CONTENTS

INTRODUCTION

CAUTION!

*The instructions provided herein should be completely reviewed and understood prior to installing, operating or repairing this equipment. All **CAUTION** and **WARNING** notes (displayed in boxes such as this one) must be strictly observed to prevent personal injury or equipment damage.*

Scope

This instruction manual includes installation, operation and maintenance information for 1.0-in. and 2.0-in. Norriseal Series 2200 and 2220 Control Valves. Please refer to separate manuals for instructions covering controllers, positioners and other optional accessories.

Description

The Series 2200/2220 Valve is designed for general purpose use in liquid and gas control applications requiring either throttling or on/off service. The Series 2200/2220 has a single-port body with three types of unbalanced trim: quick opening, equal percent and modified percent. The pneumatic spring-diaphragm actuator is either open yoke, model 2200, or close-coupled, model 2220. The valve has a hammer nut closure.

Norriseal valves are equipped standard with spring-diaphragm pneumatic actuators, either reverse acting (fail closed) or direct acting (fail open) type. Both actuators are available in No. 9 (35 in.^{2}) and No. 12 (70 in.^{2}) sizes.

Series 2200 valves are available with non-adjustable packing. Non-adjustable packing consists of PTFE V-rings, with a spring below the packing to maintain a positive stem seal.

WARNING!

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.

Valve Identification

The nameplate is attached to the upper diaphragm housing of each valve assembly with all information applicable to specific valve assemblies.

When servicing valves, always use ***only*** genuine Norriseal replacement parts. Please refer to the serial and model numbers on the nameplate when ordering replacement parts.

WARNING!

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

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CAUTION!

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

1.0 VALVE INSTALLATION AND START-UP

1. Before installing the valve, inspect it for shipment damage and for foreign material that may have collected during crating and shipment. Remove protectors from body end connections.
2. Blow out all pipelines to remove pipe scale, chips, welding slag and other foreign materials. Threaded and gasketed surfaces should also be free of any foreign materials.
3. Install the valve so that flow direction is under the seat for throttling trim, and either under the seat or over the seat for quick opening trim (reference Table 3, page 10).
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 PTFE tape or pipe thread sealant on external pipe threads.
5. The valve bodies are rated ANSI 150, 300, 600, 900, 1500, or 2500 class. Do not install the valve in a system where the working pressures can exceed those marked on the nameplate.
6. Where piping is insulated, *DO NOT insulate the valve above the hammer nut.*
7. Connect supply pressure to actuator or positioner connection. Refer to the nameplate for the maximum supply pressure. Check for proper valve operation by cycling actuator several times and observing stem movement.

WARNING!

Do not exceed the maximum supply pressure specified on the valve nameplate. Under no circumstances should the actuator supply pressure ever exceed 35 psig for #12 actuators or 50 psig for #9 actuators.

8. Actuators may require spring adjustment to suit specific operating conditions. To adjust actuator spring setting, proceed as follows:

   A. **Reverse actuator:** Loosen the lock nut on the adjusting screw on top of the actuator spring housing. Turn the adjusting screw CLOCKWISE to increase the spring's pre-load and plug seating force to achieve tighter shutoff. Turn the adjusting screw COUNTERCLOCKWISE to reduce preload. Tighten the lock nut after adjustment.

*NOTE: Adjust spring tension only to the extent necessary to achieve shut-off **and** fully open the valve at an actuator supply pressure not exceeding the maximum allowable.*

   B. **Direct actuator:** Remove the spring cover by first loosening the two set screws at the base of the cover. Turn the adjusting nut CLOCKWISE to increase the spring's pre-load and turn it COUNTERCLOCKWISE to reduce the pre-load.

TABLE 1 MAINTENANCE SCHEDULE*

ITEM	*INSPECTION SCHEDULE*
Valve Trim (Seat, Plug)	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 performed.
Seals	Inspect O-rings each time valve is disassembled.

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

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Replace the spring cover after adjustment and tighten the set screws.

NOTE: Adjust spring tension only to the extent necessary to fully open the valve at operating conditions; further increase will reduce plug seating force and may result in trim leakage.

2.0 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 both upstream and downstream. Shut off and vent supply lines to the actuator.

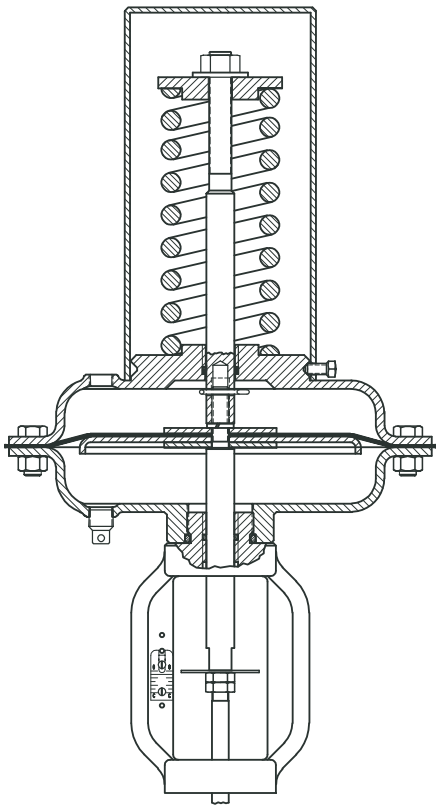
1. Isolate the valve from the process.
2. Shut off all supply lines to the actuator.
3. Release the process pressure.
4. Vent the actuator supply pressure.

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 *as long as the line is not in service and is isolated from active process by block valves.* Table 3 presents assistance in troubleshooting valve body port orientation. Refer to the parts list drawing for valve configuration.

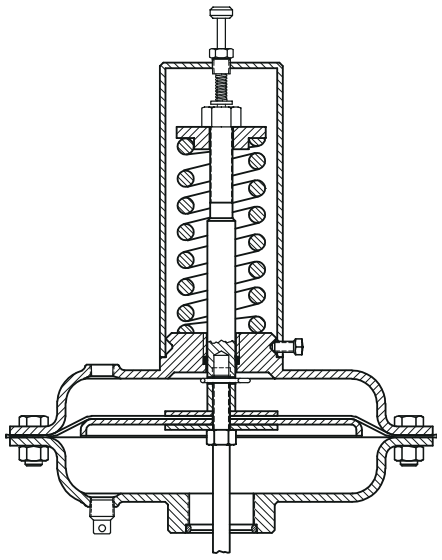
2.1 ACTUATOR DISASSEMBLY

A. Direct (Fail Open) Actuators:

1. Vent and disconnect supply pressure from the actuator.
2. Remove the spring cover by first loosening the set screws at the base of the cover.
3. Turn the adjusting nut COUNTER-CLOCKWISE until the spring's preload is completely removed (de-energized). Remove the adjusting nut, washer, upper spring retainer and spring.
4. Remove the nuts and screws from around the diaphragm housing flange and remove the upper diaphragm housing by sliding it carefully upward and off the stem.
5. Remove the cotter pin and unthread the upper stem from the lower stem.
6. Remove the bearing washers, O-ring, diaphragm, diaphragm plate and hex nut (2220).
7. Unthread the lower housing from the yoke (2200) or bonnet (2220). This is the final step in disassembly of 2220 valve actuator.
8. Loosen the two jam nuts securing the valve stem to the actuator stem and unthread the stems. Remove travel indicator from valve stem (2200 only).
9. If repair warrants, unthread the yoke (2200) from the bonnet.



Series 2200 Yoke-Mounted Direct-Acting



Series 2220 Close-Coupled Direct-Acting

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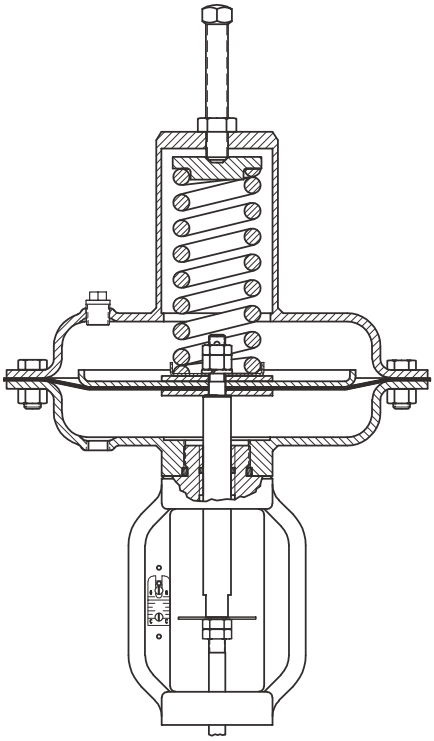
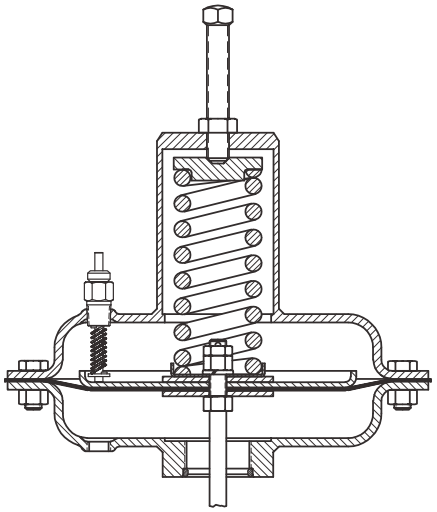
B. Reverse (Fail Closed) Actuators:



Series 2200 Yoke-Mounted Reverse-Acting

1. Vent and disconnect supply pressure from the actuator.
2. Loosen the lock nut on the adjusting screw on top of the actuator spring housing. Turn the adjusting screw COUNTERCLOCKWISE until the spring's preload is completely removed (de-energized).
3. Remove the nuts and screws from around the diaphragm housing flange and remove the upper diaphragm housing, spring and upper retainer.
4. Remove the nuts from the top of the stem.
5. Remove the lock washer, spring retainer, bearing washers, O-ring, diaphragm plate diaphragm (and hex nut [2220]).
6. Unthread the lower housing from the yoke (2200) or bonnet (2220). This is the final step in disassembly of 2220 valve actuator.



Series 2220 Close-Coupled Reverse-Acting

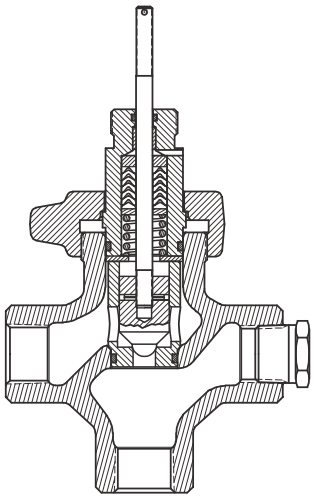
7. Loosen the two jam nuts securing the valve stem to the actuator stem and unthread the stems (2200 only). Remove the travel indicator from the valve stem.
8. If repair warrants, unthread and remove the yoke (2220) from the bonnet.

2.2 ACTUATOR RE-ASSEMBLY

To re-assemble the actuator, lubricate all O-rings and simply reverse the steps of the disassembly procedure in Section 2.1 for the appropriate actuator.

2.3 VALVE DISASSEMBLY

A. With the Actuator Remaining Attached to the Valve Body



Series 2200/2220 Body

CAUTION!

Use care to avoid damaging O-ring sealing surfaces. The surface finish of the valve stem is critical for effecting a reliable packing seal. The plug guiding bore of the seat/cage is critical for smooth operation of the valve plug. The seating surfaces of the valve plug and seat/cage are critical for tight shutoff. Assume all of these parts are in good condition when disassembling the valve and protect them accordingly.

1. Vent and disconnect supply pressure from the actuator.
2. Remove all spring compression: on a direct actuator, loosen the two set screws, remove the spring cover and turn the adjusting nut COUNTERCLOCKWISE until all spring compression is removed from the actuator

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spring. On a reverse actuator, loosen the lock nut on the actuator adjusting screw and turn the adjusting screw COUNTERCLOCKWISE until all spring compression is removed from the actuator spring.

WARNING!

Before attempting any repairs, isolate the control valve from the system and make sure that all pressure is released from the valve body both upstream and downstream. Shut off and vent supply lines to the actuator.

3. Unthread the hammer nut (turning COUNTERCLOCKWISE) from the valve body by striking the lugs with a hammer.
4. Lift the entire topworks (bonnet, actuator, stem and plug) from the valve body and place on a suitable work surface.

CAUTION!

Provide adequate support to avoid damaging trim or bending the stem when disassembling plug. Protect the stem from bending by using a solid block as a backup while hammering the pin from the plug.

5. Using a punch or 1/8 drift pin, drive the pin from the stem and unthread the plug from the stem.
6. Pull the seat/cage from the valve body. It may be necessary to hook one of the cage flow openings and pull outward to remove. A seat/cage pulling tool is available from Norriseal.

B. With the Actuator Previously Removed from the Valve

CAUTION!

Use care to avoid damaging O-ring 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. The seating surfaces of the valve plug and seat ring are critical for tight shutoff. Assume all of these parts are in good condition when disassembling the valve and protect them accordingly.

1. Disassemble the actuator by following the procedure in Section 2.1.
2. Unscrew the hammer nut (turning COUNTERCLOCKWISE) from the valve body by striking the lugs with a hammer, and remove it from the bonnet.
3. Remove the bonnet from the valve body along with the stem and plug.

CAUTION!

Use care to avoid damaging trim or bending the stem. Protect the stem from bending by using a solid block as a backup while hammering the pin from the plug.

4. Using a punch or 1/8 drift pin, drive the pin from the stem and unthread the plug from the stem.
5. Pull the seat/cage from the valve body. It may be necessary to hook one of the cage flow openings and pull outward to remove. A seat/cage pulling tool is available from Norriseal.
6. Remove the packing washer, spring and retainer from the packing plug. Pull the valve stem out of the bonnet.
7. Use a hook-shaped tool to remove the packing and O-ring. Remove stem bushing.

CAUTION!

Use care to avoid damaging or scratching bonnet bore.

2.4 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 damage that may be present.
2. Fit the plug and the seat together. While looking into the orifice from the bottom of the seat, hold the trim set in front of a bright light. If any light can be seen between the plug and seat contact surfaces, this is an indication of poor fit condition.
3. Determine the magnitude of any wear or corrosion damage. Many times the plug and seat contact surfaces can be fully restored by re-lapping. Replace any parts that are beyond restoration.

TABLE 2
LAPPING COMPOUNDS*

TRIM MATERIAL	*LAPPING MATERIAL*
300 Series SST 17-4PH SST Stellite (Alloy 6)	Clover* Boron-Carbide Grade 2A
Tungsten Carbide	9U Heavy Diamond

*Equivalent products from other manufacturers may be used.

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4. Examine the stem for pitting, scratches or damage in an area adjacent to the packing and O-ring. If worn, replace the stem.

2.5 TRIM RESTORATION

CAUTION!

Overlapping will widen the lap band and reduce plug seating force.

Lap the plug to the seat. *NOTE: This process does not apply to plugs with soft-seat inserts.*

1. Clean plug and seat in solvent and wipe dry.
2. Select the appropriate lapping compound as shown in Table 2.
3. 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. *NOTE: The use of excess compound runs the risk of uneven lapping of the surfaces.*
4. 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).
5. Seat shall have a circular uninterrupted lap band not exceeding 1/32-in. in width at the base of seating chamfer.
6. Plug will have a definite continuous lap band approximately the same width as the plug without being grooved.
7. The finished lap areas of seat and plug shall have a continuous smooth, close grained, dull appearance with no skips or tears.
8. Wash plug and seat in solvent to remove all lapping compound and wipe the parts dry.
9. Under an adequate light source, visually inspect the lapped contact surfaces of seat and plug.

2.6 VALVE RE-ASSEMBLY

CAUTION!

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

NOTE: Install and lubricate all new O-rings prior to re-assembly.

Re-assemble the valve by reversing the order of the disassembly procedure in Section 2.3.

3.0 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. Contact the Norriseal sales office or your local sales representative to order parts.

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4.0 TROUBLE DIAGNOSIS

WARNING!

Some of the corrective action procedures described in this section require the removal or disassembly of components normally under pressure. Before beginning any repair be certain that all pressure(s) have been relieved from the device in accordance with the INTRODUCTION and section references in this manual.

4.1 INTERNAL LEAKAGE PROBLEMS

SYMPTOM	*PROBABLE CAUSE(S)*	*CORRECTIVE ACTION(S)*
1. In the closed position, valve leaks process fluid from inlet to outlet port.	• Reverse-acting (fail-closed) actuator has insufficient spring tension. • Direct-acting (fail-open) actuator has excessive spring tension or insufficient actuator supply or both.	• Incrementally increase spring tension (Sec. 1.8.A) and observe for reduction in leak rate. • Decrease spring tension (Sec. 1.8.B) to the minimum necessary to achieve full opening at operating conditions and/or increase actuator supply pressure (Sec. 1.7); observe for reduction in leak rate.
	• Direct-acting (fail-open) actuator thrust output diminished due to: 1) failed O-ring around upper stem or, 2) punctured actuator diaphragm.	• Apply supply pressure to actuator then remove spring cover (Sec. 1.8.B). Check for leakage: 1) O-ring — where upper stem enters upper diaphragm housing and, 2) diaphragm — from orifice of vent plug installed in lower diaphragm housing. Apply leak-detector (soapy water) if necessary. Disassemble actuator (Sec. 2.1.A), inspect and replace seal component(s) as necessary.
	• Worn or damaged valve trim (plug and seat) or failed seat/cage-to-body O-ring.	• Remove actuator assembly at hammer nut (Sec. 2.3.A) and seat/cage from body. Inspect valve trim (Sec. 2.4) and O-ring seal components. Restore (lap) trim and/or replace component(s) as necessary.
	• Differential pressure shut-off requirement exceeds thrust output available from actuator.	• Record valve serial number, model number, flow direction, current trim size and service conditions and contact your Norriseal representative to verify actuator sizing and shut-off capability.
2. Process fluid leaks into lower diaphragm housing (Series 2220 only).	• Bonnet-to-valve stem packing and bonnet-to-valve stem O-ring failed; valve stem may be worn or damaged. Bonnet weep hole is plugged if leakage is not externally evident.	• Disassemble actuator (Sec. 2.1) and valve (Sec. 2.3.B). Inspect O-ring. Inspect sealing surfaces of bonnet and stem; packing must have some installation fit interference with both. Replace worn component(s) as necessary; clean-out bonnet weep hole if plugged.

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4.2 EXTERNAL LEAKAGE PROBLEMS

SYMPTOM	PROBABLE CAUSE(S)	CORRECTIVE ACTION(S)
1. Process fluid leaks from bonnet weep hole.	• Bonnet-to-valve stem packing failed; valve stem may be worn or damaged.	• Disassemble actuator (Sec. 2.1) and valve (Sec. 2.3.B). Inspect bonnet and stem sealing surfaces; packing must have some installation fit interference with both. Replace worn component(s) as necessary.
2. Process fluid leaks from between hammer nut and bonnet and/or valve body.	• Bonnet-to-valve body O-ring failed.	• Remove actuator assembly at hammer nut (Sec. 2.3.A). Inspect O-ring and sealing surfaces of bonnet and valve body; replace worn component(s) as necessary.
3. **Reverse-acting (fail-closed) actuators only:** Supply pressure leaks from around actuator stem at the top of yoke window opening (Series 2200); or from bonnet weep hole (Series 2220).	• Actuator stem-to-yoke O-ring failed (Series 2200); valve stem-to-bonnet O-ring failed (Series 2220).	• **Series 2200:** Disassemble actuator (Sec. 2.1.B) and inspect O-ring, yoke and actuator stem sealing surfaces. **Series 2220:** Disassemble actuator (Sec. 2.1.B) and valve (Sec. 2.3.B) and inspect O-ring, bonnet and valve stem sealing surfaces. Replace worn component(s) as necessary.
4. **Direct-acting (fail-open) actuator only:** Supply pressure leaks from around base of spring cover on top of upper diaphragm housing.	• Actuator stem-to-upper diaphragm housing O-ring failed.	• Disassemble actuator (Sec. 2.1.A) and inspect O-ring, back-up ring and sealing surfaces of stem and housing bore. Replace worn component(s) as necessary.
5. Supply pressure leaks from diaphragm housing vent plug **when valve is static (non-moving).**	• Actuator diaphragm is punctured.	• Disassemble actuator (Sec. 2.1) and replace diaphragm and diaphragm-to-diaphragm plate O-ring.

4.3 VALVE PERFORMANCE PROBLEMS

SYMPTOM	PROBABLE CAUSE(S)	CORRECTIVE ACTION(S)
1. Valve will not travel to the full open position (reverse-acting fail-closed actuator) **or** will not travel to the full-closed position (direct-acting fail-open actuator).	• Troubleshoot for actuator seal leakage (Sec. 4.2. SYMPTOM 3, 4 and 5).	• Perform corrective action(s) as necessary.
	• Actuator spring has excessive tension or supply pressure is insufficient to override spring or both.	• Decrease spring tension (Sec. 1.8) until full travel is achieved; increase actuator supply pressure (Sec. 1.7) if required.
2. Valve is fully closed and will not open — **A. Inlet flow direction is under valve seat or Inlet flow direction is over seat and trim size is ⅜ in. or smaller.**	• Supply pressure line is connected to the wrong side of actuator or reverse-acting (fail-closed) actuator spring is adjusted to solid height (all coils touching) thus providing no remaining spring compression available for valve plug lift.	• Verify actuator supply pressure source line is connected to the lower diaphragm housing. Decrease spring tension (Sec. 1.8.A) until valve opening and full travel is achieved.
	• Direct-acting (fail-open) actuator cannot vent supply pressure due to non-relieving pressure source device.	• Replace supply pressure source device with relieving type or install 3-way vent valve at actuator supply connection.

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4.3 VALVE PERFORMANCE PROBLEMS (CONTINUED)

SYMPTOM	PROBABLE CAUSE(S)	CORRECTIVE ACTION(S)
B. Inlet flow direction is over valve seat and trim size is ½ in. or larger.	• Troubleshoot according to Section 4.3.2.A PROBABLE CAUSE(S) (page 8) to first eliminate those items as the cause of fault.	• Perform corrective action(s) as necessary
	• Reverse-acting (fail-closed) actuator supply pressure **or** direct-acting (fail-open) actuator spring tension is insufficient to overcome static differential pressure holding valve plug closed against the seat.	• Increase supply pressure (Sec. 1.7) if reverse-acting (fail-closed) actuator. Increase spring tension (Sec. 1.8.B) if direct-acting (fail-open) actuator; an increase in supply pressure (Sec. 1.7) may be required to re-close valve.
	• Static differential pressure combined with trim size and inlet "flow-over" direction exceeds available actuator opening thrust.	• Record valve serial number, model number, current trim size and service conditions and contact your Norriseal Representative to verify actuator sizing and shut-off capability.
3. Valve is fully open and will not begin movement toward closed position.	• Reverse-acting (fail-closed) actuator cannot vent supply pressure due to non-relieving pressure source device.	• Replace supply pressure source device with relieving type or install 3-way vent valve at actuator supply connection.
	• Supply pressure line is connected to the wrong side of actuator **or** direct-acting (fail-open) actuator spring is adjusted to solid height (all coils touching) thus providing no remaining spring compression available for valve plug movement.	• Verify actuator supply pressure source line is connected to the upper diaphragm housing. Decrease spring tension (Sec. 1.8.B) to the minimum necessary to achieve full opening at operating conditions.
4. Valve movement is sluggish or unusually slow.	• Troubleshoot for actuator seal leakage (Sec. 4.2. SYMPTOM 3, 4 and 5).	• Perform corrective action(s) as necessary.
	• Orifice of diaphragm housing vent plug is partially plugged.	• Remove vent plug and unclog orifice.
	• Actuator supply pressure volume is too low (usually a new installation problem) or volume has diminished over time due to clogged orifices and/or filters in control devices/regulators.	• Increase supply pressure line size and/or install volume booster. Clean orifices and clean/replace filters of control devices according to manufacturers' recommendations.
5. Inlet flow direction is over seat and trim size is ½ in. or larger; generally applicable to throttling service only. On initial opening, valve instantaneously travels to full open or near full open position (no valve position control over travel range).	• Actuator opening thrust required to overcome static differential pressure holding valve plug closed against the seat is greater than opposing actuator spring force (tension) adjustment.	• Incrementally increase spring tension (Sec. 1.8) and check valve opening movement. Continue tension increase until valve plug lift from seat is controllable; an increase in actuator supply pressure (Sec. 1.7) may be required.
	• Spring force (tension) requirement for service conditions exceeds that available from actuator.	• Record valve serial number, model number, current trim size and service conditions and contact your Norriseal Representative to verify actuator sizing.

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4.3 VALVE PERFORMANCE PROBLEMS (CONTINUED)

SYMPTOM	*PROBABLE CAUSE(S)*	*CORRECTIVE ACTION(S)*
6. Generally applicable to throttling service only: With actuator spring tension adjusted to correspond with control instrument signal start point (3 psig if 3-15 range, 6 psig if 6-30 range), valve leaks in the closed position **or** will not open against static differential pressure (Sec. 4.3.5 SYMPTOM and PROBABLE CAUSE(S), page 9).	• Actuator spring force (tension) necessary to achieve tight shut-off **or** overcome static differential pressure holding valve plug closed against the seat is greater than the opposing actuator force available from the 3-15 psig or (6-30 psig) supply pressure.	• Record valve serial number, model number, current trim size and service conditions and first contact your Norriseal Representative to verify that actuator has sufficient thrust capability. A valve positioner may be needed to: 1) achieve accurate valve response to the control instrument signal independent of actuator spring tension adjustment and, 2) make use of all available actuator thrust for shut-off up to the maximum actuator rating.

5.0 VALVE BODY STYLES AND PORT ORIENTATION MARKINGS

Valve Body Styles

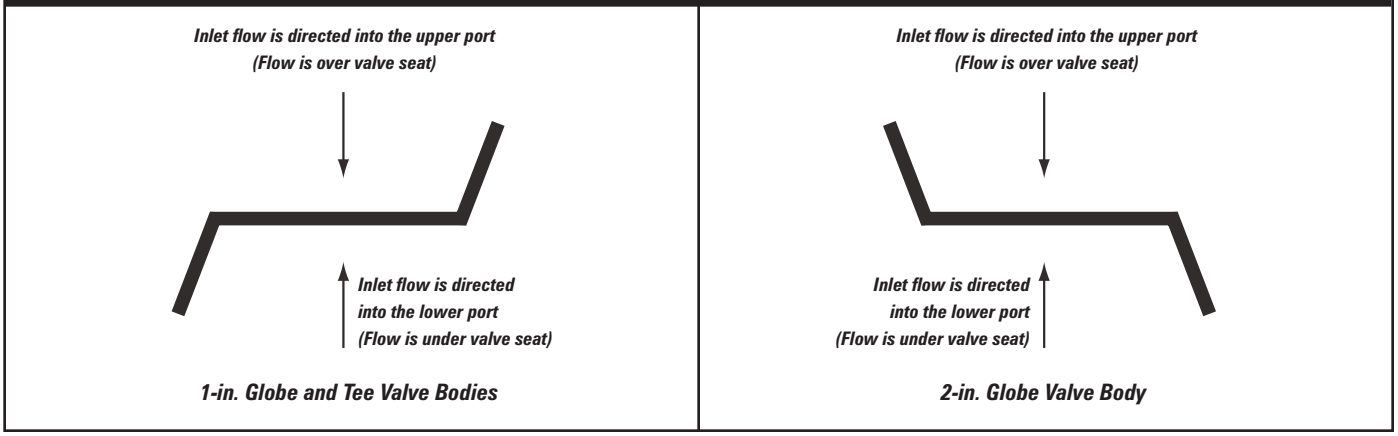
The Series 2200 and 2220 valves are available with three valve body styles:

- The GLOBE style body is available for 1-in. and 2-in. valve sizes and has two process piping connections; one on each side located in-line.
- The ANGLE style body is available for 1-in. (using a tee style body — see below) and 2-in. valve sizes and has two process piping connections; one upper port side connection and a lower port bottom connection.
- The TEE style body is available for 1-in. valve size. The female threaded NPT body has three process piping connections; one on each side located in-line (like the globe style) and an additional bottom connection located in the center. Internally, the bottom connection shares the same passageway as the lower port side connection and is provided with a pipe plug installed to permit field conversion to either globe or angle flow pattern. The tee body is also used for 1-in. angle pattern flanged, socket-weld and butt-weld bodies; the unused side port is permanently plugged and welded closed.

Valve Body Markings and Port Orientation

Globe and tee valve bodies have a **BRIDGE SYMBOL** cast on one side of the exterior. The bridge symbol represents the position of the internal cast web (or bridge) that separates the lower port-flow passage from the upper port-flow passage within the valve body. The Series 2200/2220 valve can be installed in the process system with the **inlet** fluid flow directed either into the body's **lower port (flow under seat)** or into the body's **upper port (flow over seat)** depending upon the specific application; for this reason a bridge symbol rather than a flow direction arrow is used. Valve performance and problem troubleshooting is often influenced by the fluid flow direction through the valve body. The illustrations below define the relationship of the bridge symbol geometry relative to the valve body internal port orientation.

TABLE 3 — BRIDGE SYMBOL AND VALVE BODY PORT ORIENTATION



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