

SERIES 3000

3-WAY CONTROL VALVES w/HAMMER NUT

CONTENTS

INTRODUCTION	1		
<i>Scope of Manual</i>	1	<i>Replacement of Teflon V-Ring Packing</i>	4
<i>Description</i>	1	<i>Replacement of Valve Compression Packing</i>	5
<i>Valve Identification</i>	1	<i>Valve Re-Assembly</i>	5
VALVE INSTALLATION	2		
VALVE MAINTENANCE	2	REPAIR KITS	5
<i>Actuator Disassembly</i>	3	<i>Tables:</i>	
<i>Actuator Re-Assembly</i>	3	<i>Table 1 - Maintenance Schedule</i>	3
<i>Valve Disassembly</i>	4	<i>Table 2 - Trouble Shooting</i>	6
<i>Trim Inspection</i>	4		
<i>Trim Restoration</i>	4		

INTRODUCTION

Scope of Manual

This instruction manual includes installation, operation and maintenance information for Norriseal Series 3000 3-Way Control Valves. The Series 3000 includes 3001, 3003, 3023, 3023Y, 3024, 3025, 3028, 3031, 3051 and 3060 valve series. Please refer to separate manuals for instructions covering controllers and positioners.

Description

The Series 3000 Valves are designed for general purpose use in liquid and gas control applications with either diverting or blending 3-way service. The Series 3000 has a hammer nut bonnet, quick change gasket sealed trim, and yoke-mounted or closed coupled actuator.

In the Norriseal Series 3000 3-Way Valves, the Common Port is the inlet port for diverting service and the outlet port for blending or combining service. The Upper and lower Ports are used as the outlet ports for diverting service and the inlet ports 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.

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, including trim size, trim and plug materials, and pressure and temperature limits.

Valve model numbers are 13 positions long relating to the valve feature and material configurations.

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

WARNING

Maximum allowable pressures for the valve body and actuator and the maximum allowable pressure at the maximum 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. The resulting 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.

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 shipment. 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. The Upper and Lower Ports are the outlet ports for diverting service and the inlet ports for blending or combining service.
4. Install valve using good piping practice. For flanged bodies, use a suitable gasket between the body and 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 instrument air to actuator or positioner connection. Refer to the nameplate for the maximum instrument air pressure. Check for proper valve operation by cycling actuator several times and observing stem movement. For close coupled valves, stem movement may be checked by observing position indicator in 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 setting, proceed as follows:
 - (a) **Reverse actuator** - To increase the lower seating force and achieve tighter shutoff, turn the adjusting screw at top of actuator clockwise.

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

To decrease seating force, turn the adjusting screw counterclockwise.

- (b) **Direct actuator** - Direct actuators have a spring cover which must be removed before making adjustments. Loosen screws at bottom of cover and lift it off to expose actuator spring and adjusting nut. To increase upper seat load, turn the adjusting screw 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 spring adjustments, replace spring cover.

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.

1. Isolate the valve from the process.
2. Shut off the operating lines to the actuator.
3. Release the process pressure.
4. Vent the actuator loading pressure.

Valve parts are subject to normal wear and must be inspected and replaced as necessary, with the frequency of inspection and maintenance depending upon the severity of service conditions. The following sections describe the procedures for disassembling and re-assembling the valve for normal maintenance and troubleshooting. All maintenance operations may be performed while the valve body remains in line. Table 1 lists the maintenance schedule for the valve assembly. Table 4 presents a chart for assistance in troubleshooting valve operation.

Table 1. Maintenance Schedule*

Item	Inspection Schedule
Valve Trim (Seat Cage, Plug & Insert)	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	Inspect Gaskets and 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.

Each Norrisal valve is supplied with a parts list drawing showing the valve's arrangement with a list of all parts and recommended spare parts. Refer to this drawing when using this manual.

Actuator Disassembly

- A. For reverse actuators (spring closing), either close-coupled or yoke-mounted:
 1. Remove 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 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.
- B. For direct actuators (spring opening):
1. Remove instrument air from the actuator.
 2. Unscrew the set screws at the base of the spring cover and remove the cover exposing 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.

Actuator Re-assembly

- A. For reverse actuators:
Reverse Steps 1 through 8 of Section A of the Actuator Disassembly instructions.
- B. For direct actuators:
Reverse Steps 1 through 9 of Section B of the Actuator Disassembly instructions.

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 counterclockwise with a mallet.
3. Lift the hammer nut off the body along with the packing plug, seat/cage, plug, and stem.
4. Remove the plug from the stem by loosening and removing the nut on the lower end of the stem. The plug assemblies of series 3051 and 3060 are spring loaded. The stem has sufficient thread length to unload all spring force before the nut reaches the end of the stem. The lower valve plug on the series 3060 must be removed for access to the stem nuts.
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. If the valve plug needs replacing, 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 gasket 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 tight shutoff. Assume all of these parts are in good condition and protect them accordingly unless inspection reveals otherwise.

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 seat contact surfaces, this is an indication of poor seat condition.
3. Determine the magnitude of any wear or corrosion damage. Many times the metal seat contact surfaces can

be fully restored by relapping. Soft seat parts must be replaced.

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 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 at 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. With lapping compound applied to plug, fit seat against plug and begin lapping trim with firm hand pressure applied by rotating seat back and forth against stationary plug. Occasionally change hand gripping points on seat to redistribute applied pressure during lapping process. (Keep seat as concentric to plug as possible during lapping).
 - f. Under an adequate light source, visually inspect the lapped contact surfaces of seat and plug.
 - g. Seat shall have a circular uninterrupted lap band approximately 1/32" to 1/16" in width at the base of seating chamfer.
 - h. 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 seat and plug shall have a continuous smooth, close grained, dull appearance with no skips or tears.
 - j. Wash plug and seat in solvent to remove all lapping compound and wipe the parts dry.

Replacement of Teflon V-Ring Packing

1. Remove the packing nut, 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 bottom of the bonnet. It is also possible to pull up and push down on the stem until the

packing pops loose since the packing is spring loaded.

2. Clean the packing box and all metal parts.
3. Install the new packing and associated parts in the following sequence (be careful not to damage the packing during installation):
 - a. Packing spring
 - b. Lower packing retainer
 - c. Male "V" packing ring
 - d. The "V" rings with the "V" downward toward the body
 - e. Upper packing retainer with female "V" toward the packing
 - f. Packing nut
4. Replace the valve plug/stem assembly and install the bonnet on the body using new gaskets.
5. Tighten the packing nut.

Replacement of Valve Compression Packing (Series 3028 Only)

1. Remove the two 3/8-16 nuts retaining the packing compressor bar and lift the compressor bar and packing retainer from the bonnet. Pull out the old packing with a hook, being careful to avoid scratching the packing box wall or the stem. The packing may also be pushed out using a rod inserted through the hole in the bottom of bonnet.
2. Clean the packing box and all metal parts.
3. Install the new packing and associated parts in the following sequence:
 - a. Lower packing washer
 - b. Three packing rings
 - c. Lantern ring
 - d. Six packing rings
 - e. Packing retainer
 - f. Packing compressor bar
 - g. Two 3/8" nuts
4. Replace the valve plug/stem assembly and install the bonnet on the body using new gaskets.
5. Compress the packing by tightening the two 3/8" nuts. If the compressor bar bottoms out on the bonnet when the nuts are tightened, remove the two nuts and lift the compressor bar and retainer and add one or two additional rings of packing. This provides for future adjustment of the compressor bar.
6. Lubricate the valve stem by opening the needle valve and rotating the cap screw on top of the lubricator unit. Close the needle valve.

Valve Re-assembly

CAUTION

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

Note: Use all new gaskets and seals for re-assembly.

1. Clean all gasketed 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 aid ease of assembly.
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 as required. The plug assemblies of series 3051 and 3060 are spring loaded. For series 3051, turn the stem's nut until the nut and stem washer are tight against the stem's shoulder. Back off the nut, as required, and install the cotter pin. For series 3060, turn stem's nut until the distance from the nut face to the end of the stem agrees with the dimension on the parts list.
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 new seat gasket into the seat cavity in the body's bridgewall.
7. Install the seal on the lower seat/cage and install the lower seat/cage into the body's seat cavity.
8. Install a new packing plug o-ring into the packing plug's groove.
9. Mount the packing plug with plug/stem assembly onto the body and lower seat/cage.
10. Turn the hammer nut clockwise and tighten securely with a mallet.
11. Mount the actuator on the bonnet and connect the actuator stem to the valve stem.

Repair Kits

Norriseal provides four repair kits for use in valve maintenance: a valve repair kit, a valve seal kit, a trim repair kit, and an actuator repair kit.

Table 2. Trouble Diagnosis

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