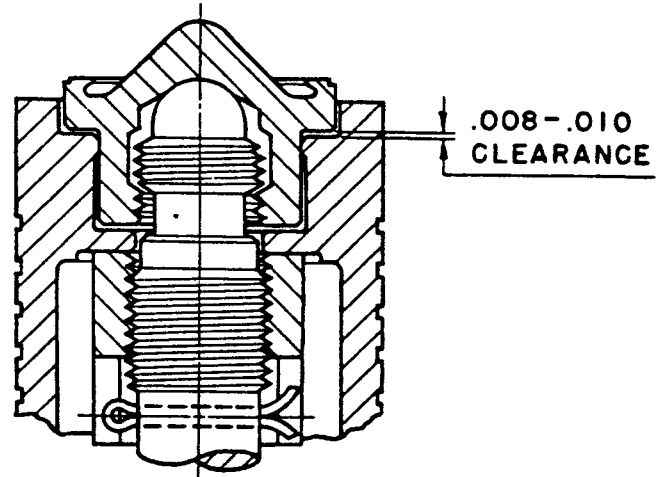


Figure 10 — Disc & Disc Holder Clearance

First, place the disc holder on the spindle, allowing it to rest on the face of the disc adjusting nut. Then assemble the disc holder and new disc. The disc should be free enough to rock on the spindle tip. If there is no freedom, lower the disc adjusting nut until the disc is free to rock slightly. Disc adjusting nut should then be lowered one notch and secured with a stainless steel cotter pin. Disc and disc holder should then be assembled. Clearance between disc and disc holder should be .008 to .010. See Fig. 10.

ADJUSTING RINGS

As to the starting position of the rings, this can be determined by the following method:

LOWER RING: Place a straight edge on the seat, bring the ring up to the straight edge then backing off one notch for each 300 pounds of set pressure, example: a valve at 2100 pounds of set pressure shall be 7 notches below the seat.

UPPER RING: Measure from the top of the guide to the seat, then set the ring using the measurement as the overall length from the top of the guide to the bottom of the ring. This will place the ring exactly at seat level when guide and ring assembly is placed into valve body.

When valve is under pressure and the position of the rings is not known, their location can be determined by the following method.

LOWER RING: Raise lower ring until contact is established with disc holder. Refer to chart in Fig. 11 Column "A" for number of notches from disc holder to seat. Example: In the case of a 1739 valve (#3 orifice), raise lower ring until it touches disc holder. Referring to Fig. 11, it will be noted that for a #3 orifice valve the lower ring must be moved clockwise 12 notches to place ring on a plane with seat. Lower ring can now be positioned by lowering it 1 notch for every 300# of set pressure.

UPPER RING: Remove both service port plugs (located on left side of valve facing outlet) and with a flashlight directed into one service port hole, the upper ring can be raised until the lower face of the ring is on a plane with the disc holder. Referring to Fig. 11 Column "B" a #3 orifice upper ring should be lowered 16 notches to place ring on a plane with seat. Ring should be left in this position.

ORIFICE	LOWER RING HOLDER TO SEAT IN NOTCHES	UPPER RING HOLDER TO SEAT IN NOTCHES
1	7	10
2	8	12
3	12	16
5	12	16
4	12	16
6	30	45
7	30	45
8	37	45
R	38	47

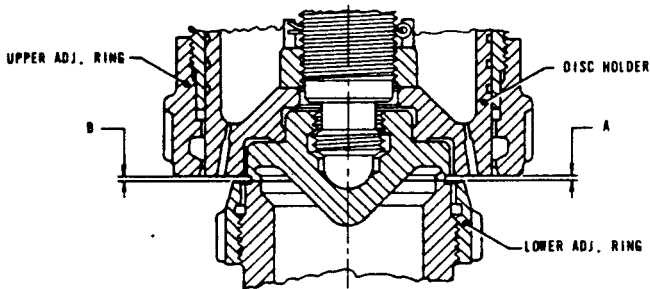


Figure 11 — Adjusting Ring Positions

OVERLAP ADJUSTMENT

As a starting position of the overlap use Table #1 for bore diameter and overlap dimension.

TABLE #1

ORIFICE	BORE DIAMETER	OVERLAP
1	1.125	.060
2	1.350	.070
3	1.800	.080
5	2.062	.090
4	2.250	.100
6	3.000	.130
7	3.750	.160
8	4.250	.180
R	4.515	.200
K	1.531	.070

The lift stop must be adjusted to the rated lift marked on the nameplate plus an additional amount as per Table #2.

The additional lift is to compensate for heated condition of the lower spindle when valve is in operation.

The following Table #2 indicates bore diameter and lift:

TABLE #2

ORIFICE	BORE DIAMETER	RATED LIFT	ADDITIONAL LIFT RECOMMENDED
1	1.125	.282	.010
2	1.350	.338	.020
3	1.800	.450	.030
5	2.062	.517	.040
4	2.250	.563	.050
6	3.000	.750	.060
7	3.750	.938	.070
8	4.250	1.063	.080
R	4.515	1.129	.090
K	1.531	.384	.030

RESTRICTED LIFT VALVES

To identify the restricted lift valve from the conventional valve at a glance, a wide deep groove has been machined in the overlap collar in the area directly below the six cotter pin slots with an additional narrow groove a distance above the outer corner, of the overlap bevel equivalent to the desired lift of the restricted valve.

As an initial setting for test purposes, the overlap collar should set in such a position as to cause the overlap to close at one-quarter of the restricted lift of the valve.

ADJUSTING RINGS: As a starting position of the adjusting rings use the method outlined in this manual for the conventional valves. The upper ring at flush with the seat and the lower ring at one notch below the seat for every three hundred pounds of set pressure.

SUPERCritical VALVES

The Maxiflow Supercritical Valve is used for steam at pressures above approximately 3200 psig. Its internal design is similar to that used in the Conventional Boiler Safety Valves. The 4500 psia 1050°F line is shown in catalog No. 18.

The springs are made from alloy steel, the discs from Inconel "X" and the seating surface of the bushing from Stellite. These materials have been found to work very well under the high temperatures and pressures to which the valve is subjected. A ball thrust bearing is used on the compression screw in all of the valves for better adjustment.

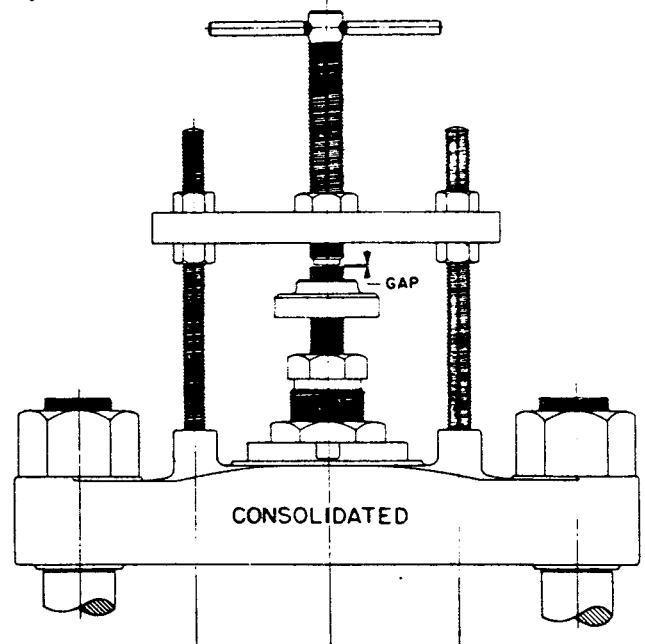


Figure 12 — Gagging Arrangement

The gagging arrangement (Fig. 12) on the supercritical valves can be used as either a gag or a lift stop. To gag the valve, the gag should be turned down on top of the spindle wrist tight. In using the gag as a lift stop, the gag can be set at a distance above the top of the spindle equal to the required lift.

HYDROSTATIC TESTING

FLANGED INLET SAFETY VALVES SHOULD BE REMOVED FROM THE BOILER DURING HYDROSTATIC TESTS AND BOILER NOZZLES BLANKED OFF.

Welded Inlet Valves

When supplied for pressures over 1200 psi, welded inlet safety valves are shipped with hydrostatic test plugs installed.

These valves are identified by a White Caution tag with red letters attached to the internal plug by wires extending thru the drain hole in the valve body. See Fig 13 & 13A.

The hydrostatic plugs are placed in the bore of the valve, inside the seating surface. Their purpose is two-fold. First, they effect closure at a point differing from the seating surface of the valve so that if the valve is lifted on hydrostatic test, the seating surface will not be as liable to become damaged. Second, by raising the disc of the valve off its seat and increasing spring compression, the set pressure of the valve is increased to a point where the valve will not leak at one and one-half times design boiler pressure. It is not necessary to gag safety valves tightly when hydrostatic plugs are used.

These plugs must, of course, be removed from the valves prior to placing the boiler in service. However, they should be retained and reinstalled whenever a hydrostatic test exceeding the boiler design pressure is to be made. **NOTE:** Removal of Hydrostatic Plugs.

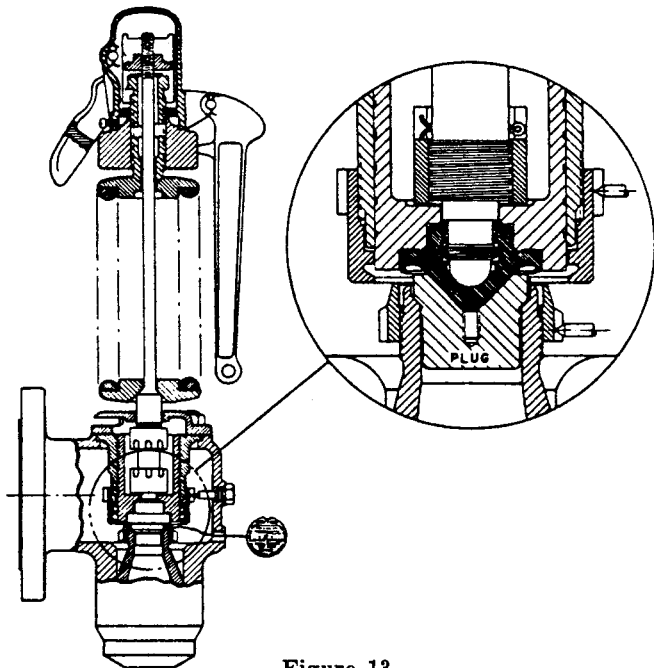


Figure 13

Valve as Shipped with Hydrostatic Plug in Place

It is recommended that a Service Engineer of Consolidated Valve Division remove the hydrostatic plugs. If this cannot be done, follow the instructions under disassembly and remove the plug taking care to clean the seating surfaces before reassembly, and returning all parts in their proper places.

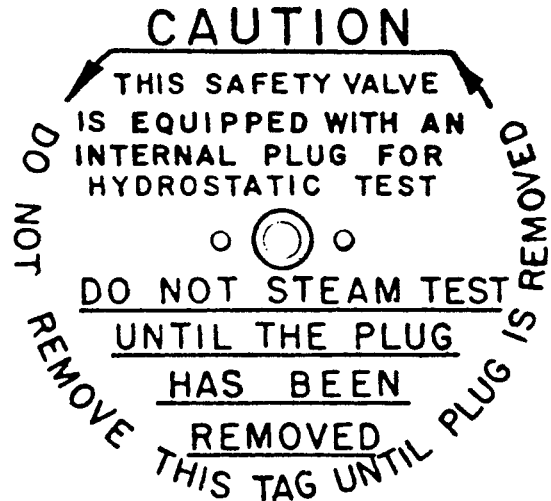


Figure 13A — Caution Tag
Gagging Valves under 1200 P.S.I.

Probably the most common source of Safety Valve trouble is over-gagging. During hydrostatic testing, and during Safety Valve setting, gags should be applied only hand tight. During setting, over-gagging will, also, cause damage to the seating surface and resultant leakage. In applying gags, remember that the valve spring will hold the valve closed against its set pressure. The additional gag load applied should be only enough to insure that the valves do not lift at the expected over-pressure.

Gags should never be applied when the boiler is cold. The spindle of the Safety Valve expands considerably with the temperature increase as pressure is raised. If it is not free to expand with this temperature change it may become seriously bent.

Boiler pressure should be brought up to within 80% of the pressure of the low set valve before applying the gags.

Tighten the gags of drum and superheater valves with only a light force applied to the gag screw head.

Reheat valves require a greater force applied to the gag screw head to hold the valve closed during hydrostatic test.

S1 DESIGN

ITEM NO.	NOMENCLATURE
1	BASE
2	INLET NECK
3	SEAT BUSHING
4	LOWER ADJUSTING RING
5	LOWER RING PIN
6	DISC
7	DISC HOLDER
8	GUIDE
9	UPPER ADJUSTING RING
10	UPPER RING PIN
11	SPINDLE
12	DISC COLLAR
13	LIFT STOP
14	GUIDE RETAINING PLATE
15	COVER PLATE STUD
16	STUD NUT
17	WASHER RETAINER
18	FLOATING WASHER
19	ORIFICE PLUG
20	OVERLAP COLLAR
21	YOKE ROD
22	BOTTOM SPRING WASHER
23	SPRING
24	TOP SPRING WASHER
25	YOKE
26	COMPRESSION SCREW
27	COMPRESSION SCREW NUT
28	RELEASE NUT
29	CAP
30	TOP LEVER
31	TOP LEVER PIN
32	DROP LEVER
33	DROP LEVER PIN
34	YOKE NUTS

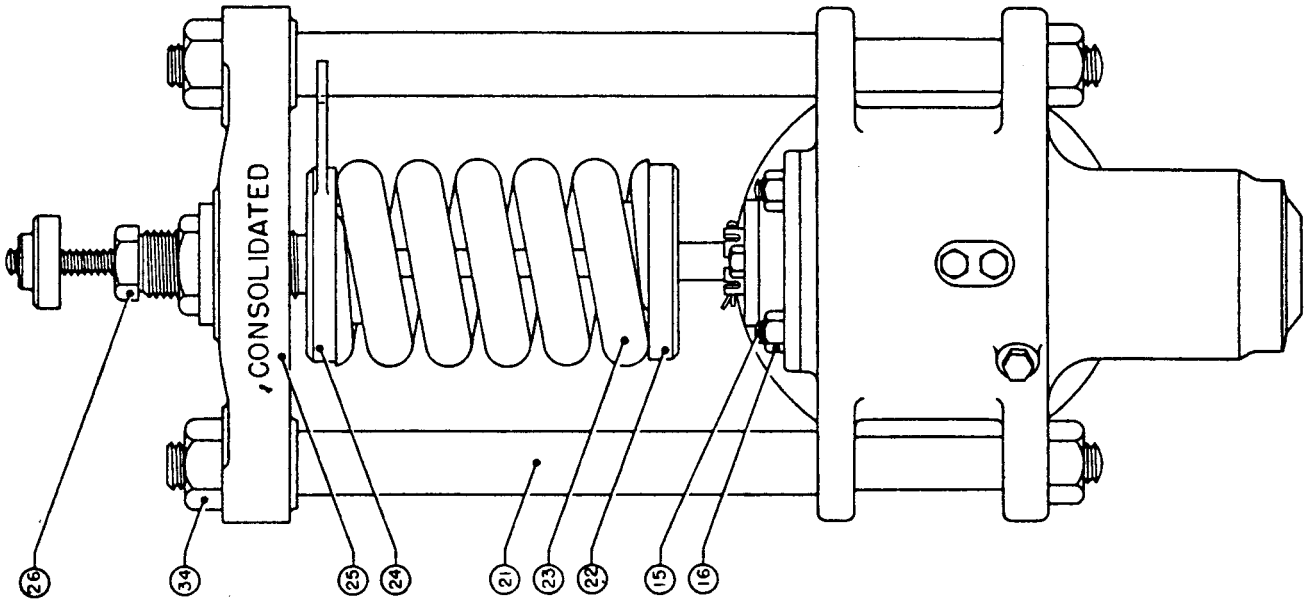
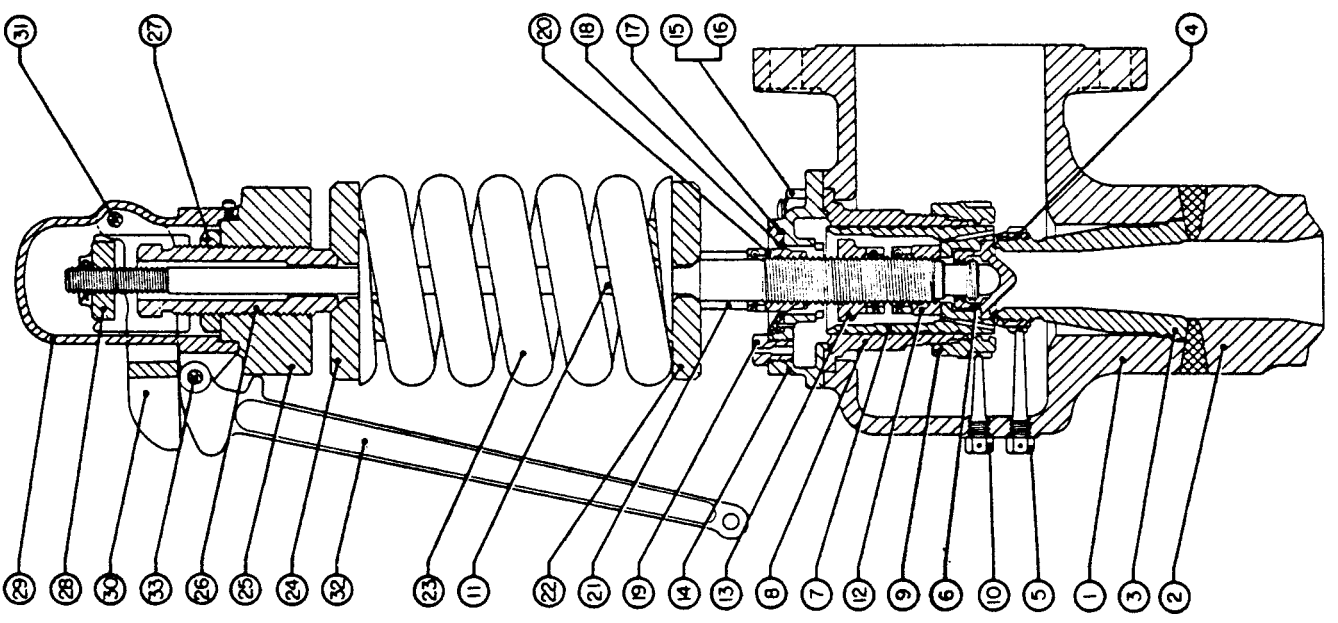


Figure 14

TO APPLY TEST GAGS

1. Refer to Figure 14. Remove CAP (29) with TOP LEVER (30) and DROP LEVER (32) attached. The RELEASE NUT (28) is fixed to SPINDLE (11) by means of a cotter pin. Note that the RELEASE NUT does not quite engage top of COMPRESSION SCREW (26). See Figure 15 for details of RELEASE NUT position.
2. Center the test gag screw in the exposed end of the SPINDLE (11) and hook the legs of gag under the sides of the YOKE as shown in Fig. 15.
DO NOT APPLY THE GAG LOAD UNTIL THE BOILER HYDROSTATIC PRESSURE IS EQUAL TO 80% OF THE PRESSURE TO WHICH THE LOW SET VALVE IS ADJUSTED. When applying the test gag, note that the spring compression on the valve is already in excess of that required for the nameplate set pressure as the result of the installed hydrostatic test plug and it is sufficient to hold valve closed up to approximately 125% of the nameplate set pressure. Therefore, the additional loadings to be applied by the gag should only be enough to prevent the valve from opening at maximum hydrostatic test pressure.

3. Apply the gag load by turning the gag screw clockwise.

If the gag on any valve has not been tightened sufficiently, the valve will leak and sometimes the leakage is accompanied by a "Sizzling" sound.

IF THIS OCCURS, THE HYDROSTATIC TEST PRESSURE SHOULD BE REDUCED UNTIL THE VALVE COMES TIGHT AND THEN THE GAG SHOULD BE TIGHTENED STILL FURTHER.

This procedure must be followed exactly since it is very difficult to stop the leak by additional gagging once it has started. Any attempt to pinch off the leakage thru the valve without first lowering the hydrostatic pressure is liable to result in damage to the valve seats.

4. After the hydrostatic test is completed, the gags should be removed when the hydrostatic pressure has been reduced to 85% to 90% of the pressure of the low set valve.

UNDER NO CIRCUMSTANCES SHOULD THE GAGS BE LEFT ON VALVES WITH NO HYDROSTATIC PRESSURE ON THE SYSTEM.

TO REMOVE THE HYDROSTATIC TEST PLUG

1. Remove the four GUIDE RETAINING PLATE STUD NUTS (16).
2. Back off the two YOKE ROD NUTS (34) uniformly until compression screw engages release nut. Now remove YOKE ROD NUTS.
3. Remove YOKE AND SPRING ASSEMBLY from valve, being careful not to damage the DISC.
4. Remove hydrostatic test plug from SEAT BUSHING.

TO REASSEMBLE VALVE

1. Always be certain that all parts are clean and free of dirt and foreign material. Dirt trapped on seating surfaces or in nozzle when valve is reassembled will invariably damage seats.
2. Reassemble YOKE AND SPRING ASSEMBLY into BASE being careful not to damage the DISC. Locate the GUIDE RETAINING PLATE (14) so that the orifice plug is accessible. The lugs on the TOP SPRING WASHER (24) should be on the right side of the valve when facing the outlet.
3. Replace the two YOKE ROD NUTS (34) and the four GUIDE RETAINING STUD NUTS (16). Tighten the YOKE ROD NUTS (34) and just snug up the four GUIDE RETAINING STUD NUTS (16).
4. Remove cotter pin from RELEASE NUT (28). Turn the RELEASE NUT counter clockwise and return RELEASE NUT to position at top of SPINDLE so that cotter pin can be reinserted in a hole drilled in the SPINDLE at that location. See Fig. 15. The valve setting is now approximately equal to the setting stamped on valve nameplate.
5. Visually center GUIDE RETAINING PLATE (14) around SPINDLE (11) and tighten the four GUIDE RETAINING STUD NUTS (16).
6. Replace CAP (29) and locate DROP LEVER (32) vertically on center line of valve.
7. Remove TOP LEVER (30) from CAP (29) and reassemble in position in accordance with Fig. 14. If properly positioned, TOP LEVER should have a small amount of vertical movement prior to engaging bottom surface of RELEASE NUT.
8. Valve is now ready for the initial field test on steam to check valve set point and blowdown.

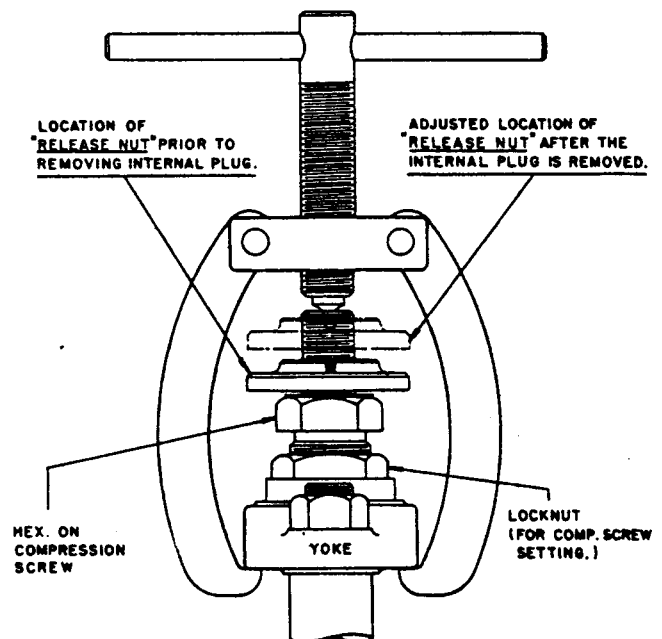


Figure 15 — Application of Test Gag

INSTRUCTIONS FOR ASSEMBLING & OPERATING THE CONSOLIDATED MAXIFLOW ROTO-LAP MACHINE

GENERAL DESCRIPTION

The Consolidated Maxiflow Roto-Lap Machine is a hand operated tool for refinishing damaged or worn nozzle seats in Consolidated Maxiflow Safety Valves. It has been expressly developed for the purpose of generating a flat surface and its use materially reduces lapping time.

The Roto-Lap will not correct a seating surface which is out of square with the valve center line, nor will it reshape the original dimensions of the nozzle seat. For either of these purposes, a special reseating machine is required or the valve must be removed from the boiler and the base and bushing assembly remachined.

GENERAL NOTES

The Maxiflow Roto-Lap Machine is made up of parts as shown in Fig. 16. A duplicate Bill of Material is also pasted inside the cover of the carrying case.

A Mounting Flange, Item 6, fabricated with three sets of four holes on three diameters is provided for use on all valves with orifice sizes #1 thru #5. Kits for #1 and #2 orifice valves include two sets of four Laps, Item 10. Kits for #3 and #4 and #5 orifice valves include one set of four Laps, Item 10, and one set of four larger or alternate Laps, Item 11.

ASSEMBLY

Proper assembly of the Roto-Lap can be ac-

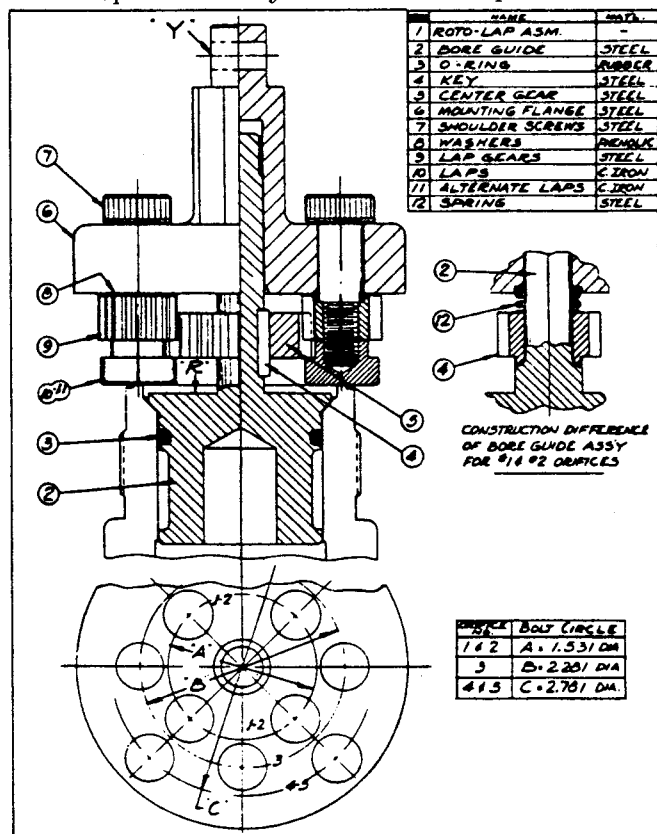


Figure 16 — Nomenclature Roto-Lap Machine

complished by referring to Fig. 16. The mounting Flange, Item 6, has three sets of four holes each; the inner set marked 1-2; the center set marked 3 and the outer set marked 4-5. First select the set of marked holes corresponding to the size of the orifice to be lapped and insert the Shoulder Screws, Item 7, downward through these holes.

The orifice-size can be identified by referring to the valve type number stamped on the valve nameplate.

The third digit in the type number is the valve orifice size or number. As an example, if the valve is Type 1747WA, the third digit, #4 is the orifice size or number and the Shoulded Screws would be inserted in the set of holes marked "4-5" on the Mounting Flange.

Next assemble the four Lap Gear Washers, Item 8, four Lap Gears, Item 9, Center Gear, Item 5, and Laps, Item 10, in this order. The shoulders on the Shoulder Screws should seat against the recesses in the top surfaces of the Laps. An Allen Set Screw wrench is provided for tightening the Shoulder Screw to the Lap. Each Lap, Lap Gear and Shoulder Screw assembly should rotate freely in the Mounting Flange.

The Center Gear must engage in all four Lap Gears and must be in place before the Laps are assembled to the Shoulder Screws. When properly assembled, the Center Gear should "float" in the space between the Laps and the Mounting Flange.

Attach the Handle Assembly to point "Y" on the Mounting Flange spud by means of the Allen Set Screw provided.

Place the Bore Guide, Item 2, inside the bore of the safety valve seat bushing or nozzle and push it down as far as it will go. The top of the flange, point "R" must be below the seating surface of the nozzle. A small amount of light oil on the "O" Ring, Item 3, will assist in getting the guide into this position.

USE

Where two different sizes of Laps are provided, the larger set will cut faster than the smaller and should be used for removing nicks and other severe damage. The smaller set of Laps cuts slower and is better for finishing the seat surface.

Applying lapping compound to the lower face of each of the Laps. Normally 1000 grit grinding compound similar to KWIK-AK-SHUN Grade #1000, should be used. However, a heavier grit compound may be used where necessary. A small amount of oil placed on the Laps with the compound will produce a better finish.

Drop the Mounting Flange Assembly over the Bore Guide extension shaft so that the shaft passes through the Center Gear and into the center hole in the Mounting Flange. TURN THE HANDLE CLOCKWISE slowly until the Key, Item 4, engages in the keyway in the center Gear and prevents its further rotation. At this point, the Laps will drop onto the seating surface. Further rotation of the handle causes the Laps to move in a planetary fashion, rotating as they travel around the seat. Lap by turning CLOCKWISE until the desired finish is produced.

SECTION III

REPLACEMENT PARTS, SERVICE

You will note that the Mounting Flange Assembly lifts off easily for periodic inspection of the seat as lapping progresses, and is easily replaced for further lapping if necessary. Also, the Bore Guide, remaining in the bore throughout the entire operation, prevents foreign material from falling into the boiler.

After the removal of nicks, etc., the surface finish can be improved if the surplus compound is wiped away from both the nozzle seat and the laps and the lapping continued with a minimum amount of compound. Final finishing should be done with a new hand lap, using 1000 grit compound to insure minimum deviation from a perfectly flat surface. Ring laps are provided in the Roto-Lap Kit for this purpose.

SECTION IV

Replacement Parts

When it becomes necessary to order replacement parts, the order should state:

1. Part name
2. Valve size
3. Valve type
4. Serial number of valve
5. When ordering spring assemblies, also state the desired set pressure.

Refer to Figure 14 for part name. All other required information will be found stamped on the nameplate attached to the body of the valve.

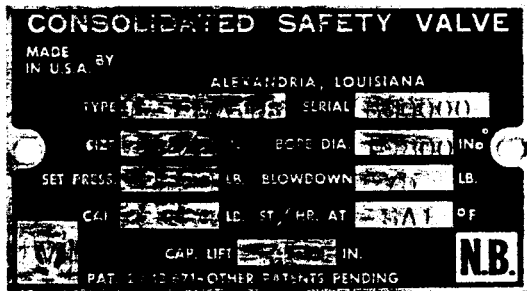


Figure 17 — Safety Valve Nameplate

In addition, the serial number is stamped on the top edge of the outlet flange. Be sure to include the one or two letters preceding the figures in the serial number. A typical valve nameplate is shown in Figure 17.

FIELD SERVICE

Utilities expect and demand service on a moment's notice. Should it become necessary, utilities can depend on Consolidated Field Service, even on extreme off-hour emergency situations.

Dresser-Industrial Valve & Instrument Division, maintains the largest field service staff in the industry. Service Engineers are located at strategic points throughout the United States to respond to customers' requirements for service. Each Service Engineer is factory trained and long experienced in servicing Safety Valves. Our Service Engineers restore disc and nozzle critical dimensions which affect valve performance, and are capable of modernizing valves in the field.

The following spare parts are recommended:

1. Disc for 50% of each type and size drum valve
2. Disc for 100% of each type and size superheater valve
3. One set of adjusting rings for each type and size superheater valve
4. One set of ring pins for each type and size valve

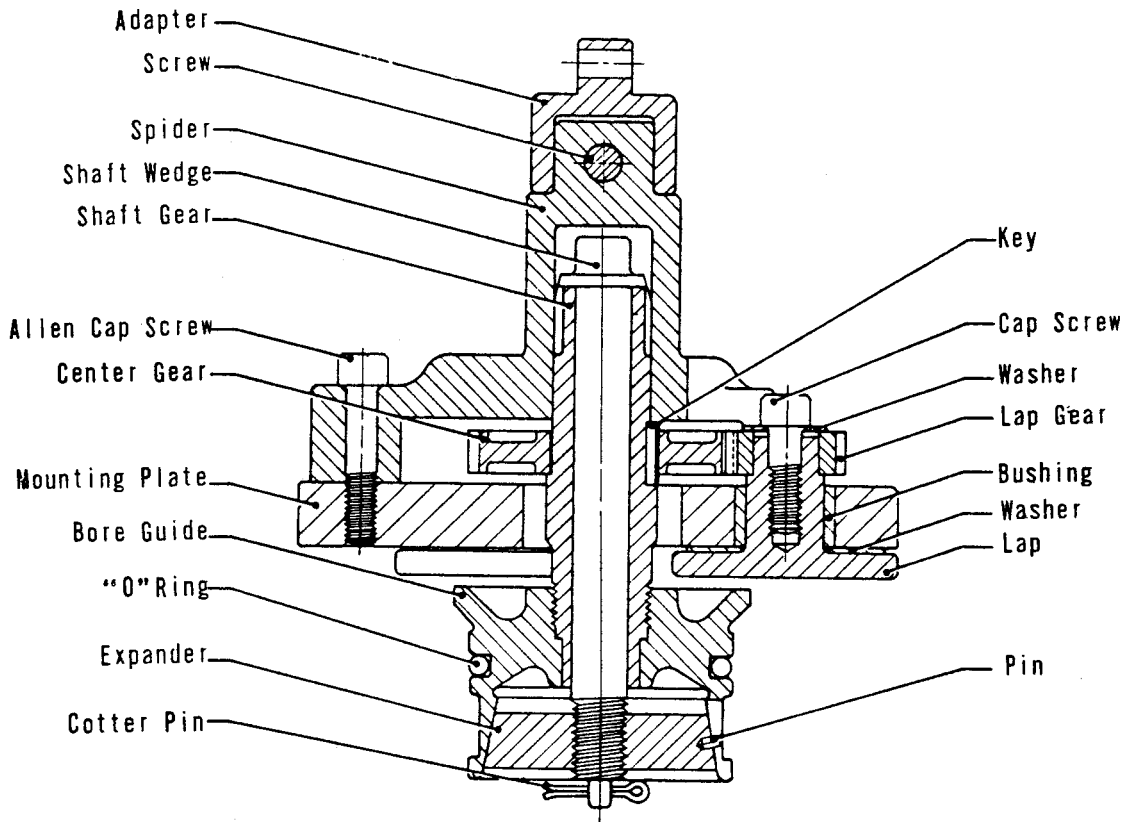
FACTORY REPAIR FACILITIES

If boiler downtime permits, it may be desirable to return the valves to the factory for repair or modernizing. The factory at Alexandria, Louisiana maintains a complete Consolidated repair center. In addition to factory production stock, the repair center utilizes its own stock room. **Most important**, this enables the factory to make return shipment of repaired valves within forty-eight (48) hours after receipt of customer's purchase order.

Each valve is tested and adjusted on Consolidated 2500# steam test boiler. Final testing is witnessed by quality control inspection as being properly set and adjusted in accordance with the ASME Power Boiler Code.

NEW VALVE WARRANTY

Both factory and field repaired valves carry a new valve warranty and is sealed to assure the customer of our guarantee against defective workmanship and materials for one full year.



ORIFICES 6 THROUGH "R"

ROTO-LAP FOR REHEAT VALVES

The Roto-Lap machine for the larger reheater valves, Orifices #6 through R is somewhat different than that described for Orifices #1 through #5 in that the mounting plate consists of two parts, the spider and the plate. The mounting plate has two sets of three holes each the inner set of which is used on the #6 and #7 orifice valves. The outer set is used for the #8 and "R" orifice valves.

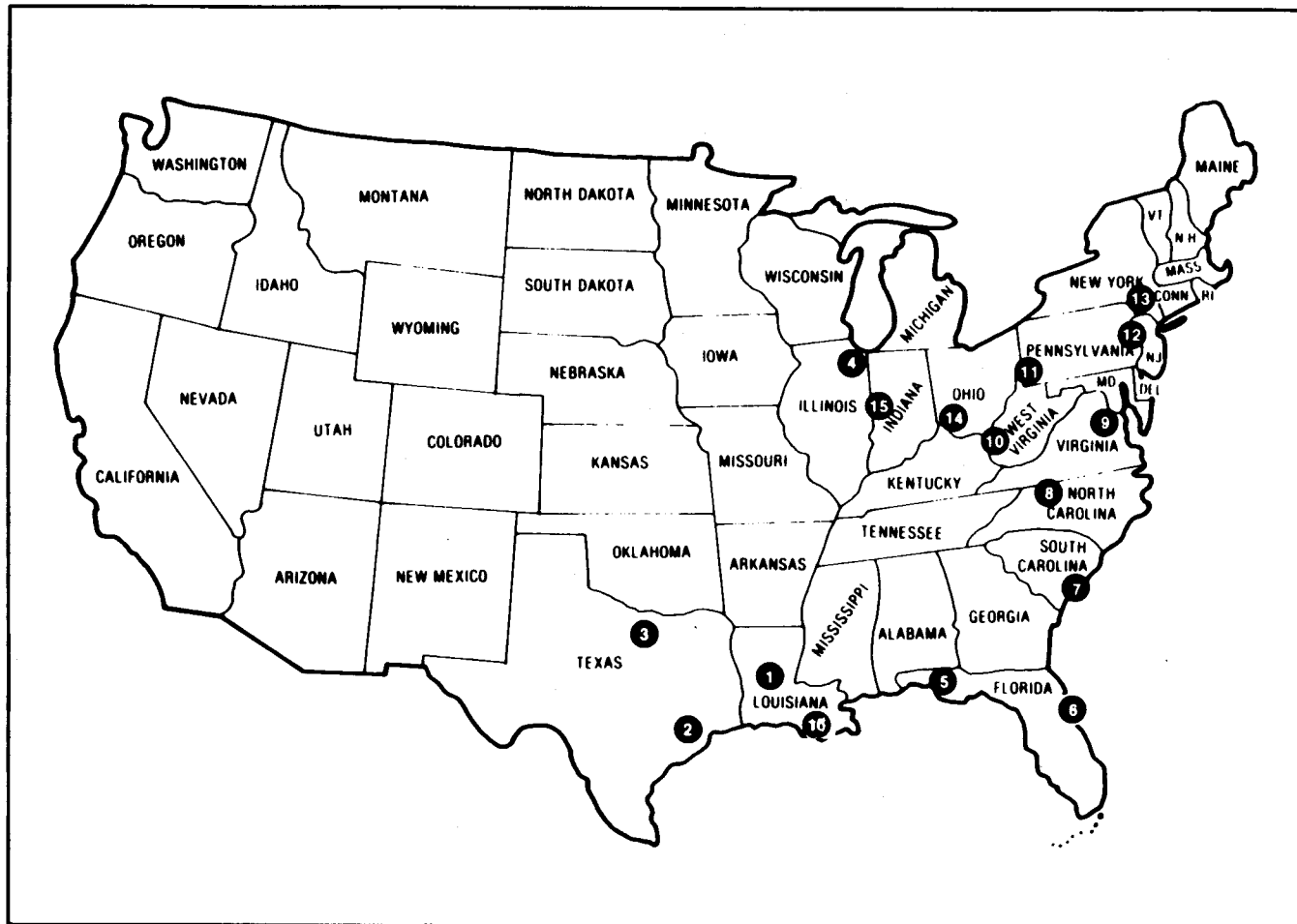
As an example, if the valve is Type 1777WA, the third digit #7 is the orifice size, and the cap

screws would be inserted in the inner set of three holes on the mounting plate.

Next assemble the three Lap Gear Washers, Item 16; three lap gears, Item 8; center gear, Item 9; and laps, Item 6 in this order, and tighten the cap screws into the laps with the Allen wrench provided.

Next install the bore guide, Item 2, with its Expander 4 and Shaft Wedge 11 into the bore of the valve, and tighten shaft wedge to expand bore guide.

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

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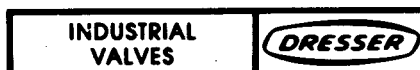
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