

INTRODUCTION

Scope

This instruction manual includes installation, operation and maintenance information for 1" through 8" Norriseal Series 2700A Control Valves. Please refer to separate manuals for instructions covering controllers and positioners.

Description

The Series 2700A Valve is designed for general purpose use in liquid and gas control applications calling for modulating or on/off service. The Series 2700A has a single-port body with two types of balanced trim, Plug control and Cage control. The pneumatic Spring/Diaphragm Actuator has the Spring in the Yoke under the Diaphragm for both direct (spring opening) and reverse (spring closing) acting modes.

The Balanced Plug Control trim is used with the fluid flowing up under the characterized valve plug. Fluid pressure drop occurs at the flow area between plug and seat. The contour on the plug characterizes flow versus lift.

The Balanced Cage Control trim is used with fluid flowing either down or up, depending on the application, through the characterized ports in the cage. Fluid pressure drop occurs at the flow area of the cage's port with the port's contour characterizing flow versus lift.

Norriseal valves are equipped with pneumatic actuators, either reverse acting (spring closing) or direct acting (spring opening) type. Both actuator types are available in a range of sizes and with a selection of springs to suit operating conditions.

The Series 2700A valves are available with either adjustable or non-adjustable packing. The non-adjustable packing is "V" ring style with a spring below the packing to maintain a load. The adjustable style is square compression packing. Both packing styles are retained with two studs holding a compressor bar on the packing retainer. The Series 2700A bonnets have an NPT thread for mounting an optional packing lubricator.

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; with a typical model number being RF-14AFDCT9NO. Table 1 relates model number positions to valve configuration.

Always refer to series 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

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 valve so that flow is in the direction indicated by flow direction arrow either cast on the body or on a tag pinned to the body.
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, valve should be installed in an upright position with actuator vertical above the body.
5. The bodies are rated ANSI 150, 300, 600, 900, 1500 or 2500 class. Do not install 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 nameplate for maximum instrument air pressure. Check for proper valve operation by cycling actuator several times and observing stem movement.

Stem travels for valves with full size trim are listed below. For valves with restricted trim, stem travel may be less than the value shown.

BODY SIZE (IN.)	STEM TRAVEL (IN.)
1	0.75
1.5	1
2	1.25
3	1.5
4	2
6	2.75
8	4

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:

Loosen lock nut on the stem below the spring, and turn adjusting nut above it clockwise to increase the spring's pre-load and plug seating force to achieve tighter shutoff. Turn adjusting nut counterclockwise to reduce preload. Re-tighten lock nut after adjustment.

Note: An increase in plug seating force will also increase diaphragm supply pressure required to fully open the valve.

b) Direct actuator:

Loosen lock nut on the adjusting nut below the spring, and turn adjusting nut clockwise to increase the spring's pre-load and turn it counterclockwise to reduce the pre-load. Re-tighten lock nut after adjustment.

Note: In a direct actuator, any increase in supply pressure to diaphragm produces a corresponding increase in plug seating force, with valve closed.

Table 1. MODEL NUMBER POSITIONS

Table 1 lists model number positions with descriptions and some common codes and definitions. For valves with model codes different from those listed, consult factory.

EXAMPLE:

MODEL NUMBER	R	F	-	1	4	A	F	D
POSITION NUMBERS	1	2	3	4	5	6	7	8

POS.	DESCRIPTION	CODE	CODE DESCRIPTION
1 & 2	BODY END CONNECTION	S	THREADED,NPT
		RF	RAISED FACE FLANGE (ANSI)
		RJ	RING JOINT FLANGE (ANSI)
		B	BUT WELD
		W	SOCKET WELD
3	VALVE CONSTRUCTION	-	STANDARD CONSTRUCTION
		N	NACE(MR-0175)CONSTRUCTION
4 & 5	BODY PRESSURE RATING (Specific WP depends on body mat'; pressures shown are for WCC steel)	2	ANSI 150 PSR CLASS, 290 PSIG
		07	ANSI 300 PSR CLASS, 750 PSIG
		14	ANSI 600 PSR CLASS, 1500 PSIG
		21	ANSI 900 PSR CLASS, 2250 PSIG
		36	ANSI 1500 PSR CLASS, 3750 PSIG
6	BONNET TYPE	A	STANDARD
		E	EXTENDED
7	BODY and BONNET MATERIAL	W	WCC
		F	CF8M
		L	LCB
		J	WC6
8	INNER SEAL MATERIALS (gaskets/Plug Seal/Back-up Ring Bearing Ring)	B	316L-GRAFOIL/NITRILE/TFE/C.F.-TFE
		D	316L-MGB/FLUOROCARBON/TFE/C.F.-TFE
		G	316L-MGB/Ryton/PEEK/Ryton
		J	INCONEL-
9	STEM PACKING TYPE	A	TFE V-RING, SPRING LOADED, NON-ADJ.
		C	TFE/GRAPHITE (Braided), ADJ.
		D	GRAFOIL, ADJ.
10	ACTUATOR TYPE	B	DIRECT (Spring to open)
		T	REVERSE (spring to Close)
11	ACTUATOR SIZE	9	No. 9, 35 Sq." (9.5" DIAMETER)
		2	No. 12, 70 Sq." (12.5" DIAMETER)
		6	No. 16, 120 Sq." (16.75" DIAMETER)
		8	No. 18, 180 Sq." (20.5" DIAMETER)
12 & 13	ACTUATOR SPRING CODE		VARIES WITH VALVE SIZE, TRIM SIZE & ACTUATOR SIZE

VALVE MAINTENANCE

WARNING

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

1. Isolate valve from the process.
2. Shut off 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 frequency of inspection and maintenance depending upon severity of service conditions. The following sections describe procedures for disassembling and re-assembling valve for normal maintenance and troubleshooting. All maintenance operations may be performed while the valve body remains in line. Table 2 lists the maintenance schedule for the valve assembly. Table 5 presents a chart for assistance in troubleshooting valve operation.

Table 2. 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 flowing fluid, high pressure drops, or high fluid velocity, body life may be greatly reduced. Inspect 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 Norriseal 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):

1. Remove instrument air from the actuator.
2. Loosen lock nut on stem below the spring, and turn adjusting nut above it counterclockwise to completely remove the spring's pre-load.
3. Unscrew the two hex-head cap screws on the stem connector and remove the stem connector.
4. Remove yoke from bonnet, using a metal punch or narrow flat metal bar and hammer to unscrew the yoke lock nut.
5. Unscrew cap screws around the diaphragm housing and remove the upper housing.
6. Invert actuator and remove the lock nut and adjusting nut from the actuator stem.
7. Remove diaphragm plate/diaphragm/stem assembly from yoke.
8. Unscrew jam nut on top of actuator stem and disassemble lock washer, diaphragm plate, diaphragm, and actuator stem.
9. Remove actuator spring and lower spring retainer from yoke.

B. For direct actuators (spring opening):

1. Remove instrument air from the actuator.
2. Loosen lock nut on adjusting nut below the spring, and turn adjusting nut counterclockwise to completely remove the spring's pre-load.
3. Unscrew cap screws around the diaphragm housing and remove upper housing.
4. Unscrew two hex-head cap screws on stem connector and remove the stem connector.
5. Remove diaphragm and diaphragm plate/stem assembly.
6. Remove actuator spring and lower spring retainer from yoke.
7. Remove yoke, using a metal punch or narrow flat metal bar and hammer to unscrew yoke lock nut.

Actuator Re-assembly

- A. For reverse actuators: Reverse Steps 1 through 6 of Section A of the Actuator Disassembly instructions.
- B. For direct actuators: Reverse Steps 1 through 7 of Section B of the Actuator Disassembly instructions.

Valve Disassembly (Balanced Plug Control Trim)

1. For reverse (spring closing) actuators, loosen lock nut on stem below the spring, and turn adjusting nut above it counter clockwise to completely remove spring's pre-load.
2. Remove the nuts from the bonnet flange studs.
3. Lift bonnet off body along with guide, cage, plug, and stem .
4. Separate plug from stem by driving out plug pin with a drift pin; plug pin is exposed and visible just above guide.
5. Remove plug from stem by turning the plug, cage, and guide counter clockwise.
6. If actuator/valve stem connector has been removed, the stem and trim assembly can be removed from bonnet. Loosen packing retainer and remove stem from bonnet. If valve plug needs replacing, always replace the entire plug and stem assembly.
7. Slide the plug out of the cage and guide.
8. Lift the seat ring and gasket out of the body.

VALVE DISASSEMBLY**(Reduced Unbalanced Plug Control Trim)**

Note: This section applies to unbalanced plug control trim, of .25" through 1.00" size, when used in 2", 3", and 4" valve bodies. For 1" valve bodies, no special procedures are required for unbalanced trim. The "stem adapter" referred to below is a special part that provides for connecting the 3/8" or 1/2" threads in the valve plug to the 5/8" threads of the valve stem.

1. Remove valve bonnet from body, as outlined in Steps 1, 2, and 3 above. When bonnet is removed from body, it will bring with it the valve plug and body/cage adapter.
2. To remove valve stem from bonnet, first remove actuator/valve stem connector, which is positioned above bonnet. Loosen stem packing, and remove stem by sliding out through bottom of bonnet.
3. Separate valve stem, with stem adapter and plug, from body/cage adapter.

4. Remove plug from stem adapter by first driving out the 1/8" diameter roll pin securing plug to stem adapter. Unscrew plug by turning counterclockwise.
5. If necessary, stem adapter may be removed from valve stem by first driving out the 3/16" diameter pin and then unscrewing adapter from stem.

Note: For reduced trim sizes of .25" through 1.00", valve seat is integral with valve cage, which is referred to below as the "seat/cage". Seat/cage is positioned within valve body by means of a seat adapter.

6. Lift seat/cage and seat adapter out of body. Separate adapter from seat/cage by pulling downward to overcome o-ring friction.

Note: (FOR 3" AND 4" VALVE BODIES ONLY)

The seat adapter mentioned above is positioned within a second adapter, which in turn, is positioned directly in the valve body. This item is referred to below as the body adapter.

7. If valve is 3" or 4" size, complete trim removal by lifting body adapter with o-ring and gasket out of body.

Valve Disassembly (Balanced Cage Control Trim)

1. For reverse (spring closing) actuators, Loosen lock nut on stem below the spring, and turn adjusting nut above it counter clockwise to completely remove the spring's pre-load.
2. Remove the nuts from the bonnet flange studs.
3. Lift bonnet off the body along with plug, and stem.
4. Separate plug from stem by driving out the plug pin with a drift pin.
5. Remove plug by turning plug counter clockwise.
6. If actuator/valve stem connector has been removed, stem can be removed from bonnet. Loosen packing retainer and remove stem from bonnet. If stem needs replacing, drive the roll pin out and unscrew plug. If valve plug needs replacing, always replace entire plug and stem assembly.
7. Lift the cage out of the body.
8. Lift the seat ring and gasket out of the body.

VALVE DISASSEMBLY

(Reduced Balanced Cage Control Trim)

Note: Disassembly procedure for reduced cage control trims is the same as for full size trim, except for one additional step. In valves with cage control trim of reduced port size, valve seat is positioned in a seat adapter, which is positioned directly in valve body.

1. After removing valve seat and gasket, complete trim removal by removing seat adapter and gasket from body.
2. Begin by performing Steps 1 through 8 above, for full size trim.

CAUTION

Use care to avoid damaging gasket sealing surfaces. Surface finish of valve stem is critical for making a good packing seal. Inside surface of cage assembly or cage retainer is critical for smooth operation of valve plug and for making a seal with piston ring. Seating surfaces of 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 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 plug and seat together. While looking into bottom of seat, hold trim set against a bright light. If any light can be seen between plug and seat contact surfaces, this is an indication of poor seat condition.
3. Determine magnitude of any wear or corrosion damage. Many times plug and seat contact surfaces can be fully restored by relapping. Replace any parts that cannot be fully restored by relapping.

Trim Restoration

CAUTION

Over Lapping will widen lap band and can reduce seat tightness.

Lap plug to seat

1. This process does not apply to plugs with soft seat inserts.
2. Clean plug and seat in solvent and wipe dry.
3. Lapping Compounds:

TRIM MATERIAL	LAPPING* MATERIAL
300 Series SST	Clover
17-4PH SST	Boron-Carbide
440C SST	Grade 2A
Tungsten Carbide	9U Heavy Diamond

*Equivalent products from other manufacturers may be used.

4. Select appropriate lapping compound as shown in the chart.
5. Using a stir stick or similar device, apply lapping compound sparingly at 3 or 4 places approximately equidistant along seat surface on plug. Use of excess compound runs the risk of uneven lapping of surfaces.
6. 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).
7. Under an adequate light source, visually inspect lapped contact surfaces of seat and plug.
8. Seat shall have a circular uninterrupted lap band approximately 1/32" to 1/16" in width at the base of seating chamfer.
9. Plug will have a definite continuous lap band approximately 1/32" to 3/32" in width without being grooved.
10. Finished lap areas of seat and plug shall have a continuous smooth, close grained, dull appearance with no skips or tears.
11. Wash plug and seat in solvent to remove all lapping compound and wipe parts dry.

Replacement of Teflon V-Ring Packing**(Non-Adjustable)**

1. Remove two 3/8-16 nuts retaining packing compressor bar and lift compressor bar and packing retainer from bonnet. Pull out old packing with a hook, being careful to avoid scratching packing box wall or stem. Packing may also be pushed out using a rod inserted through the hole in bottom of bonnet. It is also possible to pull up and push down on stem until packing pops loose since packing is spring loaded.
2. Clean the packing box and all metal parts.
3. Install new packing and associated parts in the following sequence (be careful not to damage packing during installation):
 - a) Packing spring
 - b) Lower packing retainer
 - c) Male "V" packing ring
 - d) The "V" rings with "V" downward toward body
 - e) Compressor Bar
 - f) Two 3/8" nuts
4. Replace valve plug/stem assembly and install bonnet on body using new gaskets.
5. Tighten compressor bar nuts until retainer shoulder meets bonnet surface.

Packing Lubrication

A lubricator/isolating valve is provided as an option with adjustable packing valve.

To operate lubricator, first open lubricator/isolating valve and then turn cap screw clockwise to force lubricant into packing box. Close isolating valve again after lubrication has been completed.

Replacement of Valve Compression Packing (Adjustable)

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

Valve Re-assembly (Balanced Plug Control Trim)

CAUTION

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

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

1. Clean all gasketed surfaces, including body, bonnet, and guide.
2. A light coat of lubricant, such as light oil, may be used on soft seals to aid ease of assembly.
3. Push stem through bonnet packing taking care not to damage packing.
4. Assembly of plug with insert: (For assembly of solid metal plug without insert, go to step 5.)
 - a) Place O-ring into cavity of plug butt.
 - b) Install insert into the butt and recess.
 - c) Install plug retainer, pushing the locating boss through insert and o-ring.
 - d) Install socket head cap screw and torque 1/2" screws to 60 ft.lbs. and 3/4" screws to 125 ft.lbs.

Table 3

Final Bolt Torques for Carbon Steel Bodies.
(All Values are in Foot Pounds.)

Valve Size	ANSI Pressure Class					
	150	300	600	900	1,500	2,500
1.00"						
Stud Size	0.75	0.75	0.75	0.75	0.75	0.88
Torque	110	110	110	120	120	250
1.50"						
Stud Size	0.62	0.62	0.62	0.62	0.62	0.75
Torque	85	85	85	85	85	250
2.00"						
Stud Size	0.75	0.75	0.75	0.75	0.75	1.00
Torque	75	80	80	175	175	375
3.00"						
Stud Size	0.75	0.75	0.75	0.75	1.00	1.38
Torque	90	90	90	140	225	288
4.00"						
Stud Size	0.88	0.88	0.88	0.88	1.00	1.50
Torque	145	145	145	225	288	1400
6.00"						
Stud Size	0.88	0.88	0.88	1.25	1.25	
Torque	280	280	280	375	680	
8.00"						
Stud Size	1.12	1.12	1.12	1.25	1.38	
Torque	425	425	425	465	1200	

5. Re-assemble guide, cage, and plug assembly:
 - a) Place upper plug guide upside down on a flat surface (i.e., the deep recess will be turned upward). Place seal rings into guide recess.
 - b) Place cage into upper plug guide recess with extended lip down.
 - c) Insert valve plug with stem thread down into the cage/guide. Press plug downward into lower cage through seals. A block of wood may be necessary to drive plug downward until the large portion of the valve plug (shoulder) bottoms on the internal recess of the cage.
6. Place guide gasket over the valve stem to make the seal between bonnet and upper guide.
7. Install plug/cage/guide and gasket assembly on stem by screwing plug onto valve stem clockwise until hole in plug top aligns with hole in valve stem.
8. Insert roll pin until it is flush with outside diameter of plug.

Table 4

Final Bolt Torques for Stainless Steel Bodies.
(All Values are in Foot Pounds.)

Valve Size	ANSI Pressure Class					
	150	300	600	900	1,500	2,500
1.00"						
Stud Size	0.75	0.75	0.75	0.75	0.75	0.88
Torque	110	110	110	120	120	250
1.50"						
Stud Size	0.62	0.62	0.62	0.62	0.62	0.75
Torque	85	85	85	85	85	250
2.00"						
Stud Size	0.75	0.75	0.75	0.75	0.75	1.00
Torque	75	80	80	175	175	375
3.00"						
Stud Size	0.75	0.75	0.75	0.75	1.00	1.38
Torque	90	90	90	140	275	875
4.00"						
Stud Size	0.88	0.88	0.88	0.88	1.00	1.50
Torque	145	145	145	225	288	1400
6.00"						
Stud Size	0.88	0.88	0.88	1.25	1.25	
Torque	280	280	280	375	680	
8.00"						
Stud Size	1.12	1.12	1.12	1.25	1.38	
Torque	425	425	425	465	1150	

9. Install new seat gasket into seat cavity in body's bridgewall.
10. Install seat ring into body's seat cavity.

Operation and Maintenance

11. Install new bonnet gasket into top valve body flange recess.
12. Mount bonnet and trim assembly onto body.
13. Tighten bonnet-to-body bolts to recommended torques in Table 4 or 5, identifying valve size, number of studs, stud size in inches, and recommended torque values in foot-pounds. Tighten nuts in a cross pattern in 25, 50, 75 and 100% increments of final torque values.
14. Mount actuator on bonnet and connect actuator stem to valve stem.

VALVE RE-ASSEMBLY**(Reduced Unbalanced Plug Control Trim)**

Note: The following procedure applies only to valve body sizes of 2", 3", and 4".

1. Begin by performing Steps 1 and 2 above for balanced trim.
2. Replace stem adapter on valve stem. Screw adapter onto stem until pin hole in adapter is aligned with hole through stem. Insert 3/16" diameter roll pin, and drive into place until end of pin is flush with outer surface of stem adapter.

CAUTION

Ends of roll pin must not protrude beyond outer surface of stem adapter.

3. Replace valve plug on stem adapter. Screw plug onto adapter until pin holes are aligned. Insert 1/8" diameter roll pin, to secure plug to stem adapter.
4. Install new gasket into seat pocket in body bridge.
5. For valve body size of 2", proceed to Step 6. For 3" and 4" bodies, re-install body adapter in proper position on top of gasket in body seat pocket. Install a new o-ring in body adapter groove.
6. Install a new o-ring in groove near bottom of seat/cage. Re-install seat/cage into seat adapter. Light hand pressure will be required to overcome o-ring friction.
7. Re-install seat/cage with seat adapter into valve body.
8. Install valve stem, with stem adapter and plug, upward through bottom of body/cage adapter. Plug will stop against counterbore surface in body/cage adapter.

9. Carefully insert stem upward through bottom of bonnet so that end of stem slides through packing and out through packing retainer at top of bonnet.
10. Re-install stem connector to connect valve stem to actuator stem.
11. Complete re-assembly process by performing Steps 11, 12 and 13 above.

Valve Re-assembly (Balanced Cage Control Trim)**CAUTION**

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

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

1. Clean all gasketed surfaces, including 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. Install plug and seal assembly on stem by screwing plug onto valve stem until hole in plug top aligns with hole in valve stem.
4. Insert roll pin through plug and into stem until it is flush with outside diameter of plug.
5. Install plug o-ring with a backup ring on each side in the plug's seal groove.
6. Install piston bearing ring in the plug's top groove.
7. Push stem through bonnet packing taking care not to damage packing.
8. Install new seat gasket into seat cavity in the body's bridgewall.
9. Install seat ring into body's seat cavity.
10. If valve has a soft seat, install seat insert in groove on top of seat ring.
11. Install cage on top of seat ring.
12. Install new bonnet gasket into top valve body flange recess.
13. Install new cage gasket in groove on top of cage.
14. Lower bonnet/stem/plug assembly on to body guiding plug into cage ensuring chamfer of top of cage properly compresses plug's o-ring and piston bearing ring.

15. Tighten bonnet-to-body bolts to recommended torques given in Table 4 or 5. that identifies valve size, number of studs, stud size in inches, and recommended torque values in foot-pounds. Tighten nuts in a cross pattern in 25, 50, 75 and 100% increments of final torque values.
16. Mount actuator on bonnet and connect actuator stem to valve stem.

**Valve Re-Assembly
(Reduced Balanced Cage Control Trim)**

Note: Re-assembly procedure for reduced cage control trim is the same as for full size trim, except for additional steps required to re-install seat adapter in valve body.

1. Begin by performing Steps 1 through 7 above, for full size trim.
2. Install a new gasket in seat pocket of body bridge.
3. Re-install seat adapter on top of gasket in body seat pocket.
4. Install a new gasket in recess at top of set adapter
5. Re-install valve seat on top of gasket in seat adapter recess.
6. Complete re-assembly by performing Steps 10 through 16 above for full size trim.

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 5 Trouble Diagnosis

Valve will not cycle when instrument air is applied to 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. Diaphragm plate connection at top may be loose 2. Remove upper diaphragm housing. Inspect diaphragm and replace if necessary. 3. Remove upper diaphragm housing. Inspect 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. 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.