

# OPERATING AND MAINTENANCE MANUAL

## Series 3023 3-Way Control Valve



Series 3023

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### 1.0 INTRODUCTION

#### 1.1 Description

The Series 3023 3-Way Control Valve is designed for general purpose use in liquid and gas control applications with either diverting or blending of 3-way service. It has a hammer nut bonnet, quick change O-ring sealed trim, and yoke-mounted or closed coupled actuator.

In the Norriseal Series 3023 3-Way Control Valves, the common port is the inlet port for diverting service and the outlet port is for blending or combining service. The upper and lower ports are used as the outlet ports for diverting service and the inlet ports are used for blending or combining service.

Norriseal valves are equipped with pneumatic actuators, reverse acting (spring closing), direct acting (spring opening) or pressure balanced (no spring) types. The actuators are available in a range of sizes and with a selection of springs to suit the operating conditions.

#### 1.2 Valve Identification

A valve nameplate is attached to the upper diaphragm housing of each valve assembly. The nameplate lists the serial number, series number and model number as well as other information applicable to the particular valve assembly (i.e. – trim size, trim and plug materials, etc.).

Always refer to the serial and model numbers on the valve nameplate, when ordering replacement parts.

#### **WARNING!**

*Maximum allowable pressures for the valve body and actuator, and the*

*maximum allowable temperature for the valve are shown on the nameplate mounted on the actuator. If pressure to the valve is capable of exceeding these limits, install relief valves or other over-pressure protection devices in the pressure lines.*

#### **CAUTION!**

*Before disassembly or maintenance, all pressures in this device must be relieved. Failure to relieve pressures may result in personal injury or device damage. Uncontrolled venting or spilling of line fluids may cause personal injury, loss of process control or environmental contamination.*

#### **CAUTION!**

*When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and fluid conditions. Since some body/ trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting the Norriseal sales office or your sales representative.*

### 2.0 Valve Installation and Start-Up

1. Before installing the valve, inspect it for any shipment damage and for any foreign material that may have collected during crating and shipping. Remove flange protectors from body end connections.
2. Blow out all pipelines to remove pipe scale, chips, welding slag and other foreign materials.
3. Install the valve so the common port is the inlet port for diverting service and the outlet port for blending or combining service.

4. Install the valve using good piping practice. For flanged bodies use a suitable gasket between the body and the pipeline flanges. For threaded (NPT) bodies, use TFE tape or pipe thread sealant on external pipe threads. For smooth operation, the valve should be installed in an upright position with the actuator vertical above the body.
5. Do not install the valve in a system where the working pressures can exceed those marked on the nameplate.
6. Connect the instrument air to the actuator or positioner connection. Refer to the nameplate for the maximum instrument air pressure. Check for proper valve operation by cycling the actuator several times and observing stem movement. For close coupled valves, stem movement may be checked by observing the position indicator in the actuator diaphragm housing. When the supply pressure is reduced to zero, the stem should fully return to its starting position.
7. Actuator springs are pre-set at the factory and may require adjustment to suit specific operating conditions. To adjust actuator spring settings, proceed as follows:
  - a. **Reverse actuator:**  
To increase the lower seating force and achieve tighter shutoff, turn the adjusting screw at the top of the actuator clockwise.

**NOTE:** *An increase in the lower seating force may require an increase in air supply pressure to the diaphragm to fully stroke the valve and close the upper seat.*

To decrease the seating force, turn the adjusting screw counterclockwise.

**b. Direct actuator:**

Remove the spring cover before making adjustments. Loosen the screws at the bottom of the cover and lift it off to expose the actuator spring and adjusting nut. To increase the upper seat load, turn the adjusting nut clockwise.

*NOTE: In a direct actuator, any increase in the upper seat load may require an increase in the supply pressure to stroke and close the lower seat.*

After completing the spring adjustments, replace the spring cover.

**TABLE 1 MAINTENANCE SCHEDULE\***

ITEM	INSPECTION SCHEDULE
Valve Trim (Seat, Plug, Cage & Guide)	Inspect every 6 months, under normal service conditions (low pressure drop and no sand or abrasives in fluid). Or inspect every 2 months, under service conditions, such as high pressure drop, corrosion, or fluid with sand.
Stem Packing	Inspect Packing at least once a year.
Actuator	Inspect Diaphragm, Spring and Stem once a year.
Body	The body should last many years under normal conditions. However, under severe conditions of corrosion or erosion from sand in the flowing fluid, high pressure drops, or high fluid velocity, body life may be greatly reduced. Inspect the body each time the bonnet is removed.
Bonnet	Inspect Bonnet once a year or whenever trim inspection is done.
Seals	Replace Gaskets and inspect O-Rings each time valve is disassembled.

\* Under certain operating conditions, this suggested maintenance schedule will not be adequate and a shorter time schedule may be required.

### 3.0 Valve Maintenance

#### WARNING!

*Before attempting any repairs, isolate the control valve from the system and make sure that all pressure is released from the valve body.*

*NOTE: Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends upon the severity of the service conditions.*

#### 3.1 Actuator Disassembly

3.1.1 For reverse actuators (spring closing), either close-coupled or yoke-mounted:

1. Remove all instrument air from the actuator.
2. Unscrew the spring adjusting screw to release spring force.
3. Unscrew the cap screws around

the diaphragm housing and remove the upper housing.

4. Remove the actuator spring.
5. Unscrew the jam nut and regular nut on top of the valve stem.
6. Remove the lock washer, lower spring retainer, bearing washer, diaphragm plate and diaphragm.
7. Remove the lower diaphragm housing. Use a metal punch or narrow flat metal bar and hammer to unscrew the housing lock nut.
8. For yoke-mounted actuators only:
  - a. Unscrew the two hex-head cap screws on the stem connector and remove the lower actuator stem.
  - b. Remove the yoke, using a metal punch or narrow flat metal bar and hammer to unscrew the yoke lock nut.

3.1.2 For direct actuators (spring opening):

1. Remove all instrument air from the actuator.
2. Unscrew the set screws at the base of the spring cover and remove the cover to expose the spring.
3. Unscrew and remove the spring adjusting nut at the top of the upper actuator stem.
4. Remove the washer, upper spring retainer and actuator spring.
5. Unscrew the cap screws around the diaphragm housing and remove the upper diaphragm housing, sliding it upward over the actuator stem.
6. Remove the cotter pin from the upper actuator stem and unscrew the stem.

7. Remove the bearing washers, diaphragm and the diaphragm plate.
  8. Remove the lower diaphragm housing, using a metal punch or narrow flat metal bar and hammer to unscrew the housing lock nut.
  9. For yoke-mounted actuators only:
    - a. Unscrew the two hex-head cap screws on the stem connector and remove the lower actuator stem.
    - b. Remove the yoke, using a metal punch or narrow flat metal bar and hammer to unscrew the yoke lock nut.
4. Remove the plug from the stem by loosening and removing the nut on the lower end of the stem.
  5. If the actuator/ valve stem connector has been removed, the stem and trim assembly can be removed from the packing plug. Loosen the packing retainer and remove the stem from the packing plug. Always replace the entire plug and stem assembly.
  6. Lift the lower seat and seal out of the body.

### CAUTION!

*Use care to avoid damaging sealing surfaces. The surface finish of the valve stem is critical for making a good packing seal. The inside surface of the cage assembly or cage retainer is critical for smooth operation of the valve plug and for making a seal with the piston ring. The seating surfaces of the valve plug and seat ring are critical for a tight shutoff. Assume all of these parts are in good condition and protect them accordingly unless inspection reveals otherwise.*

### 3.2 Actuator Re-Assembly

- 3.2.1 For reverse actuators:  
Reverse steps 1 - 8 of Section 3.1.1 of the Actuator Disassembly instructions.
- 3.2.2 For direct actuators:  
Reverse steps 1 - 9 of Section 3.1.2 of the Actuator Disassembly instructions.

### 3.3 Valve Disassembly

1. For reverse (spring closing) actuators, remove the compression on the actuator spring by turning the adjusting screw counter clockwise until it turns freely, indicating that spring force is fully removed.
2. Remove the hammer nut from the body by turning it counter-clockwise with a mallet.
3. Lift the hammer nut off the body along with the packing plug, seat/ cage, plug and stem.

times the metal seat contact surfaces can be fully restored by re-lapping. Soft seat parts must be replaced.

### 3.5 Trim Restoration

#### CAUTION!

*Over lapping will widen the lap band and can reduce seat tightness.*

1. Lap the plug to the seat:
  - a. This process does not apply to plugs with soft seat inserts.
  - b. Clean the plug and seat in solvent and wipe dry.
  - c. Use lapping compound Clover Boron – Carbide Grade 2A or equivalent product from other manufacturer.
  - d. Using a stir stick or similar device, apply lapping compound sparingly in 3 or 4 places approximately equidistant along the seat surface on the plug. The use of excess compound runs the risk of uneven lapping of the surfaces.
  - e. Fit the seat against the plug and begin lapping trim while applying firm hand pressure by rotating the seat back and forth against the stationary plug. Occasionally change your hand gripping points on the seat to redistribute the applied pressure during the lapping process. (keep the seat as concentric to the plug as possible during lapping)
  - f. Under an adequate light source, visually inspect the lapped contact surfaces of

### 3.4 Trim Inspection

1. Visually inspect the valve plug and seat for signs of erosion, pitting, scratches and damage from corrosion. A magnifying glass can be helpful in determining the type and severity of any damage that may be present.
2. Fit the plug and the seat together. While looking into the bottom of the seat, hold the trim set against a bright light. If any light can be seen between the plug and the seat contact surfaces, this is an indication of poor seat conditions.
3. Determine the magnitude of any wear or corrosion damage. Many

the seat and plug.

- g. The seat shall have a circular uninterrupted lap band, approximately 1/32" to 1/16" in width at the base of the seating chamber.
- h. The plug will have a definite continuous lap band approximately 1/32" to 3/32" in width without being grooved.
- i. The finished lap areas of the seat and plug shall have a continuous smooth, close grained, dull appearance with no skips or tears.
- j. Wash the plug and seat in solvent to remove all lap-ping compound and wipe the parts dry.

### 3.6 Replacement of Teflon V-Ring Packing

1. Remove the stem and the packing retainer from the bonnet. Pull out the old packing with a hook, being careful to avoid scratching the packing box wall or stem. The packing may also be pushed out using a rod inserted through the hole in the top of the bonnet. Since the packing is spring loaded, it is also possible to pull up and push down on the stem until the packing pops loose.
2. Clean the packing box and all metal parts.
3. Install the new packing and

associated parts in the following sequence:

- a. Upper packing retainer with the female "V" toward the packing
- b. The "V" rings with the "V" downward toward the body
- c. Male "V" packing ring
- d. Lower packing retainer
- e. Packing spring

Replace the valve plug/ stem assembly and install the bonnet on the body using new O-rings.

### 3.7 Valve Re-Assembly

#### **CAUTION!**

*If the packing will be reused and was not removed from the bonnet, use care when installing the stem to avoid damaging the packing with the valve stem threads.*

*NOTE: Use all new gaskets and seals when re-assembling.*

1. Clean all sealing surfaces, including the body, bonnet and guide.
2. A light coat of lubricant, such as light oil, may be used on the soft seals to make assembly easier.
3. Assemble the plug parts on the stem, arranging the plug retainer, plug insert, seals and plug as shown on the Parts List Drawing.

Fasten the plug and parts to the stem with a nut and cotter pin.

4. Place the upper seat spacer and the upper seat/ cage over the stem. Install the seal on the upper seat/ cage.
5. Push the stem through the bonnet packing taking care not to damage the packing.
6. Install the seal on the lower seat/ cage and install the lower seat/ cage into the body's seat cavity.
7. Install a new packing plug O-ring into the packing plug's groove.
8. Mount the packing plug with the plug/ stem assembly onto the body and lower seat/ cage.
9. Turn the hammer nut clockwise and tighten securely with a mallet.
10. Mount the actuator on the bonnet and connect the actuator stem to the valve stem.

### 4.0 Repair Kits

Norriseal provides four repair kits for use in valve maintenance:

- 1) valve repair kit
- 2) valve seal kit
- 3) trim repair kit
- 4) actuator repair kit.



**Table 2 Trouble Shooting**

<b>Symptom</b>	<b>Probable Cause(s)</b>	<b>Corrective Action(s)</b>
1. Valve will not cycle when instrument air is applied to the actuator.	<ul style="list-style-type: none"> <li>• Broken valve stem.</li> <li>• Diaphragm ruptured or torn.</li> <li>• Diaphragm plate connection at top may be loose.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace Stem.</li> <li>• Remove upper diaphragm housing. Inspect the diaphragm and replace if necessary.</li> <li>• Remove upper diaphragm housing. Inspect the plate-to-stem connection and tighten if loose.</li> </ul>
2. Excessive trim leakage with valve closed	<ul style="list-style-type: none"> <li>• Insufficient shut-off force from actuator.</li> <li>• Foreign object interfering with plug-to-seat contact.</li> <li>• Plug and seat contact surfaces may be worn or damaged.</li> </ul>	<ul style="list-style-type: none"> <li>• For reverse actuator - increase spring load.</li> <li>• For direct actuator - increase supply pressure to diaphragm.</li> <li>• Remove actuator and bonnet from body. Inspect trim and remove foreign objects if present.</li> <li>• Inspect critical surfaces of plug and seat. For minor wear or damage, lap seating surfaces. If severely worn or damaged, replace plug and seat.</li> </ul>
3. Fluid leakage from top of bonnet.	<ul style="list-style-type: none"> <li>• Stem packing is worn or loose.</li> </ul>	<ul style="list-style-type: none"> <li>• For non-adjustable spring loaded packing: remove and replace packing.</li> <li>• For adjusting packing: tighten adjusting nut(s) or add extra packing rings.</li> </ul>
4. Fluid leakage from body/bonnet joint.	<ul style="list-style-type: none"> <li>• Body/bonnet O-ring may be worn or damaged.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect O-ring, replace if necessary.</li> </ul>
5. Instrument air leaks from outer edge of diaphragm housings.	<ul style="list-style-type: none"> <li>• Cap screws securing upper and lower housings may be loose.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect cap screws, tighten as necessary.</li> </ul>
6. Instrument air leaks from actuator vent connection located in upper housing of reverse actuator or lower housing of direct actuator.	<ul style="list-style-type: none"> <li>• Diaphragm may be torn or ruptured, allowing air to leak through.</li> </ul>	<ul style="list-style-type: none"> <li>• Disassemble upper and lower housing and inspect diaphragm. Replace if damaged.</li> </ul>
7. Valve stem movement is sticky or jerky.	<ul style="list-style-type: none"> <li>• Valve stem or actuator stem may be bent or misaligned.</li> </ul>	<ul style="list-style-type: none"> <li>• Disassemble valve and/or actuator to inspect stem. Replace if bent or otherwise damaged.</li> </ul>

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