WARNING
The protection and safety of equipment, property and personnel depends on the proper operation of the safety valves described in this manual. All Emerson safety valves should be kept in proper working condition in accordance with the manufacturer’s written instructions. Periodic testing and maintenance by the user of this equipment is essential for reliable and safe valve operation.
All installation, maintenance, adjustment, repair and testing performed on safety valves should be done by qualified technicians having the necessary skills and training adequate to perform such work. All applicable Codes and Standards, governing regulations and authorities should be adhered to when performing safety valve repair. No repair, assembly, adjustment or testing performed by other than Emerson or its authorized assemblers and representatives shall be covered by the warranty extended by Emerson to its customers. The user should use only original, factory supplied OEM parts in any maintenance or repair activity involving this product.

SAFETY PRECAUTIONS
When the safety valve is under pressure never place any part of your body near the outlet of the valve. The valve outlet and any separate drains should be piped or vented to a safe location. Always wear proper safety gear to protect hands, head, eyes, ears, etc. anytime you are near pressurized valves. Never attempt to remove the safety valve from a system that is pressurized. Never make adjustments to or perform maintenance on the safety valve while in service unless the valve is isolated from the system pressure. If not properly isolated from the system pressure, the safety valve may inadvertently open resulting in serious injury. Remove the safety valve prior to performing any pressure testing of the system. The safety of lives and property often depends on the proper operation of the safety valve. The valve must be maintained according to appropriate instructions and must be periodically tested and reconditioned to ensure correct function.

This Maintenance Manual is provided as a general guide for the repair and maintenance of the safety valves described herein. It is not possible to describe all configurations or variations with such equipment. The user is advised to contact Emerson Valves and Controls or its authorized assemblers and representatives for assistance in situations that are not adequately covered or described in this manual. Before removing a safety valve for maintenance, ensure that the system pressure has been fully depressurized. If an isolation block valve is used ensure that any trapped fluid between the block valve and the safety valve is safely vented. Before disassembling the safety valve ensure that the valve has been decontaminated from any harmful gasses or fluids and that it is at a safe temperature range for handling. Fluids can be trapped in the dome space of pilot operated safety valves. Before installation, the Installation and Operational Safety Instructions should be fully read and understood. These Instructions may be requested from the factory or are available at Emerson.com/FinalControl.
1 GENERAL VALVE DESCRIPTION

1.1 Operation
The Series 727 Pilot Operated Safety Valve uses the principle of loading the larger area of
a differential area piston with line pressure to
hold the piston closed up to set pressure. On
rising system pressure, the pilot actuates at set
pressure, venting the small volume of steam
in the dome of the unloader. The unloader
(see Note 1) is connected directly to the main
valve dome chamber and allows the pressure
to vent into the outlet of the main valve. When
dome pressure is reduced to 40% of system
pressure, the main valve disk lifts off the nozzle
seat, thereby venting system pressure through
the outlet.

When system pressure drops by 5 to 7% of set,
the pilot closes, forcing the reseat piston off its
seat, allowing system pressure to re-enter the
pilot and close the unloader. Recharging of the
main valve dome occurs through the hole in the
main valve piston causing the disk to reseat on
the nozzle.

When operating below set pressure, the inlet
and main valve dome pressures are equal so
that the seating force on the main valve seat is
equal to the system pressure times the seating
area. Since the seat load increases with system
pressure, the main valve maintains premium
seat tightness up to set pressure.

2 MAIN VALVE MAINTENANCE

2.1 Disassembly
(Refer to Figures 1 thru 3A)

2.1.1 Notes: for ease of repair, the tools and
repair kits specified in Section 7 and
Section 8 should be used.

2.1.2 Use a 1/16” wrench to remove all supply
tubing and set aside. Disconnect tubing
from unloader to outlet flange (See note 1).
If the field test option is installed, remove
both shuttle check valves, related tubing
and fittings and set aside.

2.1.3 Remove blowdown hand valve if one is
installed on the pilot. Use a ¼” alien wrench
to remove pilot retaining screws and pilot
from main valve mounting block and set
aside.

On the 6 x 8 and 8 x 10 valves, the mounting
block will be removed along with its pilot.
Clean off all gasket residue where applicable
being careful not to damage surfaces.

2.1.4 Reposition main valve with cap (2) up.

Remove cap nuts (7). The compressed dome
springs (10) should raise the cap off the valve
body. Remove the cap (2). If the cap appears
stuck to the valve body, free it by tapping
around the cap edge with a brass hammer
or by wedging a large bladed screw driver
between cap and body to free cap.

Should the loosened cap still not rise,
proceed with caution. The spring loaded
damper may be stuck in the piston and
could suddenly release after the cap is
removed.

Remove damper (8), dome spring (10)
and filter assembly (19). Filter may be
removed by grabbing sleeve with pliers.
Set filter assembly aside for cleaning and
inspection. Reuse if not damaged. Remove
and discard seal (20) at filter port on both
cap and body. Do not remove unloader
(if valve is equipped with one) unless it
leaks. Remove pipe plug (18) in cap (2)
(See detail A in Figure 2) and remove drain
plunger (17) and spring (16) if valve is so
equipped (see detail A in Figure 2).

NOTE
1. If valve is not equipped with an unloader contact
factory for instructions (refer to Figure 1).
2. The disk cannot be disassembled from the 2", 3"
and 4" valve size piston. The 6" and 8" size disk can
be removed for replacement or relapping. Loosen
three disk assembly retaining screws located inside
piston at spring stop. Hold piston and unscrew disk
assembly with strap wrench.

2.1.5 Remove piston (4) with disk (29). For sizes
6 x 8 and 8 x 10, a 1/2-13 UNC eye bolt can be
threaded into back of piston to aid in
removal. The weight of 6" and 8" pistons
may require use of a lift assist device.
Protect disk seat face from damage.
(See Note 2)

2.1.6 Before removing liner (5), remove and
discard compacted liner seal (13) being
careful not to damage metal surfaces.
Remove liner (5).

2.1.7 Use only a 12 point socket to remove
nozzle retaining screws (9), and spring
washers (23). To remove nozzle (3),
reinstall two screws 180 degrees apart
without the spring washers. Tap lightly on
screws and drive nozzle (3) free of seal (15).
Remove screws, nozzle (3), nozzle seal (15)
and extrusion ring (14). Discard screws (9),
washers (23) and nozzle seal (15). Under no
condition reuse items 9, 23, and 15.

2.2 Repair

2.2.1 Inspect the nozzle (3) and disk (29) seat
surfaces for nicks or scratches. Restoration
of disk and nozzle seat surfaces should only
require lapping and polishing. If the seat
surfaces are damaged more extensively,
machining may be required. Refer to
Section 9.

2.2.2 Inspect piston rings (11 and 12) for scratches
or galling. If replacement is required refer
to ring kits listed in Section 7. Remove
rings and centralizer springs (21 and 22).
Discard rings and springs. Assemble
new rings and centralizers on piston.
Following the instructions supplied
in each kit. If piston ring expanders
described in Section 8 are not available,
both rings can be hand installed on the
piston. Carefully expand correct ring over
piston O.D. Place brass shim stock under
ring gap end to prevent scratching piston.
Slide ring into groove.

2.2.3 Inspect liner (5) interior for damage.
Replace liner if damaged.
2.2.4 If the unloader assembly requires service, disassemble by clamping the unloader body in a steel jawed vise and unscrew the hex head bushing with a 12" crescent wrench. Remove and discard the seal. Remove unloader piston from body [See Note 3]. See Section 7, repair kits, for seal replacement information. The unloader piston and bushing seat surfaces may be restored by lapping and polishing. If the seating surfaces are damaged more extensively, machining may be required. Refer to Section 9. Reassemble, using the instructions in the repair kit.

2.2.5 The field test option on a valve (see Figure 3, views B and D) will not need to be repaired unless steam was detected leaking from the field test port. The field test option consists of a dome shuttle check valve, inlet shuttle check valve, field test port and assorted tubing and fittings [see Figure 3 and 7]. Repair of the shuttle check valves consists of replacing the internal PTFE O-rings. [See Section 7, Repair kits.] Disassemble shuttle check valve by clamping the body in a vise to remove the ⅞" hex bushing. Reassemble using the instructions in the repair kit.

NOTE
3. The unloader piston is a two piece unit that cannot be disassembled.

2.3 Assembly
Refer to Section 7 for repair kits and Section 8 for repair tools.

2.3.1 Important: before assembly, thoroughly clean all valve parts with oil free solvent and dry, paying particular attention to all sealing surfaces. Do not bead or sand blast. Check both damper and nozzle for matching orifice “letter” designators before assembling.

2.3.2 Install extrusion ring [14] (with radius edge into flange corner), followed by new nozzle seal [15] and then nozzle [3] [see detail C in Figure 2]. Lightly secure nozzle [3] with new retaining screws [9] and new belleville washers [23] [See detail B in Figure 2 for washer stack orientation]. Use a 12 point socket to tighten screws in a clockwise pattern, one revolution per screw, until all screws are fully seated. This procedure will ensure proper compression of new nozzle seal. Do not alternately tighten screws as this method could cause seal failure.

2.3.3 Stand valve on its outlet flange; install liner [5] in valve body. Lubricate 45E step in liner with silicone grease.

2.3.4 If a piston installation sleeve is used, [see Section 8.2 for details] place sleeve on top of liner. Lubricate I.D. of sleeve with silicone grease. Wipe both piston and nozzle sealing surfaces with a clean cloth or rag. Insert piston into sleeve to compress rings with radial hole in piston toward valve inlet [refer to Figure 1]. Insert and center a wooden or plastic dowel into piston and lightly tap piston into liner approximately half way. Remove installation sleeve and force piston down to nozzle. Install spring [10], damper [8] and liner seal [13]. Do not damage seal.
**Anderson Greenwood Series 727 Pilot Operated Safety Relief Valves**

Installation and Maintenance Instructions

### Parts

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<td>1</td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>Retainer screw</td>
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<td>Seal extrusion ring</td>
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<td>Seal</td>
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<td>Bolt, disk retainer</td>
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<tr>
<td>31</td>
<td>Screw, disk retainer</td>
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**Note**

Valve may not be equipped with drain plunger assembly depending on date of production.

**Figure 2**

- See detail A
- See detail B
- See detail C
- See detail D
- See detail E

- Belleville stack orientation before installation

- 6" and 8" piston
FIGURE 3

2” and 3” valve with field test accessory

4” valve without field test accessory
TABLE 1 - TORQUE VALUES FOR VALVE ASSEMBLY (foot-pounds)

<table>
<thead>
<tr>
<th>Bolt size</th>
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<th>Bolt size</th>
<th>Carbon steel</th>
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<td>378</td>
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<tr>
<td>1/8</td>
<td>50</td>
<td>1/4</td>
<td>405</td>
</tr>
<tr>
<td>1/2</td>
<td>75</td>
<td>1 (8” 150/300 CL)</td>
<td>450</td>
</tr>
<tr>
<td>5/16</td>
<td>110</td>
<td>1 (8” 600 CL)</td>
<td>450</td>
</tr>
</tbody>
</table>

Valve sizes 6 x 8, 8 x 10 without field test option

Valve sizes 6 x 8, 8 x 10 with field test option
3 PILOT MAINTENANCE

3.1 Pilot disassembly
(Refer to Figure 4A style pilot)
To facilitate assembly, place all parts in an orderly arrangement so the parts can be assembled in the proper sequence.
Before beginning disassembly, have the correct tools and repair kits specified in sections 7 and 8 available.

3.1.1 Remove vent (24) and manual blowdown hand valve if one is installed (refer to Figure 7).
3.1.2 Use a 1½” wrench to hold bonnet and remove bonnet cap (3). Use a depth micrometer or calipers to measure and record the distance from top of adjusting screw to top of pilot body. This measurement will be used in 3.2.1 step “o”. Loosen locknut (6) and back out adjusting screw (5) to relieve pilot spring compression.
3.1.3 Remove bonnet (2), being careful to catch spring (7) and spring washers (4 and 26) when they disengage. Turn pilot upside down on a soft surface to remove remaining internal parts from upper half of body. Discard disk (9). Remove nozzle (10) and seal (11) and discard.
3.1.4 Loosen safety screw (20) on locknut (18) with a 5/32” allen wrench. Loosen locknut (18) and blowdown adjustment screw assembly. Remove assembly from body.
3.1.5 Place reseat seat (12) in a vise. Using an 11/16” wrench on the blowdown adjustment screw (21), loosen and remove seat. Remove reseat piston (15) located inside. Discard both reseat seat (12) and reseat piston (15).
3.1.6 Remove tube fitting from blowdown adjustment screw (21), and then remove locknut (18), reseat bushing (16) and Grafoil® gaskets. Discard gaskets.

NOTE
GRAFOIL® is a registered trademark of UCAR Carbon.

3.2 Pilot assembly
(Refer to Figure 4A style pilot)
The lapped and polished metal seats are the key to proper pilot operation and care must be taken in handling these components. Before assembly, thoroughly clean all parts with an oil free solvent and dry. This is important for the nozzle seat area. Do not bead blast or sand. Examine pilot parts and remove any oxide build up with light buffing using a wire brush or wheel.

3.2.1 Assemble pilot in the following order:
A. Insert reseat piston (15) into the blowdown adjustment screw (21) with lapped face turned toward internally threaded opening.
B. Lubricate reseat seat threads lightly with Fluorolube to prevent galling.
C. Install reseat seat (12) into the blowdown adjustment (21) screw. Clamp seat in vise and securely tighten adjustment screw with 1/8” wrench to seat the metal to metal seal.
D. Lightly lubricate external threads on the blowdown adjustment screw with Fluorolube and install bushing (16), thread seal (19) and locknut (18) as shown. Leave the locknut loose. Install thread seal (17) on reseat bushing (16).
E. Shimming is required as shown at item (25). Multiple shims are supplied to be used as required. A shim stack of approximately .125 inches is required to initially set the pilot travel. Shim thicknesses available are .012-.025, and .063 inches. The shim stack height may be changed later to adjust the minimum pilot lift to .010-.025 inches. Shim adjustment is explained in Figure 5A. The shims are C-washers and can be added or removed as required with the lower unit assembled.
F. Install a shim stack (25) of approximately .125 inches thick onto the blowdown adjustment screw (21). Rotate the reseat bushing (16) on the screw (21) to lightly secure the shim stack. Install the assembly into the lower end of the pilot body cavity and tighten the bushing (16) securely.
G. Install ¼ NPT pipe plugs in the upper two ports shown at (22) coated with Jet-Lube Thick or Thin.
H. Install ½ NPT pipe plug in port shown at (23) wrapped with PTFE tape. (If optional manual blowdown hand valve is required, install it last after mounting the pilot to body.)
I. Install fitting in the lower “dome” port for attachment to the pilot test stand and install fitting in the supply port for testing.
J. Insert spacer rod (13) into the reseat assembly with large end down before installing upper guide assembly.
K. Refer to Figure 4A: install disk (9), ball (27) and spring washer (28) into spindle (8) and spindle (8) into guide (14) taking care to keep disk seat clean.
L. Install nozzle (10) and seal (11) into guide (14) and install complete upper guide assembly into the upper body cavity.
Note: this is easier with the body turned on its side.
M. Install lift test dial indicator and special housing shown in Figure 5A. Check spindle lift and adjust as described in this Figure by adding or removing shims.
3.3 Pilot disassembly
(Refer to Figure 4B and 4C style pilot)

To facilitate assembly, place all parts in an orderly arrangement so the parts can be assembled in the proper sequence. Before beginning disassembly, have the correct tools and repair kits specified in sections 7 and 8 available.

3.3.1 Remove vent (24) and Manual blowdown hand valve (see Figure 7) if installed.

3.3.2 Use a 1¼” wrench to hold bonnet and remove bonnet cap (3). Use a depth micrometer or calipers to measure and record the distance from top adjusting screw to top of pilot body. This measurement will be used in 3.4.2 step “O”. Loosen locknut (6) and back out adjusting screw (5) to relieve pilot spring compression.

3.3.3 Remove bonnet (2), being careful to catch spring (7) and spring washers (4 and 26) when they disengage. Turn pilot upside down on a soft surface to remove remaining internal parts from upper half of body. Discard disk (9). Remove nozzle (10) and seal (11) and discard.

3.3.4 Use a 1¼” wrench on bushes (16) to remove blowdown adjustment assembly from pilot body (1). Remove thread seal (17) and discard. Place bushing (16) in vise. Remove nut (18). Hold the adjustment screw (21) with an 9/16” wrench and remove tube fitting from blowdown adjustment screw (21). Unscrew adjustment sleeve (42) from blowdown adjustment screw (21). Remove seal retainer (41). Remove adjustment screw (21) from bushing (16), remove packing (19) from bushing and discard. Remove retainer (45) and set aside.

3.3.5 Place reseat seat (12) in a vise. Use a ½” wrench on the blowdown adjustment screw (21) to loosen and remove seat. Remove reseat piston (15) located inside. Discard both reseat seat (12) and reseat piston (15).

3.4 Pilot assembly
(Refer to Figure 4B and 4C style pilot)

The lapped and polished metal seats are the key to proper pilot operation and care must be taken in handling these components. Before assembly, thoroughly clean all parts with oil free solvent and dry. This is important for the nozzle seat area. Do not bead blast or sand. Examine pilot parts and remove any oxide build up with light buffing using a wire brush or wheel.

3.4.1 Assemble pilot in the following order:
A. Insert reseat piston (15) into the blowdown adjustment screw (21) with lapped face turned toward internally threaded opening.
B. Lubricate reseat seat threads lightly with fluorolube to prevent galling.
C. Install reseat seat (12) into the blowdown adjustment (21) screw. Clamp seat in vise and securely tighten adjustment screw with 11/16” wrench to seat the metal to metal seal.
D. Refer to Figure 4C: preassemble the blowdown adjustment unit as follows:
1. Insert blowdown adjustment screw (21) into bushing (16).
2. Slide new packing (19) on adjustment screw (21) and press into bushing (16) using seal retainer (41).
3. Lubricate threads on bushing (16) and nut (18) with Fluorolube and place bushing in vise. Install and tighten nut to compress packing (19) and force seal retainer (41) metal to metal with bushing and nut. Remove nut (18) and set aside. Remove seal retainer (41).
4. Install pin [43] into seal retainer [41]. Pin must protrude .062” to .067” into adjustment sleeve (42) pocket. Lightly coat pocket of seal retainer with Fluorolube.
5. Install retainer [45] into slots on bushing (16) and blowdown adjustment screw (21). Reinstall seal retainer [41] on blowdown adjustment screw (21).
6. Lubricate threads on adjustment screw (21). Install left-hand threaded adjustment sleeve (42) on screw until sleeve bottoms off inside retainer pocket. Check movement of sleeve in pocket against pin stop. Continue to rotate until blowdown adjustment screw (21) and retainer [45] shoulder off against bushing (16). Lightly coat bottom of sleeve surface (contact with nut) with Fluorolube.
7. With bushing in vise, install nut [18] and tighten. Check rotation of sleeve (42) with ¼” open-end wrench. Hold blowdown adjustment screw with wrench to prevent retainer (45) from twisting out. Adjustment screw should move in and out smoothly, stop to stop.
8. Hold body of adjustment screw (21) and install tube fitting into end and tighten. Coat threads of tube fitting with Jet Lube Thick or Thin before installation.
E. Shimming is required as shown at item (25). Multiple shims are supplied to be used as required. A shim stack of approximately .125 inches is required to initially set the pilot travel. Shim thicknesses available are .012, .025, and .063 inches. The shim stack height may be changed later to adjust the minimum pilot lift to .010-.025 inches. Shim adjustment is explained in Figure 5B. The shims are C-washers and can be added or removed as required with the lower unit assembled.
F. Install a shim stack (25) of approximately .125 inches thick onto the blowdown adjustment screw (21) on top of the retainer (25). Rotate the adjustment sleeve (42) to lightly secure the shim stack. Install the complete blowdown assembly into the lower end of the pilot body cavity and tighten the bushing (16) securely.
G. Install ⅜ NPT pipe plugs in the upper two ports shown at (22) coated with Jet-Lube Thick or Thin.
H. Install ⅜ NPT pipe plug in port shown at (23) wrapped with PTFE tape. If optional manual blowdown hand valve is required, install it last after mounting of pilot to body.
I. Install fitting in the lower “dome” port for attachment to the pilot test stand.
J. Insert spacer rod (13) into the reseat assembly with large end down before installing upper guide assembly.
K. Refer to Figure 4B: install disk (9), ball (27) and spring washer (28) into spindle (8) and spindle (8) into guide (14) taking care to keep disk seat clean.
L. Install nozzle (10) and seal (11) into guide (14) and install complete upper guide assembly into the upper body cavity.
Note: this is easier with the body turned on its side.
M. Install lift test dial indicator and special housing as shown in Figure 5B. Check spindle lift and adjust as described in the procedure by adding or removing shims.
N. After setting minimum pilot lift to the specified range (.010”-.025”), and before removing the dial indicator, adjust the blowdown adjustment screw in until pilot lift is approximately .050”. This will put the blowdown near the normal range for final adjustment. Tighten locknut (18).
O. After setting pilot lift, remove the special housing and dial indicator and install bonnet spring washer (29), spring (7), spring washers (26) and (4), bonnet (2), adjustment screw (5), and locknut (6). Apply a very light coat of Fluorolube only to threads on spring bonnet before assembly. Tighten bonnet securely to completely seat the nozzle gasket. Turn adjusting screw (5) in until top of screw is the same distance from top of pilot body as measured in step 3.3.2. This will get the pilot reasonably close to set pressure to facilitate final adjustment on the test stand.
P. Install vent (24) in pilot body.
Q. The pilot is now ready to be adjusted for set pressure and reseat pressure. See Figure 6 for requirements of pilot test stand. See Section 4 for setting procedure.
R. After plot is adjusted, install cap (3) and safety screw (20) into locknut (18). Secure with sealing wire from cap (3) through hole in safety screw (20).
PARTS

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<td>12</td>
<td>Reseat seat</td>
<td>26</td>
<td>Lower spring washer</td>
<td>40</td>
<td>Bolt, ½-28 x ⅜</td>
</tr>
<tr>
<td>13</td>
<td>Spacer</td>
<td>27</td>
<td>Ball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Case guide</td>
<td>28</td>
<td>Washer, pilot</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note washer orientation
ANDERSON GREENWOOD SERIES 727 PILOT OPERATED SAFETY RELIEF VALVES
INSTALLATION AND MAINTENANCE INSTRUCTIONS

FIGURE 4B

Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>16</td>
<td>Reseat bushing</td>
<td>31</td>
<td>Bolt</td>
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<tr>
<td>2</td>
<td>Bonnet</td>
<td>17</td>
<td>Thread seal</td>
<td>32</td>
<td>O-Ring</td>
</tr>
<tr>
<td>3</td>
<td>Cap</td>
<td>18</td>
<td>Lock nut</td>
<td>33</td>
<td>Lever</td>
</tr>
<tr>
<td>4</td>
<td>Upper spring washer</td>
<td>19</td>
<td>Thread seal</td>
<td>34</td>
<td>Spring, torsion</td>
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<td>5</td>
<td>Adjusting screw</td>
<td>20</td>
<td>Safety screw</td>
<td>35</td>
<td>Nut, gland</td>
</tr>
<tr>
<td>6</td>
<td>Hex jam nut</td>
<td>21</td>
<td>Blowdown adj. screw</td>
<td>36</td>
<td>Pin, roll</td>
</tr>
<tr>
<td>7</td>
<td>Spring</td>
<td>22</td>
<td>Pipe plug ½ npt</td>
<td>37</td>
<td>Cam</td>
</tr>
<tr>
<td>8</td>
<td>Spindle</td>
<td>23</td>
<td>Pipe plug ¾ npt</td>
<td>38</td>
<td>O-Ring</td>
</tr>
<tr>
<td>9</td>
<td>Disk</td>
<td>24</td>
<td>Vent</td>
<td>39</td>
<td>Washer, lock</td>
</tr>
<tr>
<td>10</td>
<td>Nozzle</td>
<td>25</td>
<td>Shim</td>
<td>40</td>
<td>Bolt, ½-28 x ½</td>
</tr>
<tr>
<td>11</td>
<td>Nozzle seal</td>
<td>26</td>
<td>Lower spring washer</td>
<td>41</td>
<td>Seal retainer</td>
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<td>12</td>
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<td>27</td>
<td>Ball</td>
<td>42</td>
<td>Adjustment sleeve</td>
</tr>
<tr>
<td>13</td>
<td>Spacer</td>
<td>28</td>
<td>Washer, pilot</td>
<td>43</td>
<td>Pin</td>
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<tr>
<td>14</td>
<td>Case guide</td>
<td>29</td>
<td>Washer, bonnet</td>
<td>44</td>
<td>Fitting - special</td>
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<tr>
<td>15</td>
<td>Reseat piston</td>
<td>30</td>
<td>Lever, gag rod</td>
<td>45</td>
<td>Retainer</td>
</tr>
</tbody>
</table>

Second generation design pilot assembly beginning with Serial No: 92-10501

Note: washer orientation

Detail A

Sealing wire

See detail A

Install in hole nearest this view

Notice the washer orientation

Supply port

Vent
FIGURE 4C

Blowdown adjustment pre-assembly

Shim placement
1. Install pilot on test stand.
2. With pilot assembled as shown, without spring, spring washer and adjusting screw, back blowdown adjustment stem all the way out (downward position). Full counterclockwise position.
3. Pressurize inlet to 25 psig and measure lift of spindle. Lift must be .010 to .025. Physically cycle dial indicator up and down to measure pilot lift.
4. Add shims between bushing and blowdown stem to obtain correct lift. To add shims, the reseat assembly must be removed from body. Shims are "C" washers, therefore disassembly of lower unit is not required. Snap shims on or off and combine as required to meet lift requirements. Measure shim thickness before removal so thickness adjustments can be made as required.

<table>
<thead>
<tr>
<th>Shim</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>06.0925.003</td>
<td>.063</td>
</tr>
<tr>
<td>06.0925.002</td>
<td>.025</td>
</tr>
<tr>
<td>06.0925.001</td>
<td>.012</td>
</tr>
</tbody>
</table>
1. Install pilot on test stand.
2. With pilot assembled as shown, without spring, spring washer and adjusting screw, rotate blowdown adjustment sleeve counterclockwise to place the adjustment screw in the full down position.
3. Pressurize inlet to 25 psig and measure lift of spindle. Lift must be .010 to .025. Physically cycle dial indicator up and down to measure pilot lift.
4. If required, add shims between bushing and blowdown stem to obtain correct lift. To add shims, the blowdown assembly must be removed from body. Shims are "C" washers, therefore disassembly of lower unit is not required. Snap shims on or off and combine as required to meet lift requirements. Measure shim thickness before removal so thickness adjustments can be made as required.

**FIGURE 5B**

<table>
<thead>
<tr>
<th>Shim</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>06.0925.003</td>
<td>.063</td>
</tr>
<tr>
<td>06.0925.002</td>
<td>.025</td>
</tr>
<tr>
<td>06.0925.001</td>
<td>.012</td>
</tr>
</tbody>
</table>

**Warning:** Use a backup wrench on this fitting. Do not allow it to rotate when connecting fitting.

**Note:** Retainer prevents adjustment screw from rotating.
4 PILOT SET PRESSURE ADJUSTMENT

4.1 General
Two adjustments are provided; one for adjusting the set pressure and one for adjusting the reseat pressure.

4.2 Definitions

4.2.1 Definitions of test pressures:

4.2.1.1 Set pressure
The pressure at which the pilot reduces the pressure at the dome connection to 50% or less of supply. Also referred to as nameplate set.

4.2.1.2 Cold differential test pressure
The set and reseat pressure the pilot is adjusted to actuate on the test stand that includes corrections for high temperature service conditions. This pressure is also included on the nameplate.

4.2.1.3 Cracking pressure
The point at which the pilot first begins to leak on increasing pressure.

4.2.1.4 Reseating pressure
The pressure at which the pilot valve closes to restore pressure at the dome connection. This pressure will be 50% or more of the pressure at the pilot supply pressure port at the time of reseat.

4.2.1.5 Dome pressure
The pressure at the dome port connection on the pilot.

4.2.1.6 Blowdown
The difference between the set pressure and the reseat pressure, expressed as a percent of set pressure, or in psig.

4.3 Test procedures

[Refer to Figure 6 for test set-up]

4.3.1 General
The ASME Section VIII Pressure Vessel Code requires that pilots on pilot operated valves for steam service be set using steam except for those pilots which have set pressures beyond the capability of the test facility. For those pilots, the test medium may be air.

The air set pressure is the cold differential test pressure and is so indicated on the nameplate (Refer to Figures 8 and 9). This pressure will be higher than nameplate set. Refer to 4.5 performance requirements for correct setting values.

4.3.1.1 Test set up
Install the pilot valve on the test drum similar to that shown in Figure 6. The “dome” connection is a blind connection with a pressure gauge to indicate the dome pressure reduction achieved while the pilot actuates at set pressure.

4.3.1.2 Set pressure adjustment
[Refer to Figure 4A and 4B]
Remove cap (3) and loosen locknut (6). Adjust the spring adjusting screw (5) to obtain the correct set pressure. Clockwise rotation will increase the set pressure.

Note: tighten the locknut after each adjustment is made.

4.3.1.3 Reseat adjustment
[Refer to Figure 4A style pilot only]
Remove safety screw (20). Loosen locknut (18) to adjust the reseat pressure. It is not necessary to loosen the compression fitting on the supply port for the adjustment screw to rotate. Hold locknut (18) and use the wrench flats (9/16”) on the blowdown adjustment screw to adjust it in or out. Move in 45E (⅛ th turn) increments. Moving the screw in shortens blowdown and out increases blowdown.

Note: if the compression fitting must be loosened under pressure, care should be taken not to over-loosen and allow excessive leakage.

4.3.1.4 Reseat adjustment
[Refer to Figure 4B style pilot]
Loosen safety screw (20). Use a ¾” open end wrench on the adjustment sleeve (42) to adjust the reseat pressure. Rotating the adjustment sleeve clockwise shortens blowdown; counter clockwise increases blowdown.

4.3.1.5 Performance check - relieving pressure
Cycle the pilot a minimum of three times after the adjustment to make sure the pop and reseat pressures are consistent. Increase and decrease the pressure slowly to obtain an accurate reading and to expose any erratic performance.

4.4 Pilot performance

4.4.1 Slowly increase the pressure at the inlet port until leakage is detected at the pilot exhaust port. Check for leakage with a bubble tube tester for air set or a metal rod for steam set. The presence of condensate on the rod indicates a leakage. This pressure shall be recorded as the cracking pressure.

4.4.2 Further increase the pressure at the inlet port until the pilot actuates or “pops”. This pressure shall be recorded as the set pressure.

4.4.3 Shut off the inlet pressure to the test accumulator and bleed inlet pressure to allow the pilot to reseat. This pressure shall be recorded as the reseat pressure. Check the valve for leakage at the exhaust port with a bubble tube tester for air set or a metal rod for steam set.
4.4.4 Repeat paragraphs 4.4.1 through 4.4.3 a minimum of three times. The cracking pressure, set pressure and reseat pressure shall be within the limits specified in the applicable performance requirements for three consecutive cycles. The valve action shall be consistent.

4.4.5 Slowly increase the inlet pressure until the crack test pressure specified in the applicable valve specification sheet is reached. Maintain this pressure for one minute and check for leakage at the exhaust port with a bubble tube tester for air set or a metal rod for steam set.

4.4.6 Tighten locknut (18) and reinstall safety screw (20) and tighten. Replace cap (3) and tighten.

4.5 Performance requirements

Cold differential set is the increase in specified set to compensate for the change in spring force with increased temperature. Cold differential set is the test bench setting pressure. Specified set is the nameplate set pressure.

### 4.5.1 Cold differential set

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>Cold differential set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 295°F</td>
<td>100% of specified set</td>
</tr>
<tr>
<td>296°F to 400°F</td>
<td>101% of specified set</td>
</tr>
<tr>
<td>401°F to 800°F</td>
<td>103% of specified set</td>
</tr>
</tbody>
</table>

4.5.2 Set pressure tolerance (1)

| Above 70 psig          | ± 3% of specified cold differential set for air set or ± 3% of the specified set for steam set |
| 70 psig and below      | ± 2 psig |

4.5.3 Crack pressure

| 50 psig to 1200 psig   | 90% +10%/-0% of the specified set for steam set |
| 50 psig to 1200 psig   | 94% ± 1% of the specified set for steam set |

4.5.4 Reseat pressure

| 50 psig to 1200 psig   | 94% ± 1% of the specified set for steam set |

4.5.5 Leakage test

**Air**
No leakage for one minute at pressure below the crack pressure.

**Steam**
No visible condensate on metal rod at pilot outlet for 10 seconds when tested 3 minutes after reseat.

**NOTE**

1. ± 3% or 2 psig is ASME specified performance tolerance. AG setting tolerance is:
   - Above 70 psig: + 2% - 0%
   - 70 psig and below: + 1 psig - 0 psig

---

**FIGURE 6**

Dome pressure should be zero when pilot is actuated and no gas flow is detected at pilot vent.

This valve must be closed when setting pilots above 600 psig.

Set pressure adjustment (inside cap) [turn in to increase set pressure; turn out to decrease set pressure]

Pilot exhaust vent

Pipe nipples

Mounting stub

Flexible supply hose

Pilot isolation valve

Accumulator (approx. ¼ cu. ft.)
Part no. TD-1

Accumulator vent valve

Condensate drain

Coupling

Supply valve

Flexible supply hose

Filter

Air supply

Flexible supply hose

Accumulator (approx. ¼ cu. ft.)
Part no. TD-1

Accumulator vent valve

Pilot isolation valve

Flexible supply hose

Pilot exhaust vent

Pipe nipples

Mounting stub

Flexible supply hose

Pilot isolation valve

Accumulator (approx. ¼ cu. ft.)
Part no. TD-1

Accumulator vent valve

Dome pressure should be zero when pilot is actuated and no gas flow is detected at pilot vent.

This valve must be closed when setting pilots above 600 psig.

Set pressure adjustment (inside cap) [turn in to increase set pressure; turn out to decrease set pressure]

Pilot exhaust vent

Pipe nipples

Mounting stub

Flexible supply hose

Pilot isolation valve

Accumulator (approx. ¼ cu. ft.)
Part no. TD-1

Accumulator vent valve

Condensate drain

Coupling

Supply valve

Flexible supply hose

Filter

Air supply
Anderson Greenwood Series 727 Pilot Operated Safety Relief Valves
Installation and Maintenance Instructions

5 LEAK TESTING ASSEMBLY

5.1 Air
The main valve with pilot assembled to it and all tubing connections should be leak tested for external leaks using a pressure equal to 90% of set. Air at ambient temperature shall be used unless otherwise specified.

WARNING
Do not cycle main valve on air. The opening and closing forces could damage the internal components.

5.2 Steam
Apply steam pressure to the inlet equal to 90% of the set pressure. Check for visual leakage at the main valve nozzle and seat, piston seal, cap seal, unloader fittings and other pressure and tubing connections. Tighten bolts or fittings as required. If a leak is observed between the cap and body, be sure the cap has been assembled squarely against the body before tightening cap bolts.

6 FIELD TEST INSTRUCTIONS

6.1 Hot set pressure verification
If the valve is equipped with the optional field test accessory, an accurate check of the set pressure can be made after the valve has been in service a minimum of 2 hours. System pressure should be 90% or less of set pressure. The main valve will not cycle during this procedure but will operate should system relief be required during the test.

6.1.1 Test procedure
(Refer to Figure 7)
A. Connect test gas bottle to field test port.
B. Close vent valve.
C. Slowly open supply pressure valve on test gas bottle.
D. Increase pressure slowly to pilot until pilot pops. Observe pressure at pop. Repeat test as required until three consistent pops are observed.
E. To remove test set-up, close supply pressure valve and open vent valve.
F. The pop pressure measured is the hot set pressure and should be within the nameplate set pressure tolerance. These tolerances are ± 2 psig, below 70 psig and ± 3% above 70 psig.

6.2 Cold set pressure verification
Before the valve is installed or immediately after bringing the valve on line and before the valve reaches normal operating temperature, the set pressure can be checked using test procedure 6.1.1 except that the pressure read on the test gage will be the cold differential test pressure on the nameplate. This pressure is established based on the specified temperature during operation and will be greater than the nameplate set pressure to compensate for the reduction in spring force due to temperature. The set pressure tolerances listed in 6.1.1 F apply.

Figure 7
Manual blowdown valve (option)
Lift lever (option)
Unloader
Flex hose
Field test injection port (¼-NPT male elbow not supplied)
Nitrogen bottle
Supply pressure valve
Vent valve
(4 x 6 valve shown)
The kits listed below are available from stock. To order kits specify the base number and select the last three digits from the following tables. To make sure correct kits are purchased the order should specify the valve model and serial number.

**Kit base number: 06-1237-XXX**

### 7 MAIN VALVE

<table>
<thead>
<tr>
<th>Kit and contents</th>
<th>2 x 3</th>
<th>3 x 4</th>
<th>4 x 6</th>
<th>6 x 8</th>
<th>8 x 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal kit: liner seal, nozzle seal, filter assembly, filter-seal, Belleville washers, nozzle retaining screws</td>
<td>-003</td>
<td>-005</td>
<td>-007</td>
<td>-009</td>
<td>-011</td>
</tr>
<tr>
<td>Ring kit: damper ring piston ring, and centralizer springs</td>
<td>-020</td>
<td>-021</td>
<td>-022</td>
<td>-023</td>
<td>-024</td>
</tr>
</tbody>
</table>

### 7 PILOT

<table>
<thead>
<tr>
<th>Kit and contents</th>
<th>All pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal kit: nozzle seal, thread seals, packing seal</td>
<td>-001</td>
</tr>
<tr>
<td>Seal kit: disk, nozzle, reseat seat, reseat piston, ball and washer</td>
<td>-002</td>
</tr>
</tbody>
</table>

### 7 UNLOADER: FOR 4X6, 6X8, AND 8X10

<table>
<thead>
<tr>
<th>Kit and contents</th>
<th>All pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal</td>
<td>-013</td>
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</tbody>
</table>

### 7 UNLOADER: FOR 2X3 AND 3X4

<table>
<thead>
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<th>Kit and contents</th>
<th>All pressures</th>
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</thead>
<tbody>
<tr>
<td>Seal</td>
<td>-015</td>
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</tbody>
</table>

### 7 FIELD TEST SHUTTLE CHECK VALVES

<table>
<thead>
<tr>
<th>Kit and contents</th>
<th>All pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal</td>
<td>-014</td>
</tr>
</tbody>
</table>

### 8 REPAIR TOOLS

#### 8.1 Special

The tools listed below are available by special order. Contact Anderson Greenwood’s Sales Department for price and delivery.

1. 2" Piston ring expander
   - Snap-on tools # PRS-8
   - AG part no. 05-1185-054
2. 3" and 4" Piston ring expander
   - Snap-on tools # PRS-10
   - AG part no. 05-1185-055
3. 6" Piston ring expander
   - Diesel supply Co.
4. 8" Piston ring expander
   - Diesel supply Co.
8.2 Piston installation sleeve

<table>
<thead>
<tr>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>2.700</td>
<td>2.495</td>
<td>2.550</td>
<td>2.862</td>
<td>3.075</td>
<td>.03</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>2.493</td>
<td>2.540</td>
<td>2.860</td>
<td>3.065</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3”</td>
<td>3.750</td>
<td>3.495</td>
<td>3.597</td>
<td>4.138</td>
<td>4.325</td>
<td>.060</td>
<td>1.88</td>
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<tr>
<td></td>
<td>3.493</td>
<td>3.587</td>
<td>4.136</td>
<td>4.315</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4”</td>
<td>5.188</td>
<td>4.870</td>
<td>4.970</td>
<td>5.267</td>
<td>5.402</td>
<td>.060</td>
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<td></td>
<td>4.868</td>
<td>4.960</td>
<td>5.265</td>
<td>5.592</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6”</td>
<td>8.340</td>
<td>7.995</td>
<td>8.170</td>
<td>8.722</td>
<td>9.067</td>
<td>.100</td>
<td>1.56</td>
</tr>
<tr>
<td></td>
<td>7.993</td>
<td>8.160</td>
<td>8.720</td>
<td>9.057</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8”</td>
<td>10.940</td>
<td>10.485</td>
<td>10.770</td>
<td>11.222</td>
<td>11.555</td>
<td>.150</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>10.483</td>
<td>10.760</td>
<td>11.220</td>
<td>11.545</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tolerance:  
- Hundredths: ± .03  
- Thousandths: ± .010  
- Angles: ± 10°

8.3 Special
1. 12 point sockets, nozzle retaining screw removal/installation  
   - ¼” for 2 x 3, 3 x 4  
   - ⅜” for 4 x 6  
   - ⅝” for 6 x 8, 8 x 10
2. 1/4” Open end wrench  
3. ¾” Open end wrench  
4. ½” Allen wrench  
5. ¼” Allen wrench  
6. Brass hammer  
7. 12” Crescent wrench  
8. Wood or plastic dowel rod  
9. Optional tools  
   - Air impact tool w/socket set thru ½”  
   - Over head crane or hoist  
   - Strap wrench  
10. Housing-pilot lift indicator  
    - AG part no. 06-1330-001  
11. 2” Dial indicator/0.01 increments  
    - .100 stem travel/1.00 stem extension  
12. Brass shim stock

8.4 Lubricant/sealants
1. Dow Corning-Silicone-33 grease (or equivalent)  
2. Jet-Lube “Thick or Thin”  
3. Hooker Chemical “Fluorolube” LG-160

Pilot

Earlier design: nameplate only on pilot  
Present design: nameplate only on pilot and main valve

FIGURE 8  FIGURE 9
9 PISTON DISK AND NOZZLE SEALING FACE REPAIR

The piston disk and nozzle seat faces are manufactured to close tolerances and finishes. Care must be exercised in reworking both mating surfaces to insure a tight seat after main valve assembly. Refacing of both parts is limited to the “mated” minimum heights and tolerances listed in Table 2 shown in Figure 10.

9.1 Lapping

The finer points of lapping should be considered a mechanical art. The ability of the average repair person to produce a good lapped seat will require practice. No effort has been made in this manual to establish an exact lapping procedure. However, it is very important to insure that the laps you are using (whether donut laps or flat lapping plates) are flat within 2 light bands. Otherwise an uneven surface will be transferred to the seat sealing area.

The following items are required when lapping a piston disk or nozzle.

A. One flat lap per valve (see list below.)
B. Clover compound “C”, 220 grit medium, to remove, grooves, pits, and dents.
C. Clover compound, “1A”, 320 grit, very fine, for general smoothing of seats.
D. Clover compound, “3A”, 500 grit, extremely fine, for general smoothing of seats.
E. Clover compound, “6A”, 1000 grit, micro fine, for final finishing of seat.
F. Cotton rags, clean and lint free.

Before lapping, chamber the leading edge of both disk and nozzle with a ring grade of sandpaper. This will break the inner and outer edges and remove any small metal particles that might be attached to the sharp corner surfaces.

9.1.1 LAP PART NUMBERS FOR ORDERING LAPS

<table>
<thead>
<tr>
<th>Valve size</th>
<th>Part numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 3</td>
<td>06.1595.001</td>
</tr>
<tr>
<td>3 x 4</td>
<td>06.1595.002</td>
</tr>
<tr>
<td>4 x 6</td>
<td>06.1595.003</td>
</tr>
<tr>
<td>6 x 8</td>
<td>06.1595.004</td>
</tr>
<tr>
<td>8 x 10</td>
<td>06.1595.005</td>
</tr>
</tbody>
</table>

9.2 Remachining disk and nozzle

Machining of the piston chamfer to maintain the minimum “B” dimension is permissible until the minimum “A” is achieved. When this occurs, no further machining is possible and either one or both components must be replaced.

WARNING

Mated heights less than the dimensions given in Table 2 will result in seal ring damage and potential failure of main valve function.

TABLE 2 - MINIMUM REMACHINED PISTON AND NOZZLE DIMENSIONS

<table>
<thead>
<tr>
<th>Valve size</th>
<th>2x3</th>
<th>3x4</th>
<th>4x6</th>
<th>6x8</th>
<th>8x10</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A”</td>
<td>3.54</td>
<td>4.89</td>
<td>5.305</td>
<td>7.72</td>
<td>11.13</td>
</tr>
<tr>
<td>“B”</td>
<td>0.88</td>
<td>0.89</td>
<td>1.310</td>
<td>1.64</td>
<td>2.10</td>
</tr>
</tbody>
</table>

NOTES

Disk face: \[ \frac{0.003}{Y} \]
Nozzle face: \[ \frac{0.003}{X} \]
9.2.1 Lathe set-up for nozzle machining
Grip nozzles with a four jaw independent chuck as shown being careful not to damage clamped sealing surface. True up the work so that surface runs flat ± 0.001 on indicator.

9.2.2 Lathe set-up for machining piston/disk - 2” thru 4”
Note: do not attempt to remove disk.
Grip piston and disk with a four-jaw independent chuck as shown. True up the work so that surface B runs flat ± 0.001 on indicator.

9.2.3 Lathe set-up for machining 6” and 8” disk
Grip disk assembly with a four-jaw independent chuck as shown. True up work so that surface B runs flat ± 0.001 on indicator.

Notes
A. Use a piece of soft metal such as copper between jaws and clamped surface.
B. Take light cuts using a fine feed. This will produce a smooth finish. Do not polish with emery cloth or sandpaper as the result will affect flatness. Observe the dimensions and tolerances in Table 2.
9.3 Remachining unloader piston and bushing

9.3.1 Piston
Chuck part in lathe with four-jaw independent chuck as shown. True up work so that surface B runs flat ± .001.

NOTES
A Use a piece of soft metal such as copper between jaws and clamped surface.
B Take light cuts using a fine feed. This will produce a smooth finish. Do not polish with emery cloth or sandpaper as the result will affect flatness. Limit material removal to .010 maximum.

9.3.2 Bushing
Chuck part in lathe with four-jaw independent chuck as shown. True up work so that surface B runs flat ± .001.