

# Masoneilan

a Baker Hughes business

## 49000 Series

### Energy Management Control Valve

Instruction Manual (Rev.D)



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**THESE INSTRUCTIONS ASSUME THAT OPERATORS ALREADY HAVE A GENERAL UNDERSTANDING OF THE REQUIREMENTS FOR SAFE OPERATION OF MECHANICAL AND ELECTRICAL EQUIPMENT IN POTENTIALLY HAZARDOUS ENVIRONMENTS. THEREFORE, THESE INSTRUCTIONS SHOULD BE INTERPRETED AND APPLIED IN CONJUNCTION WITH THE SAFETY RULES AND REGULATIONS APPLICABLE AT THE SITE AND THE PARTICULAR REQUIREMENTS FOR OPERATION OF OTHER EQUIPMENT AT THE SITE.**

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## Safety Information

### Important - Please read before installation

These instructions contain **DANGER**, **WARNING**, and **CAUTION** labels, where necessary, to alert you to safety related or other important information. Read the instructions carefully before installing and maintaining your control valve. **DANGER** and **WARNING** hazards are related to personal injury. **CAUTION** hazards involve equipment or property damage. Operation of damaged **equipment can, under certain operational conditions, result in degraded process system performance that can lead to injury or death. Total compliance with all DANGER, WARNING, and CAUTION notices is required for safe operation.**



This is the safety alert symbol. It alerts you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



When used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, could result in property damage.

**Note: Indicates important facts and conditions.**

## About this Manual

- The information in this manual is subject to change without prior notice.
- The information contained in this manual, in whole or part, shall not be transcribed or copied without Baker Hughes's written permission.
- Please report any errors or questions about the information in this manual to your local supplier.
- These instructions are written specifically for the 49000 Series control valve, and do not apply for other valves outside of this product line.

## Useful Life Period

The current estimated useful life period for the **Masoneilan™** 49000 Series control valve is 25+ years. To maximize the useful life of the product, it is essential to conduct annual inspections, routine maintenance and ensure proper installation to avoid any unintended stresses on the product. The specific operating conditions will also impact the useful life of the product. Consult the factory for guidance on specific applications if required prior to installation.

## Warranty

Items sold by Baker Hughes are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment provided said items are used according to Baker Hughes recommended usages. Baker Hughes reserves the right to discontinue manufacture of any product or change product materials, design or specifications without notice.

### **Note: Prior to installation**

- The valve must be installed, put into service and maintained by qualified and competent professionals who have undergone suitable training.
- All surrounding pipe lines must be thoroughly flushed to ensure all entrained debris has been removed from the system.
- Under certain operating conditions, the use of damaged equipment could cause a degradation of the performance of the system which may lead to personal injury or death.
- Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the product.

# Introduction

## Scope

The following instructions are designed to guide the user through the installation and maintenance of the Masoneilan 49000 Series control valves.

The Masoneilan 49000 Series product is part of Masoneilan's Severe Service Product portfolio, and is custom designed to fit our customer's most difficult applications. This document provides detailed installation and maintenance instructions for the 49000 Series product line.

## Serial Plate

The serial plate is usually fixed to the side of the actuator yoke. It indicates information about the valve including size and type, pressure class rating, body/bonnet material, and serial number.

## After Sales Service

Baker Hughes offers Masoneilan After Sales Service comprised of highly qualified technicians to support the installation, operation, maintenance and repair of its equipment. For support contact the local Baker Hughes Masoneilan representative or Baker Hughes Masoneilan factory located closest to you.

## Spare Parts

Only Masoneilan replacement parts should be used when carrying out maintenance operations. Obtain replacement parts through local Baker Hughes representatives or Masoneilan Parts Department.

When ordering spare parts, the MODEL AND SERIAL NUMBERS indicated on the manufacturer's serial plate MUST BE GIVEN. The serial plate is on the side of the actuator yoke.

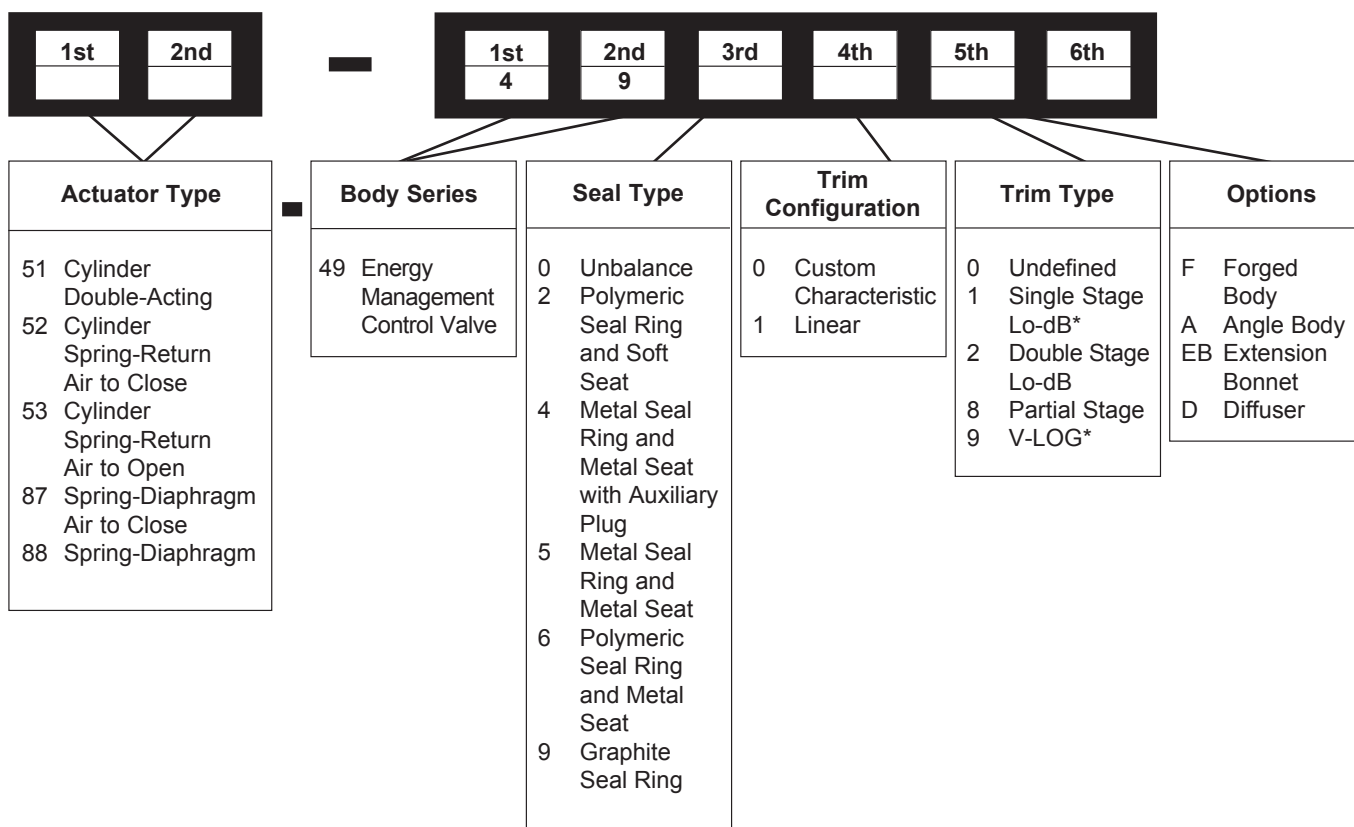
## Actuator and Accessories

Actuators and other valve accessories have their own instruction manuals, that provide information and details on the assembly and installation. Refer to the appropriate instruction manual for each unique accessory.

## Unpacking

Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts. Contact the local Baker Hughes Sales Office or Service Center with any issues or problems. Be sure to note the valve model number and serial number in all correspondence.

## Numbering System



# Installation

## Piping Cleanliness

Before installing the valve in the line, clean piping and valve of all foreign material such as welding chips, scale, oil, grease or dirt. Gasket mating surfaces must be thoroughly cleaned to ensure leak-free joints. Sacrificial start-up fixtures can be purchased from Baker Hughes to protect the operational trim during the installation and line flushing phases.

### **WARNING**

If major system or piping modifications (or repairs) are performed, thorough flushing and blowdown of the system will be required prior to reinstalling the trim. Sacrificial flushing trim should be installed in the valve to protect the integrity of the flow passages. Failure to follow this warning will violate the valve warranty agreement and could result in control instability, excessive noise levels, and valve leakage.

## Isolation Bypass Valve

To allow for in-line inspection, maintenance and removal of the valve without service interruption, provide a manually operated shutoff valve on each side of the control valve and a manually operated throttling valve in the bypass line.

## Heat Insulation

In case of a heat-insulated installation, do not insulate the valve bonnet and take protective measures relative to personal safety.

## Hydrostatic Testing and Line Cleaning

During this operation, the control valve must not be used as an isolating valve. This means that the valve must always be opened before carrying out pressure tests in the process line, cleaning of pipes, etc. otherwise equipment damage or failure of the seal rings could result. If the valve is to remain installed during line cleaning, flushing trim MUST be installed to prevent damage to trim components.

## Flow Direction

The valve must be installed so that the process fluid will flow through the valve in the direction indicated by the flow arrow located on the body.

## Welded Connections

### **CAUTION**

Carefully review the information in this section prior to welding any valves inline. Refer any additional questions to the local Baker Hughes Sales Office or Service Center.

### Pre-Weld Preparation

Carefully follow the installation steps defined in the sections noted above prior to performing weld procedures.

### Welding Process

Perform welding process in accordance with the standard requirements for the materials and weld construction of the specific valve. Apply post weld heat treatment if required.

### **CAUTION**

Internal valve components should be removed prior to performing welding or pre/post weld heat treatment weld heat treatment in order to prevent damaging any soft goods (such as PTFE seals). If unable to remove the elastomeric components, then other methods must be employed to prevent the local temperature around the seals from exceeding the maximum material limits (typically 450°F / 232°C for PTFE based materials).

### Post Weld Cleaning & Assembly

Inspect the body, bonnet, and trim components for cleanliness and surface condition. Remove any foreign materials, such as weld chips, slag or scale. Make sure there are no nicks, scratches, burrs or sharp corners on sealing and sliding surfaces. Clean all gasket interface surfaces and reassemble using new gaskets to ensure sealing integrity.

## Actuator Assembly

Assemble the pneumatic actuator onto the control valve using the appropriate instructions for the specific actuator model and type. Connect air pressure lines to the actuator ports to meet intended operating mode (i.e., air-to-extend, air-to-retract, or double-acting).

## Disassembly

### **CAUTION**

Prior to performing any maintenance on the valve, isolate the valve and vent the process pressure.

### Valve Actuation

Access to the internal components of the valve should be accomplished with the actuator removed. Follow the detailed instructions below and refer to the appropriate actuator instruction manuals.

### **WARNING**

Actuator may be pre-loaded with tension from air pressure or springs. Prior to disconnecting instrumentation read all instructions for the specific actuator.

## Disconnect Instrumentation

Disconnect all mechanical connections between the positioner and the other instruments. Disassemble the valve stem and actuator stem coupling as described in the following sections.

## Air-to-Retract Actuators

Apply sufficient air pressure to the actuator to retract the stem completely. Disconnect the plug stem from the actuator stem depending on the connection type as described below.

### Threaded Connection

Unscrew the plug stem from the actuator stem, making sure the plug never contacts the seating area (liner or seat ring) at any time during disassembly.

## CAUTION

**Contact between the plug and seating area during this disassembly process may cause damage to the seating surfaces. It may be necessary to disassemble the actuator yoke from the valve bonnet and lifting the actuator off the valve to avoid plug to seating surface contact.**

### Split Clamp Connection

Remove the screws and disassemble the stem connector from the valve and actuator stem.

## Air-to-Extend Actuators

For this actuator configuration, the valve plug is already in the fully retracted position without any air pressure applied. Disconnect the plug stem and actuator stem as described in the threaded connection and stem connector sections above depending on the connection type.

## Actuator Removal

Disconnect all electrical and air connections to and from the actuator. Disassemble yoke nut or yoke attachment screws, and lift the actuator off of the valve being careful not to damage the bonnet threads

## Valve Disassembly

The valve must always be reassembled with new packing set and gaskets. Before disassembly, make sure the recommended spare parts are available for reassembly.

1. Disconnect the piping to the leak detector connection on the bonnet (if applicable).
2. Remove the packing flange nuts (19) then remove the packing flange (17) and the packing follower (16).
3. Check the exposed part of the valve stem (8) to confirm it is clean enough for ease of removal of the bonnet (2).
4. Remove the body nuts (13).

For valve configurations designed with a two piece bonnet assembly (bonnet and bonnet flange):

5. Disassemble the bonnet flange (3) from the valve body (1).
6. Lift the bonnet (2) and metal seal (11) to remove from the valve body (1). During this operation, the valve stem (8) must be pushed downward to ensure the valve plug (6) remains inside the valve body.

**Note: The metal seal (11) will require some force to remove from the bonnet (2). Using a common tool, such as a small pry bar, lever the seal up at various points to lift out evenly.**

7. Remove the cage gasket (10A) from the top of the valve cage (4). Proceed to step 10.

For valve configurations designed with a single piece bonnet:

8. Lift the bonnet (2) and remove from the valve body (1). During this operation, the valve plug stem (8) must be pushed downward to ensure the valve plug (6) remains inside the valve body (1).
  9. Remove the body gasket (Not Shown) from the groove on top of the valve body (1).
  10. Remove the valve plug assembly (6) from the valve cage by pulling the valve plug stem (8) upward.
  11. Remove the cage (4) by lifting the part out of the valve body (1).
  12. Remove the seat ring (5) by lifting the part out of the valve body (1).
- Note: The upper seat ring gasket (24) is located on the top groove of the seat ring.**
13. Remove the lower seat ring gasket (24) from the valve body (1).
  14. Remove the packing set (11) and the guide bushing (26) from the bonnet (2).

## Plug Stem Disassembly

## CAUTION

**The valve plug assembly is screwed and pinned to ensure stability and performance. Due to the critical purpose of the plug assembly and tolerance requirements, Baker Hughes highly recommends avoiding in the field maintenance of this part. The plug assembly should be purchased as a complete assembly. However, if urgent field repair is required, follow the instructions below.**

The valve plug stem is screwed into the valve plug (6) and pinned. To disassemble the stem, the valve plug must be held as shown below in Figure 1, taking care not to damage the guiding surfaces. Disassemble the plug stem groove pin (9) from the assembly.

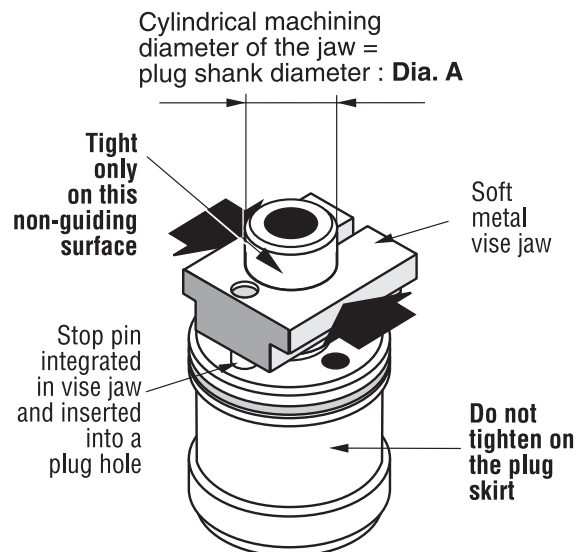


Figure 1: Correct Plug Clamping Surface



By means of flats or using a nut and counter-nut on the end of the stem, unscrew the stem from the plug taking care not to apply a bending movement which could deform it.

## Maintenance & Repair

The purpose of this section is to provide recommended maintenance and repair procedures. These procedures assume the availability of standard shop tools and equipment.

### Maintenance

#### Packing Box

Tight sealing within the packing box is obtained by compression of the packing (15). Compression must be achieved by evenly tightening the packing flange nuts (19) on the packing flange (17). Periodic re-tightening of the packing flange nuts may be required to maintain proper sealing.

## CAUTION

**Be careful not to over tighten the packing as this could prevent proper operation of the valve. If leakage persists after maximum packing compression, then the packing needs to be changed.**

#### PTFE Packing

Carbon/PTFE and pure PTFE packing rings are cut in such a way that they can be replaced without having to separate the valve plug stem from the actuator stem.

1. Unscrew and remove the packing flange nuts (19).
2. Lift the packing flange (17) and packing follower (16) up along the valve stem (8).
3. By means of a puller, remove the packing (15) being careful not to damage the sealing surface of the packing box or the valve plug stem.
4. Replace the packing rings, placing the cut in each ring about 120° apart from the adjacent ring. Press rings in one at a time.
5. Reassemble the packing follower (16) and the packing flange (17).
6. Tighten the packing flange nuts (19) without over compressing the packing rings.
7. Put the valve back into service and check for leakage.
8. Tighten packing flange nuts (19) as required.

#### Valve with Graphite Packing

To replace Graphite packing, it is necessary to separate the valve plug stem from the actuator stem.

1. Remove the packing flange nuts (19) from the packing flange studs (18).
2. Lift the packing flange (17) and packing follower (16) up along the valve stem (8).
3. By means of a puller, remove the packing (15) being careful not to damage the sealing surface of the packing box or the valve plug stem.
4. Replace the packing (15). Press a back-up ring (carbon/graphite/Inconel braided ring) into the bonnet (2). Next press the expanded graphite rings into the packing area one at a time. Press an additional back-up ring into packing area.

5. Reassemble the packing follower (16) and the packing flange (17).
6. Tighten the packing flange nuts (19) without over-compressing the packing rings.
7. Open and close the valve several times then retighten the packing as required.
8. Put the valve back into service and check for leakage.
9. Tighten packing flange nuts (19) as required.

## Repair of Parts

Prior to reassemble, examine parts carefully for any scratches, unusual wear, or other damage.

### Guiding Surfaces

Guiding surfaces of the cage, valve plug, guide bushing, plug stem, and auxiliary pilot plug must be checked. See Figures 2 and 3. If there are only slight wear indications, then gently use a light abrasive, such as fine grit sandpaper, to smooth out guiding surfaces. Parts with greater damage or wear on the guiding surfaces must be replaced.

### Seating Surfaces

The seat ring seating surface and valve plug seating surface must be completely free of dents, wear, or scratches. Consult factory should you see any signs of slight deterioration prior to attempting touchup. If a slight defect exists on either the seat ring seating surface or the valve plug seating surface, lapping can be applied per the following instructions.

1. Clean body gasket surface areas.
2. Install a new seat ring gasket (10B).

**Note : Seat ring gasket (10B) is temporarily placed to hold the seat ring during lapping.**

**It is imperative to use a new gasket or a test part having the same geometrical characteristics in order to insure the correct position of the seat ring during lapping.**

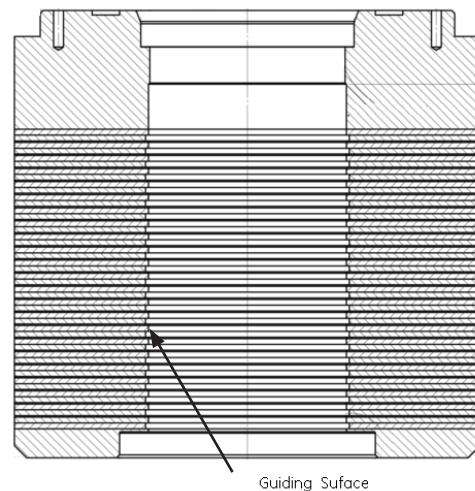
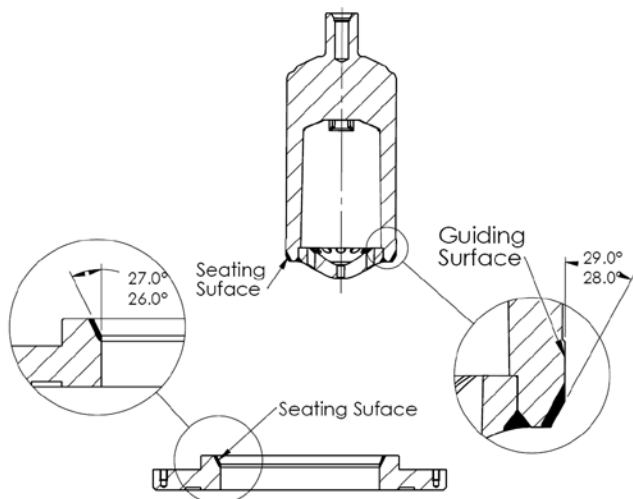


Figure 2

**This gasket (or similar part) can be kept after lapping for future lapping use.**



**Figure 3**

**The gasket used for lapping must not be reused for the body reassembly.**

3. Place seat ring (5) or seat ring diffuser (Not Shown) in the body, noting the seating angle is up.
4. Spread a fine layer of high quality lapping compound (600 grit) on the seating surface.
5. Assemble the cage (4) and (if applicable) cage retainer (Not Shown) and the plug assembly (Items 6, 8 & 9) into the valve body (1) per the valve plug assembly instructions.
6. Assemble the bonnet (2) and the guide bushing (7).
7. Place an appropriate tool on the valve stem (8) thread to allow for manual rotation.
8. Lap by slightly rotating the valve plug in alternate directions.
9. After several rotations, lift the valve stem, turn it 90 degrees, and repeat the operation.
10. Lapping can be repeated, but should be limited as much as possible so that the seat remains sufficiently narrow to guarantee tightness.
11. After lapping, disassemble the parts to clean them and then reassemble, making sure the seating angles are within tolerance. See Figure 3.

**Note: For more details on the lapping procedure and seating angles, please consult the factory and provide the valve serial number (found on the serial plate on the actuator).**

## Gaskets

Gasket seating surfaces must be free of dents, scratches, corrosion, or other types of damage. Clean mating surfaces as required and replace any non-conforming parts. Spiral wound gaskets (10) must always be replaced after disassembly.

## Seal Rings

Seal rings (14), back-up rings (22), retaining ring (Not Shown), and conical springs (Not Shown) can be reused if they are free of scratches, erosion, corrosion, or other damage.

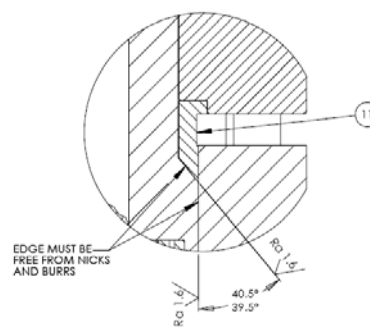
## Metal Seal

For the two piece bonnet configurations:

Prior to reassembly, the metal seal (11) should be inspected for cracks or signs of wear. The metal seal can be reused if it is free from scratches, erosion, corrosion, or any other type of damage.

If slight wear exists on the metal seal, a new layer of coating should be re-applied to the original condition by the factory or a Masoneilan Authorized Repair Center.

Prior to reassembly of the valve, inspect the inside of the valve body around the area where the metal seal seats. It is common to find slight ridges or depressions from where the seal was originally seated. During initial assembly these depressions aid in the sealing of the valve, however these areas can become leak paths during reassembly if the surface is not restored to its original finish as described below.



**Figure 4**

To prevent this potential leakage, machine the seating angle of the bonnet at 40 degrees by approximately 0.1 inches (2.5 mm) deep, thus causing the metal seal to seat further down inside the valve body (on a new un-deformed surface). Refer to Figure 4 for details. If this procedure is required more than twice please consult factory.

## Valve Plug

If the valve plug needs to be repaired see instructions for Valve Re-assembly.

## Valve Reassembly

### Pinning the Valve Plug

The valve plug assembly consists of a stem (16) that is threaded into The valve plug assembly consists of a stem (8) that is threaded into the valve plug (6). To secure this assembly, the stem (8) is then pinned (9) to the valve plug (6).

If the valve plug (6) or stem (8) needs to be replaced, an entire assembly should be purchased from the factory to ensure product strength and integrity. Re-machining of these parts in the field can seriously impair the mechanical strength and integrity of the valve plug stem assembly.

### Completing Valve Body Assembly

Proceeds as follows:

### Seat Ring Installation

1. After checking all sealing surfaces to ensure they are thoroughly clean, assemble the seat ring gasket (10B) in the valve body (1). Make sure the gasket is centered properly in the body.

- Assemble the seat ring (5) or seat ring diffuser (Not Shown) into the valve body on top of the seat ring gasket (10B), ensuring that the threaded lifting holes are facing up.

## Trim, Bonnet and Body Assembly

- Place pinned plug stem assembly vertically on stable surface. Carefully lift cage (4) and lower over plug stem assembly. (Threaded holes are provided in cage for lifting).
- Attach lifting eye to stem attach thread. Lift plug stem and cage together using lifting eye. (Plug will stop against shoulder inside of cage).
- Carefully lower plug stem assembly and cage into the body until the cage contacts the seat ring. Be sure that the cage is aligned with and fully seated against the seat ring (5) and that the seat gasket (10B) and cage gasket (10A) are in place. Continue to lower until plug is seated and remove hoist and lift eye.

**Note: Correctly assembled valves with in specification components should pass leakage testing with no lapping of the plug to seat-ring. In the rare instance that a valve does not shut off, light lapping of the plug to seat is allowed as a repair.**

## Balance Seal Installation (B019)

### Flow to open installation (FTO):

- Ensure that the plug and the seal groove are clean and free of sharp edges.
- Lightly lubricate the seal (14), backup rings (22), top of plug and seal groove with Dow Corning 111 or equivalent.
- Position the two backup rings over plug and seat them in the groove as illustrated. Slip the Omni seal (14) over the plug ensuring that the open (cup) end of the seal faces up and seats against the backup rings. (See Figure 5a.)

### Flow to close installation (FTC):

- Ensure that the plug and the seal groove are clean and free of sharp edges.
- Lightly lubricate the seal (14) backup rings (22), top of plug and seal groove with Dow Corning 111 or equivalent.
- Slip the Omni seal over plug ensuring that open (cup) end of the seal faces down and seat it in the groove.
- Position the two backup rings over plug and seat against the Omni seal as illustrated. (See Figure 5b.)

### Balance seal, metal (high temp) type FTO and FTC (seal is non-directional):

- Ensure that the plug and the seal groove are clean and free of sharp edges.
- Lightly lubricate the seal, inner and outer rings, top of plug and seal groove with Dow Corning 111 or equivalent.
- Slide the rings over plug and seat in the groove. Be sure to stagger the end gaps of the inner and outer rings.

## Bonnet Assembly

- Make sure the packing (15) and guide bushing (7) have been removed from the bonnet (2).
- Position the bonnet (2) above the valve body (1), oriented as shown in Figure 6.

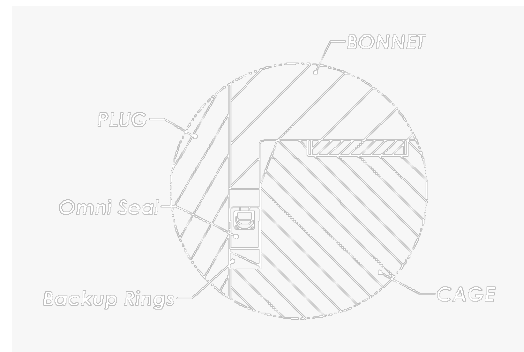


Figure 5a: Flow to Open

### For configurations designed with a two piece bonnet (bonnet and bonnet flange):

- Assemble the bonnet (2) over the valve stem (8) and push it down carefully. Be careful not to damage the stem during the assembly process.

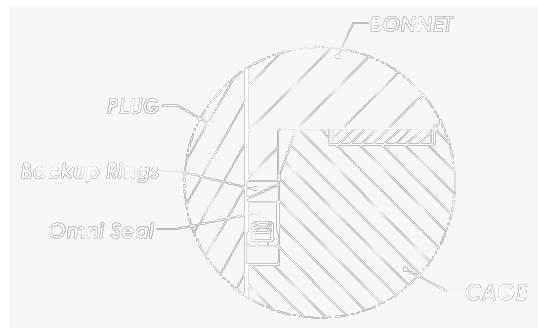


Figure 5b: Flow to Close

- Place the metal seal (11) over the bonnet (2) and press the metal seal down into the groove formed between the body and the bonnet.
- Assemble the bonnet flange (3) over the bonnet (2) and align the bolt holes with the body studs (12). Make sure the bonnet flange is also aligned with the metal seal (11). Proceed to step 8.

### For trim configurations designed with a single piece bonnet:

- Install body gasket (Not Shown) on to the groove on top of the valve body (1).
- Assemble the bonnet (2) over the valve stem (8) and push it down carefully to align the bolt holes with the body studs (12). Be careful not to damage the stem during the assembly process. Be sure the bonnet is oriented as shown in figure 6.
- Grease the threads of the valve body studs (4) and the bearing surfaces of the body stud nuts (13).
- Assemble the body stud nuts (13) manually. Hand-tighten the nuts evenly so the internal parts are held in place. The face of the bonnet should be parallel to the upper face of the valve body.

## Tightening Body Nuts

In order to achieve perfect alignment of the body and the internal components, it may be beneficial to provide loading to the plug stem assembly (Items 6, 8 & 9) during tightening. This may benefit the positioning of various parts in installations where the actuator and trim are installed horizontally.

The force can be applied with the actuator as follows:

Place the actuator on the valve bonnet (2) by means of the yoke nut or bolts (Not Shown) and connect the valve plug stem (8) to the actuator stem.

# CAUTION

**During this operation, make sure the plug does not turn when it is seated. If the plug travel is very small and there is a large amount of plug stem inside the actuator, it may be necessary to remove the yoke nut and lift the actuator so that the plug is not touching the seat.**

Refer to the appropriate instruction manual for the actuator and each unique accessory.

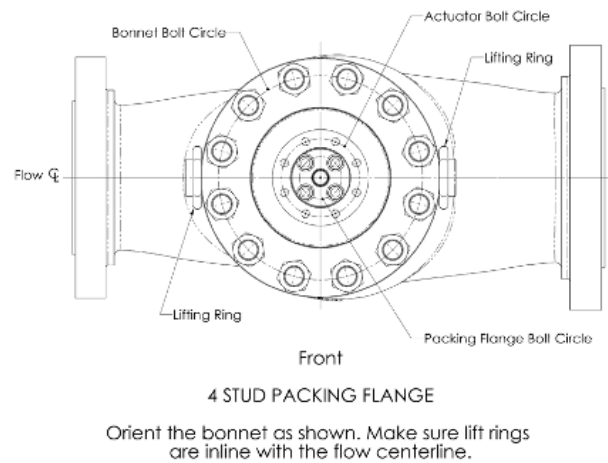
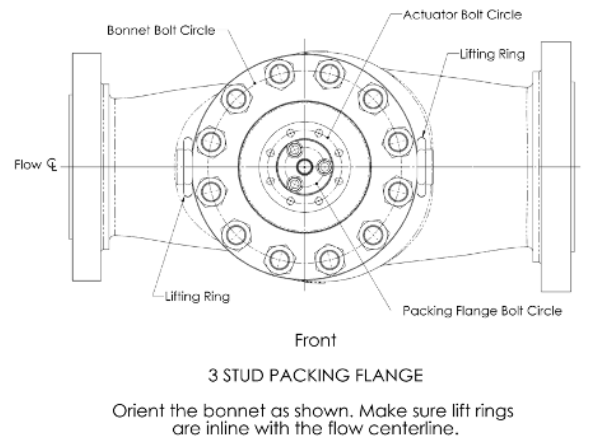
Tighten the bonnet stud nuts to the appropriate torque value found in Table 1. Tighten in sequence using at least 5 equal increments of torque. (See Figure 7 for torque sequence and recommended torque steps). It is important to ensure that the bonnet and bonnet flange are tightened down evenly to ensure proper alignment and fit of the internal components required for smooth valve operation and performance. In larger sizes ( 12" and larger), it is highly recommended that two assembly personnel, directly opposed to one another, perform the torque sequence and assure even installation; i.e. no tipping or uneven gaps between the bonnet flange and body.

At each torque step, torque down the bolting with no bushing installed and check alignment of the stem and packing bore, then test fit the stem bushing (7) to ensure that plug to cage alignment is maintained. After tightening, be sure that the bonnet studs protrude by at least one thread above the nuts. Studs with less than one thread above the nut are cause for rejection.

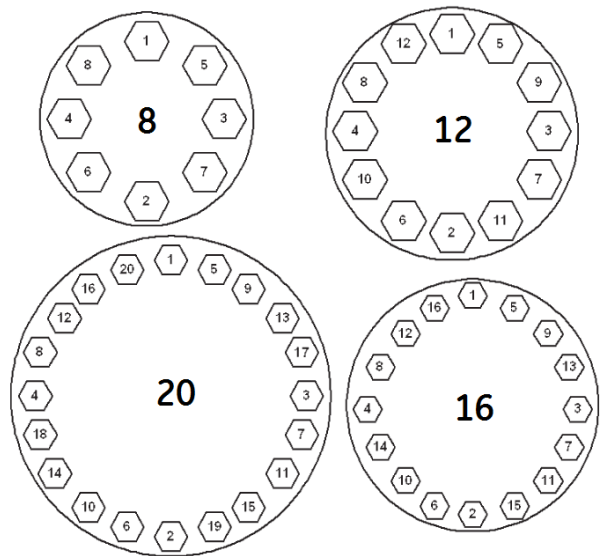
## Packing Box Assembly

If applicable, slide the guide bushing (7) onto the valve plug stem (8) and let it drop to the bottom of the packing box.

Assemble the packing box components per the maintenance instructions in the Packing Box maintenance procedure on page 5.



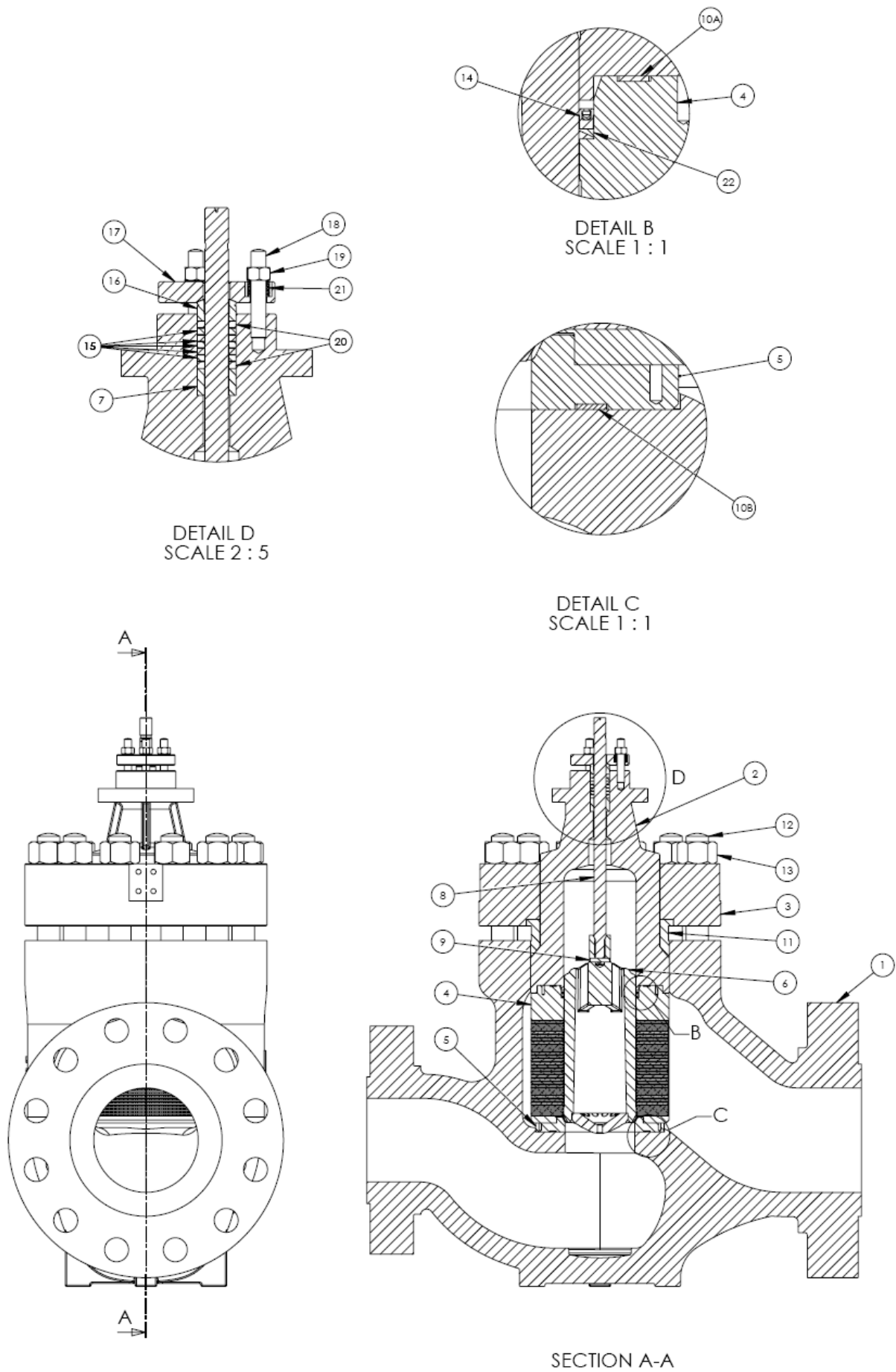
**Figure 6: Bonnet orientation**



**Note: Tighten bonnet nuts in five equal steps.**  
**Figure 7: Torque Sequence**

BODY		STUDS AND NUTS				ASSEMBLY TORQUE					
Nominal sizes (inch)	ASME Classes	Sizes of Studs (inch)	No. of Studs & Nuts	Studs Part No.	Stud Projection Required protrusion from Body with studs bottomed +/- 6.5 [0.25]		<ul style="list-style-type: none"> <li>• <b>Body/bonnet material:</b> Carbon steel, Chrome moly Stainless steel, Duplex</li> <li>• <b>Bolts / nuts materials:</b> A193 Gr B7 / A194 Gr 2H, A193 Gr B7M / A194 Gr 2HM, A320 Gr L7 / A194 Gr 7, A193 Gr B16 / A194 Gr 7 A453 Gr 660 / A194 Gr 7. A 453 Gr 660 / A 194 GR 8.</li> </ul>				
					mm	[inch]	Torque mdaN		Torque [ft lbs]		
3	600	1.250-8 UN-2A	8	011514429	127.8	5.03	66	76	490	560	
	1500	1.750-8 UN-2A	8	400120877	184.3	7.26	200	230	1500	1700	
	2500	2.250-8 UN-2A	8	011487935	228.1	8.98	390	450	2900	3300	
4	600	1.250-8 UN-2A	8	011514429	127.8	5.03	66	76	490	560	
	1500	1.750-8 UN-2A	8	400120877	184.3	7.26	200	230	1500	1700	
	2500	2.250-8 UN-2A	8	011487935	228.1	8.98	390	450	2900	3300	
6	600	1.375-8 UN-2A	8	400139447	136.0	5.35	89	103	660	760	
	1500	1.875-8 UN-2A	8	365637000	202.0	7.95	260	300	1900	2200	
	2500	2.250-8 UN-2A	8	400148235	263.3	10.37	490	560	3600	4100	
8	600	1.375-8 UN-2A	12	720016107	151.0	5.94	84	96	620	710	
	1500	1.875-8 UN-2A	12	001247622	221.1	8.70	260	300	1900	2200	
	2500	2.250-8 UN-2A	12	720015679	288.3	11.35	470	540	3500	4000	
10	600	1.625-8 UN-2A	12	720017027	194.0	7.64	150	160	1100	1200	
	1500	2.250-8 UN-2A	12	400148235	263.3	10.37	410	460	3000	3400	
	2500	2.750-8 UN-2A	12	720009360	357.3	14.07	850	960	6300	7100	
12	600	1.500-8 UN-2A	16	400112840	202.2	7.96	120	140	920	1030	
	1500	2.250-8 UN-2A	16	720015679	288.3	11.35	410	460	3000	3400	
	2500	3.000-8 UN-2A	16	720016109	419.0	16.50	1060	1170	7800	8600	
16	600	1.875-8 UN-2A	16	400134919	250.3	9.85	240	270	1800	2000	
	1500	2.750-8 UN-2A	16	720016110	368.3	14.50	830	920	6100	6800	
20	600	1.750-8 UN-2A	20	720016112	259.3	10.21	220	240	1600	1800	
	1500	2.750-8 UN-2A	20	720016111	407.3	16.04	840	940	6200	6900	
24	600	2.000-8 UN-2A	20	720015678	299.5	11.79	340	380	2500	2800	
30	600	2.250-8 UN-2A	20	720016108	336.5	13.25	490	540	3600	4000	

**Table 1: Torque Values**



**Figure 8: Typical Assembly**

Item No.	Description
1	Body
2	Bonnet
3	Bonnet Flange
4	Cage (V-LOG Stack)
5	Seat Ring
6	Plug
7	Guide Bushing
8	Plug Stem
9	Plug Pin
10•	Gasket
11	Metal Seal (Bridgeman)
12	Body Bonnet Stud
13	Body Bonnet Hex Nut
14	Balance Seal
15•	Packing Ring
16	Packing Follower
17	Packing Flange
18	Packing Stud
19	Packing Nut
20	Anti-Extrusion Ring
21	Disc Spring
22	Backup Ring

• **Recommended spare part (some parts may not be applicable to all designs)**

*Note: Actual parts list may differ according to specific valve supplied*

Plug Stem Diameter	N1 (turn)	in	mm
1"	1.25	0.09	2.3
3/4"	1.25	0.08	2.0

**Table 2: Type 88 , Air to Open – Valve Seating**

## Actuation

### Type 87/88 Multi-Spring Diaphragm Actuators

#### Connecting Type 87 (Air to Extend) No. 10, 16 and 23 Actuators (Figure 9a & 9b)

1. Install actuator on the valve body with drive nut (33). Tighten drive nut
2. Position top and bottom stem connectors (2 and 4) and replace the two socket head cap screws (5). Turn the plug stem as far as possible into lower part of the stem connector (2 or 6) refer to Table 3 and figure 11b for stem connector positioning.
3. Pneumatically or with the handwheel, stroke the actuator to the rated spring range or stroke (if using the handwheel).
4. Using the stem lock nuts (1) unscrew the plug stem until the plug touches the seat.

## CAUTION

**DO NOT TURN the plug against the seat as damage to parts can occur**

5. Release the pressure in the actuator or back off the handwheel to raise the stem.

#### Connecting Type 88 (Air to Retract) No. 10, 16 and 23 Actuator (Figure 10a & 10b)

1. Connect manual loading panel tubing to lower diaphragm case
2. Apply required air pressure to completely retract stem (10).
3. Install actuator on the valve body with drive nut. Tighten the drive nut.
4. Apply initial air pressure and unscrew the top stem connector (4) in accordance with dimension "X" in Table 3 and figure 10b.

## CAUTION

**DO NOT TURN the plug against the seat as damage to parts can occur**

5. Release air pressure
6. Using stem lock nuts (1), unscrew the plug stem until the plug touches the seat.
7. Pneumatically or with the handwheel, stroke the actuator to raise the plug off the seat. Unscrew the plug stem one full turn and lock the stem in place with the lock nut(s) (1) against the stem connector or flange (2 or 6).
8. Line up the travel scale (9) with the pointer and check actuator for proper operation.

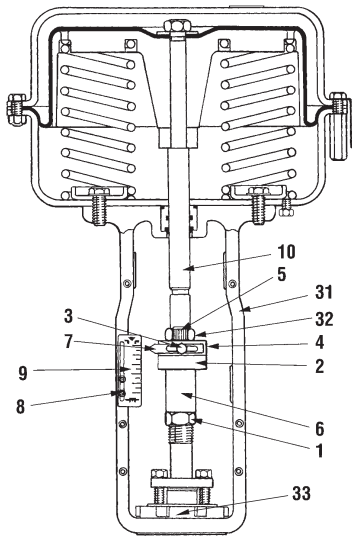
Actuator Size	Travel		"X" Actuator 87		"X" Actuator 87	
	in	mm	in	mm	in	mm
10	0.8	20	5.12	130	4.62	117.3
10	1.5	38	5.44	138.2		
16	0.8	20	8.00	203.2	7.02	178.3
16	1.5	38	8.50	228.6		
16	2.0	51	9.28	235.7		
16	2.5	63.5	9.50	241.3		
23	0.8	20	8.25	209.5		
23	1.5	38	8.62	218.9		
23	2.0	51	9.12	231.6		
23	2.5	63.5	9.59	243.6		

**Table 3: Position of Top Stem Connector**

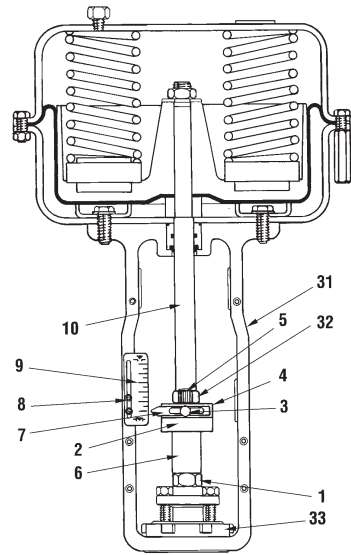
**Parts Reference For Spring Diaphragm Actuators - Type 87/88 Multispring**

Item No.	Description
1	Hex Nut
2	Stem Connector, Bottom
3	Cap Screw, Hex Head
4	Stem Connector, Top
5	Cap Screw, Socket Head
6	Connector Insert
7	Pointer
8	Screw, Pan Head
9	Scale, Travel
10	Actuator Stem
31	Yoke, Machining
32	Lock Nut
33	Yoke Nut

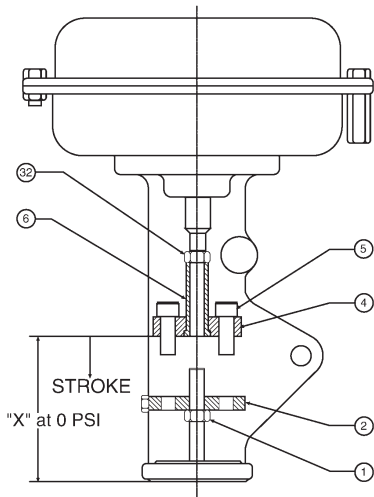




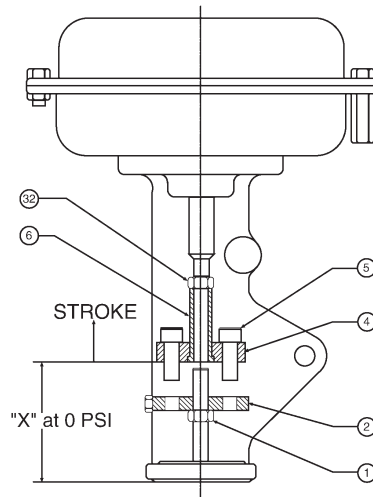
**Figure 9a**  
**Type 87 Air to Close**  
**No. 10-16-23**



**Figure 10a**  
**Type 88 Air to Open**  
**No. 10-16-23**



**Figure 9b**  
**Type 87 Actuator**  
**Air to Extend (Close)**



**Figure 10b**  
**Type 88 Actuator**  
**Air to Retract (Open)**

## Type 51/52/53 Cylinder Actuators

Connecting Double Acting (Model 51) (Figures 13)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the Top Plate (17).
3. Apply required air pressure through the manual loading panel to completely extend the actuator stem.
4. Reconnect manual loading panel tubing from the Top Plate (17) to the Yoke (1), which is integrated into the bottom plate connection.
5. Retract the actuator stem either pneumatically or with a handwheel approximately 1" (2mm) using the visual stroke scale as shown in Figure 11.

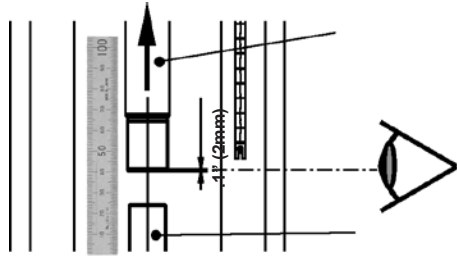


Figure 11

6. Assemble the Split Clamp (22).

**Note: If the split clamp does not engage with both stems, then retract the actuator stem until alignment and engagement is achieved.**

### CAUTION

**Make sure the valve is fully extended. Use caution to keep appendages clear of pinch points.**

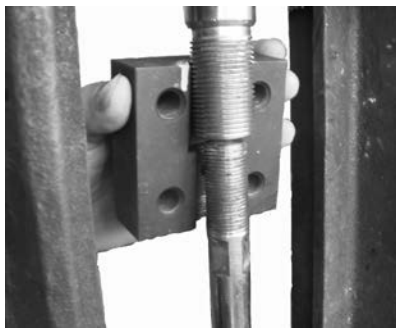


Figure 12

7. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
8. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.

## Connecting Air to Extend (Model 52) (Figure 14)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the top plate (17).
3. Apply required air pressure through the manual loading panel to completely extend the actuator stem.
4. Retract the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale as shown in Figure 11.
5. Assemble the Split Clamp (22).

**Note: If the split clamp does not engage with both stems, then retract the actuator stem until alignment and engagement is achieved.**

### CAUTION

**Make sure the valve is fully extended. Use caution to keep appendages clear of pinch points.**

6. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
7. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.

## Connecting Air to Retract (Model 53) (Figure 15)

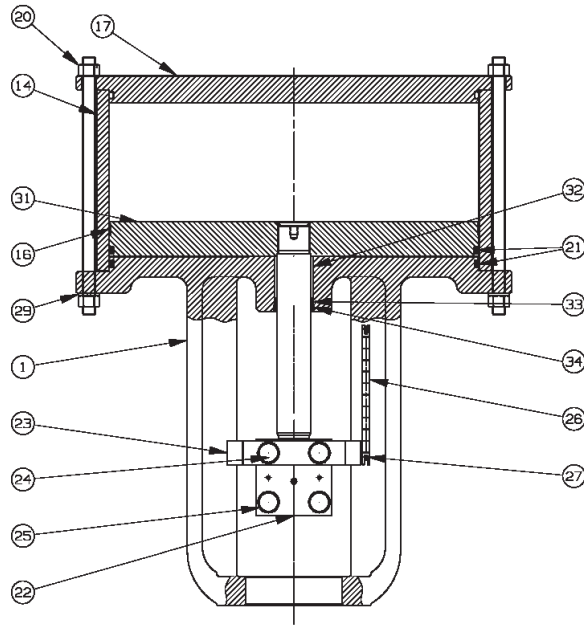
1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the yoke (1), which is integrated into the bottom plate connection.
3. Retract the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale as shown in Figure 11.
4. Assemble the Split Clamp (22).

**Note: If the split clamp does not engage with both stems, retract the actuator stem until alignment and engagement is achieved.**

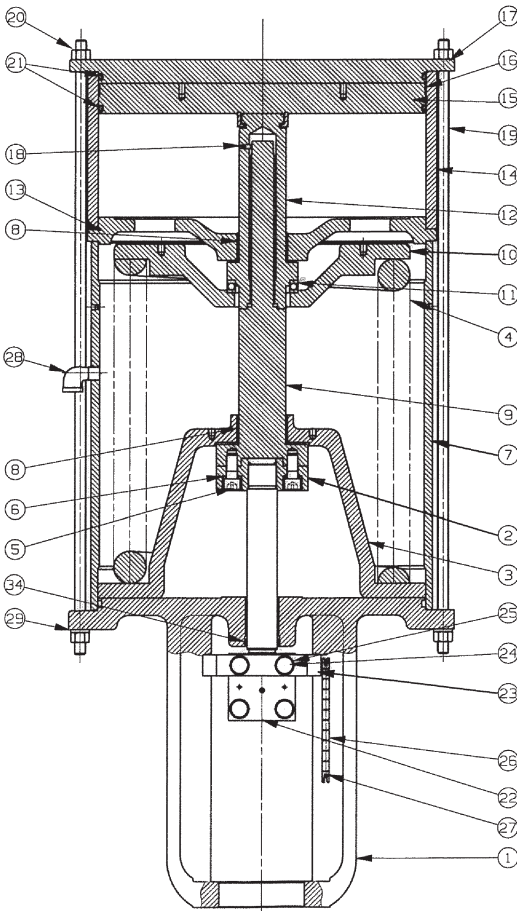
### CAUTION

**Make sure the valve is fully retracted. Use caution to keep appendages clear of pinch points.**

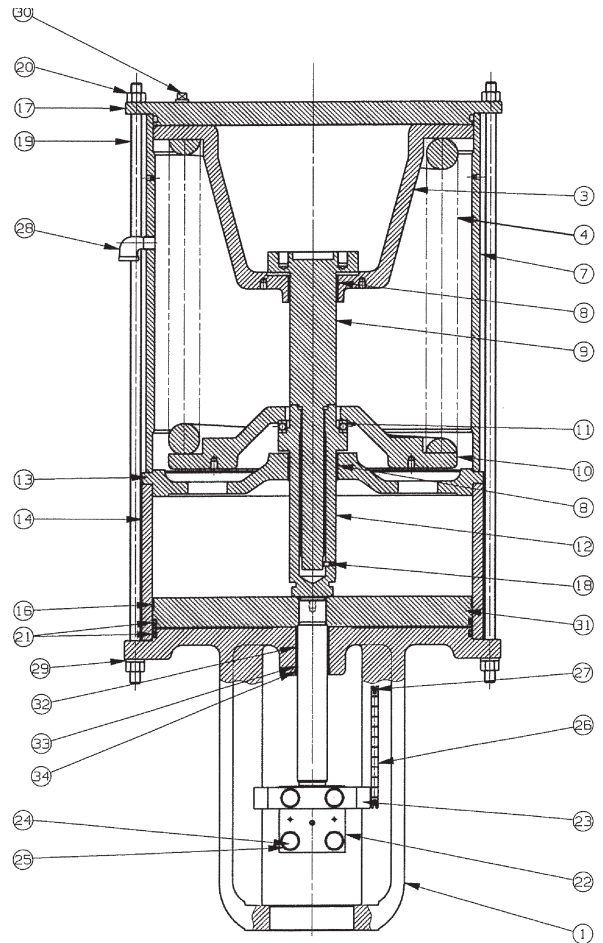
5. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
6. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.



**Figure 13**  
**Model 51 Double Acting**  
**Without volume chamber**



**Figure 14**  
**Model 52 (air to extend)**  
**without handwheel**



**Figure 15**  
**Model 53 (air to retract)**  
**without handwheel**

**Parts Reference Table 51/52/53 Actuators**

Ref No.	Description	Ref No.	Description
1	Yoke	24	Hexagon bolt
2	Piston rod S/A	25	Spring lock washer
3	Lower spring button	26	Indicator plate
4	Spring	27	Cross recessed head screw
5	Hexagon socket head cap screw	28	Exhaust pipe
6	Spring lock washer	29	Spring lock washer
7	Spring tube	30	Plug
8	• Guide bushing	31	• Piston S/A
9	Compression bolt	32	• Guide bushing
10	Upper spring button	33	• O ring (Piston rod)
11	Thrust bearing	34	• Rod scraper
12	Compression nut		
13	Separator plate Model 52/53		
14	Cylinder tube Cylinder tube		
15	Guide ring		
16	• Guide ring		
17	Top plate		
18	Set screw		
19	Center bolt		
20	Hexagon nut		
21	• O ring (Piston, Top plate)		
22	Split clamp		
23	Indicator arm		

• Recommended Spare Parts

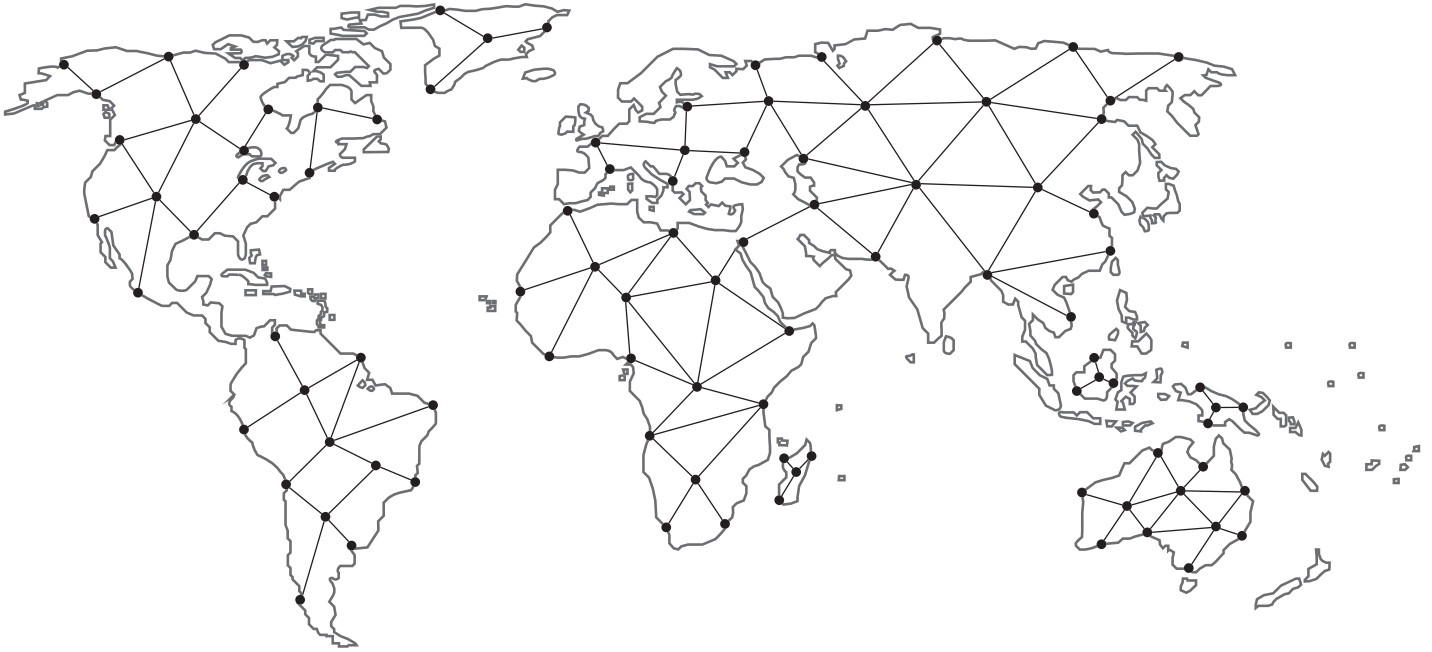
**Notes**

# Notes

**Notes**

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