

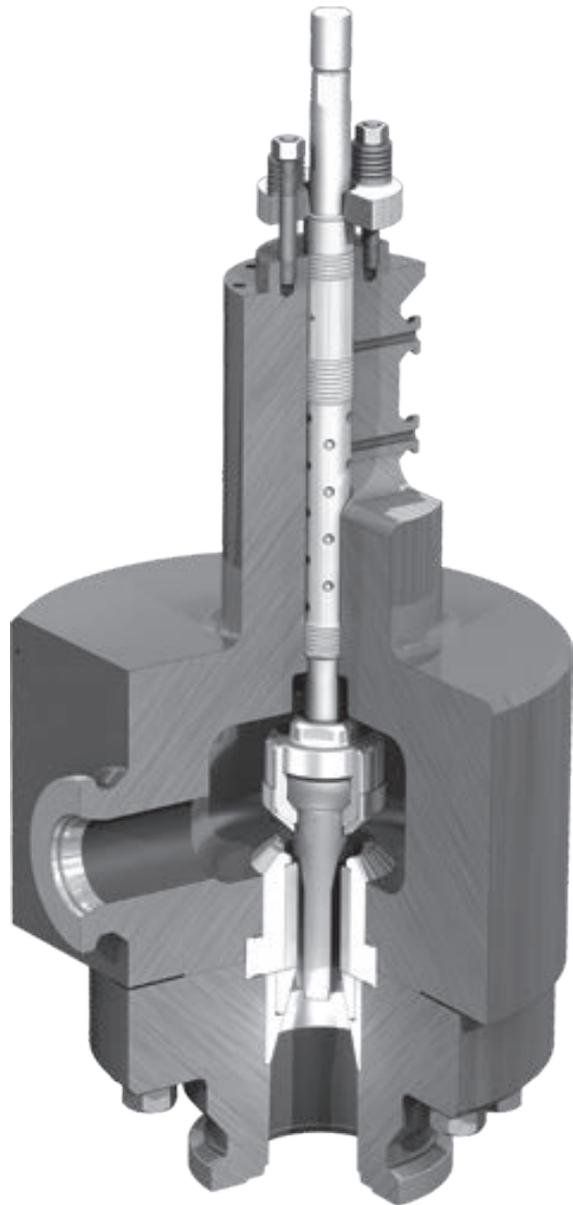
# Masoneilan

a Baker Hughes business

## 74000 Series

### Erosion Resistant Control Valves

Instruction Manual (Rev.C)



**THESE INSTRUCTIONS PROVIDE THE CUSTOMER/OPERATOR WITH IMPORTANT PROJECT-SPECIFIC REFERENCE INFORMATION IN ADDITION TO THE CUSTOMER/OPERATOR'S NORMAL OPERATION AND MAINTENANCE PROCEDURES. SINCE OPERATION AND MAINTENANCE PHILOSOPHIES VARY, BAKER HUGHES COMPANY (AND ITS SUBSIDIARIES AND AFFILIATES) DOES NOT ATTEMPT TO DICTATE SPECIFIC PROCEDURES, BUT TO PROVIDE BASIC LIMITATIONS AND REQUIREMENTS CREATED BY THE TYPE OF EQUIPMENT PROVIDED.**

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# Table of Contents

<b>Safety Information</b> .....	<b>1</b>
About this Manual .....	1
Useful Life Period.....	1
Warranty.....	1
<b>Introduction</b> .....	<b>2</b>
Serial Plate.....	2
After Sales Service.....	2
Spare Parts .....	2
Actuator and Accessories.....	2
<b>Numbering System</b> .....	<b>2</b>
<b>Unpacking</b> .....	<b>3</b>
<b>Installation</b> .....	<b>3</b>
Piping Cleanliness.....	3
Isolation Bypass Valve .....	3
Heat Insulation .....	3
Hydrostatic Testing and Line Cleaning.....	3
Flow Direction .....	3
Welded Connections .....	3
Actuator Assembly .....	3
<b>Disassembly</b> .....	<b>4</b>
Valve Actuation.....	4
Disconnect Instrumentation.....	4
Air-to-Retract Actuators.....	4
Air-to-Extend Actuators .....	4
Actuator Removal.....	4
Valve Disassembly.....	4

<b>Maintenance &amp; Repair</b> .....	<b>5</b>
Packing Box .....	5
PTFE Packing .....	5
Valve with Graphite Packing .....	5
Parts Repair .....	5
Seating Surfaces.....	5
Gaskets .....	5
Plug/Stem S/A.....	5
Seat Ring S/A and Venturi S/A.....	6
<b>Valve Reassembly</b> .....	<b>6</b>
Body Stud Assembly .....	6
Bull Nose Guide .....	6
Trim / Lower Flange .....	6
Body Stud and Nut Torquing .....	6
Single bolt circle arrangement.....	6
Double bolt circle arrangement .....	6
Packing Box .....	8
Valves with Leak-Off Connection .....	9
Valves without Leak-Off Connection .....	9
<b>Actuation</b> .....	<b>11</b>
Type 87/88 Multi-Spring Diaphragm Actuators .....	11
Type 51/52/53 Cylinder Actuators .....	13
Parts Reference Table for Models 51/52/53 Actuators.....	15

## 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 **Masoneilan™** 74000 Series control valves, and do not apply for other valves outside of this product line.

## Useful Life Period

The current estimated useful life period for the 74000 Series control valves 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 74000 Series control valves.

The Masoneilan 74000 Series product is part of Baker Hughes's Engineered Product portfolio, and is custom designed to fit our customer's most difficult applications. This document provides detailed installation and maintenance instructions for all sizes, ratings and trim types used in the 74000 Series product line.

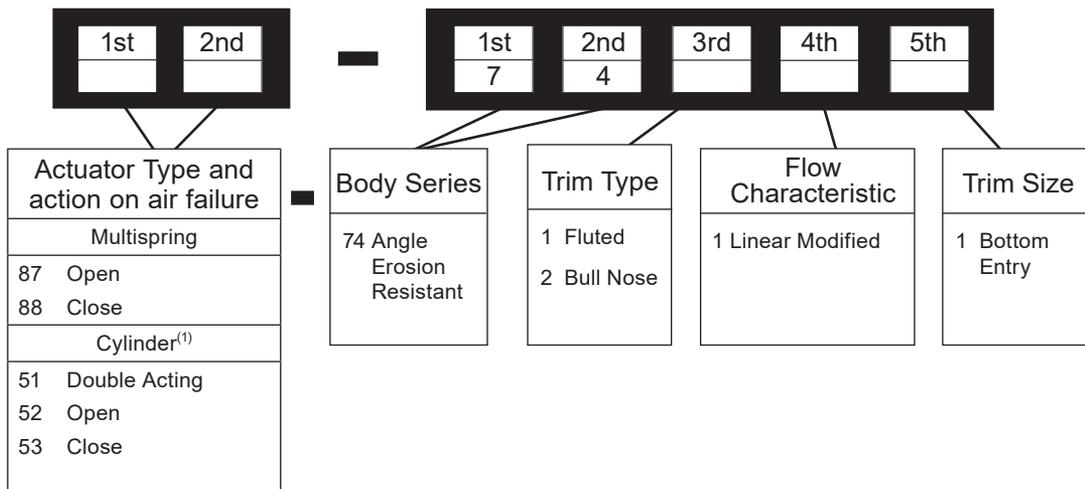
## Serial Plate

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 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 representative or Masoneilan factory located closest to you.

# Numbering System



1. Piston actuator preferred solution for stability purposes.

# 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 Aftermarket Center with any issues or problems. Be sure to note the valve model number and serial number in all correspondence.

## Installation

### **CAUTION**

**The 74000 Series control valve must always be installed with the flow tending to close the valve plug. For applications where insulation of the valve body is required, do not insulate the valve bonnet.**

## 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 74000 Series trim. Sacrificial flushing trim should be installed in this 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

When wrapping this valve with heat insulation, note that the 74000 Series is a bottom entry valve requiring unique considerations. To allow for maintenance, the insulation configuration should allow for removal of valve body from the line and separation of the upper and lower body components at the flange joint. Also note that the packing box is integral to the upper body and should not be externally insulated so that this region does not retain excessive heat.

## 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. Flushing and hydrostatic test equipment can be purchased from the Baker Hughes factory.

## 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 any post weld heat treatment in order to prevent damage. 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 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.

### Stem Connector

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

## 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 74000 Series is a bottom entry valve and must be removed from the pipeline for disassembly.

### CAUTION

The 74000 Series valve is a bottom entry design and thus the valve must be inverted for proper disassembly. Inverting the valve requires pre-planning of the rigging and lifting process. Once inverted, the valve must be cradled in an appropriate fixture to support its weight and provide stability during maintenance activities.

Refer to Figure 6 and Table 3 for valve assembly cross section and component Tag Numbers.

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 Valve Body (B001) (if applicable).
2. Loosen the Packing Studs (B200) prior to inverting the valve so that the Plug/Stem sub-assembly (B119) can be removed with minimum force.
3. Remove the Body Nuts (B014) from the Lower Flange (B010).

### **CAUTION**

Plug/Stem sub-assembly (B119), Seat Ring sub-assembly (B102), and Venturi sub-assembly (B142) are all made from hard materials and have brittle properties. Extreme care should be used while removing these parts to prevent chipping and breaking.

4. Remove the Lower Flange (B010). Note that the Venturi sub-assembly (B142) may remain nested in the Lower Flange (B010).
5. Separate the Venturi sub-assembly (B142) from the Lower Flange (B010).
6. Inspect the Venturi sub-assembly (B142) to ensure it is free from defects including early signs of erosion, such as scratches and wear.

**Note: The Venturi sub-assembly (B142) is a two-piece assembly made up of a Venturi Housing (B142a) and a Venturi Insert (B142b). This sub-assembly must be purchased as a complete assembly.**

7. Remove the first Body Gasket (B015).
8. Prior to removing the Seat Ring sub-assembly (B102), push the Plug/Stem sub-assembly (B119) off the seat and use caution to avoid unnecessary contact to prevent chipping and breaking.

- Remove the Seat Ring sub-assembly (B102), and the second Body Gasket (B015) from the Valve Body (B001). For valves larger than 2", remove the Conical Spring (B013). Inspect the Seat Ring Insert (B102b) to ensure it is free from defects including early signs of erosion, such as scratches and wear.

**Note: The Seat Ring sub-assembly (B102) is a two-piece assembly made up of an outer piece and an inner liner. This assembly should be purchased as a complete assembly.**

- Remove the Plug/Stem sub-assembly (B119) by pulling the stem portion through the packing box section. Inspect the Plug/Stem sub-assembly (B119) to ensure it is free from defects including early signs of erosion, such as scratches and wear.

**Note: Plug/Stem sub-assembly (B119) is made from hard materials and has brittle properties. Extreme care should be used while removing this part to prevent chipping and breaking.**

## CAUTION

The valve should now be inverted again to a right-side-up position to disassemble the packing box. Inverting the valve requires pre-planning of the rigging and lifting process. Once inverted, the valve must be cradled in an appropriate fixture to support its weight and provide stability during maintenance activities.

- Remove all of the packing box components.
- Thoroughly inspect all surfaces in the Valve Body (B001), Plug/Stem sub-assembly (B119), Seat Ring sub-assembly (B102), Venturi sub-assembly (B142), and Lower Flange (B010) for any visual defects or damage. Carefully inspect the dynamic sliding surfaces and the seal interface areas.

## 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.

### Packing Box

Packing box maintenance is one of the principal tasks during routine servicing. Tightness of the packing is maintained by proper compression. Compression is achieved by evenly tightening the Packing Nuts (B201) against the Packing Flange (B213). Periodic re-tightening of the Packing Nuts (B201) may be required to maintain proper sealing.

Care must be taken not to over tighten, as this could create unnecessary friction preventing smooth valve operation. If packing leakage persists after applying maximum compression, then the packing needs to be replaced.

The valve must be isolated and the process pressure vented prior to performing any packing box maintenance.

### PTFE Packing

Kevlar®/PTFE, 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.

- Unscrew and remove the Packing Nuts (B201) and Disk Springs (B714).
- Lift the Packing Flange (B213) and Packing Follower (B212) up along the Plug Stem (B120).
- Using a packing puller tool, remove all packing box components being careful not to damage the sealing surface of the packing box or the Plug Stem (B120).
- Replace the Packing Rings (B207), placing the cut in each ring about 120° apart from the adjacent ring. Press rings in one at a time.
- Reassemble the Packing Follower (B212) and the Packing Flange (B213).
- Tighten the Packing Nuts (B201) without over compressing the Packing Rings (B207).
- Put the valve back into service and check for leakage.
- Tighten Packing Nuts (B201) as required.

## Valve with Graphite Packing

To replace graphite packing, it is necessary to separate the Plug/Stem sub-assembly (B119) from the actuator stem.

- Remove the Packing Nuts (B201) and packing Disk Springs (B714).
- Lift the Packing Flange (B213) and Packing Follower (B212) up along the Plug/Stem sub-assembly (B119).
- Using a packing puller tool, remove all packing box components being careful not to damage the sealing surface of the packing box or the Plug Stem (B120).
- Replace the Packing Rings (B207). Press a back-up ring (carbon/ graphite/Inconel braided ring) into the packing box. Next press the expanded graphite rings into the packing area one at a time. Press an additional back-up ring into packing area.
- Reassemble the Packing Follower (B212) and the Packing Flange (B213).
- Tighten the Packing Nuts (B201) without overcompressing the Packing Rings (B207).
- Open and close the valve several times, then retighten the packing as required.
- Put the valve back into service and check for leakage.
- Tighten the Packing Nuts (B201) as required.

## Parts Repair

Carefully examine parts for any scratches, unusual wear, or other visual damage prior to re-assembly.

## Seating Surfaces

The Seat Ring sub-assembly (B102) and valve/Stem sub-assembly (119) seating surfaces must be completely free of dents, scratches, wear, or other visual damage. Any seating surfaces showing signs of minor deterioration must be replaced with OEM parts from the factory.

## 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 (B015 and B102) must always be replaced after disassembly.

## Plug/Stem S/A

The Plug/Stem sub-assembly (B119) are assembled under tight tolerances to prevent damage to the hardened (and extremely brittle) parts. For this reason, the Plug/Stem sub-assembly (B119) must always be replaced together as a complete assembly with factory OEM parts.

## Seat Ring S/A and Venturi S/A

**Note: These sub-assemblies are each fit together using a heat shrinking process. The seat and liner of each of these assemblies should never be separated. The assemblies must always be replaced as complete assemblies using factory OEM parts.**

## Valve Reassembly

Make sure the valve body and gasket surfaces are clean and free of any damage.

### CAUTION

**The 74000 Series valve is a bottom entry design and thus the valve must be inverted for proper reassembly. Inverting the valve requires pre-planning of the rigging and lifting process. Once inverted, the valve must be cradled in an appropriate fixture to support its weight and provide stability during maintenance activities.**

The 74000 Series must always be reassembled with new packing and gaskets. Before disassembly, make sure the recommended spare parts are available for reassembly.

## Body Stud Assembly

Lubricate threads of the Body Studs (B002), using Gripcott NF or equivalent, and screw them into the Valve Body (B001) until the studs bottom out. Do not over torque as it will damage the stud and prevent future removal.

## Bull Nose Guide

Bull Nose Trim requires a Bull Nose Guide (B011) which is welded into the Valve Body (B001). This guide is installed at the factory and should not require field service. If the Bull Nose Guide (B011) has need for replacement, contact Baker Hughes Masoneilan Engineering for guidance regarding removal and re-installation.

## Trim / Lower Flange

1. Install the Plug/Stem sub-assembly (B120/B112) into the Valve Body (B001), leading with the stem side.
2. For trim sizes 2" and less, install the Upper Seat Ring Gasket (B103a) in the gasket groove in the Valve Body (B001).
3. For trim sizes greater than 2", install the Conical Spring (B013) in the Valve Body (B001). Make sure spring is correctly installed per Figure 6, where the spring OD is in contact with the valve body face.
4. Install the Seat Ring (B102) in the Valve Body (B001), sliding it onto the Plug/Stem sub-assembly (B112).

5. Install the Seat Ring Gasket (B103) in seat ring gasket groove.
6. Install the Body Gasket (B015) in the gasket groove in the Valve Body (B001).
7. Place the Venturi (B142) on the underside of the seat ring face and align it with the seat ring opening so that the Lower Flange (B010) can be lowered in place.
8. Lubricate the exposed Body Stud (B002) threads using Gripcott NF or equivalent.
9. Lower the Lower Flange (B010) over the Venturi (B142) and then onto the locating boss of the Valve Body (B001).

## Body Stud and Nut Torquing

1. Lubricate the Body Nut (B014) contact surfaces using Gripcott NF or equivalent.
2. Install the Body Nuts (B014) onto the Body Studs (B002). Prior to and while tightening the Body Nuts (B014), ensure that the Lower Flange (B010) and valve trim are centered and free moving.

## Single bolt circle arrangement

1. Tighten the Body Nuts (B014) in the sequence indicated by the Figure 1 or 2 or 3 based on quantity, and torque them in successive, uniform, and progressive levels using a calibrated torque wrench. During torquing, ensure that the Lower Flange (B010) face stays parallel to the Valve Body (B001) face. Torque to the maximum values in Table 1 for ASME Class 2500 or Table 2 for ASME Class 600. When the final torque values are achieved, confirm that the Lower Flange (B010) face is contacting the Valve Body (B001) face.

## Double bolt circle arrangement

1. Begin with the internal bolt pattern and torque the nuts in the order indicated by the Figure 4 or 5 depending on bolt quantity, and torque them in successive, uniform and progressive levels using a calibrated torque wrench. When the torque values in Table 1 are reached, confirm that the Lower Flange (B010) face is in metal to metal contact with the Valve Body (B001) face.
2. Follow with the external bolt pattern and torque the nuts in the order indicated by the Figure 4 or 5 depending on bolt quantity, and torque them in successive, uniform and progressive levels. When the torque values in Table 1 are reached, confirm that the Lower Flange (B010) face is in metal to metal contact with the Valve Body (B001) face.

### CAUTION

**The valve should now be inverted again to a right-side-up position to assemble the packing box and install the actuator. Inverting the valve requires pre-planning of the rigging and lifting process. Once inverted, the valve must be cradled in an appropriate fixture to support its weight and provide stability during maintenance activities.**

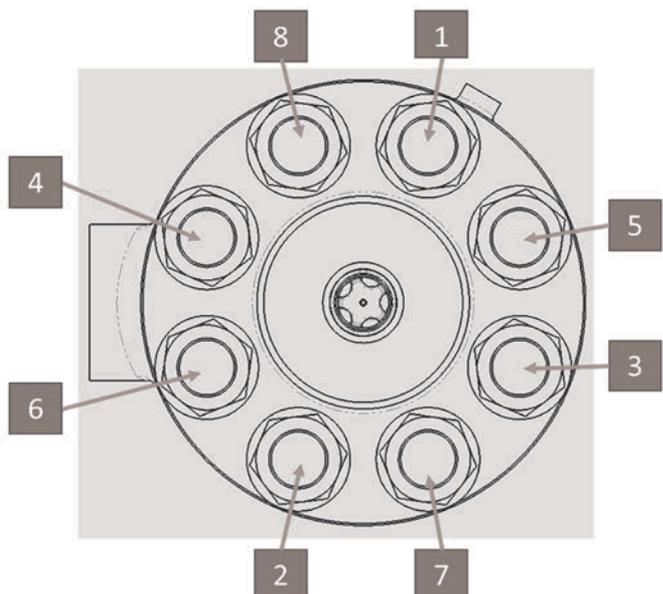


Figure 1 - Torque Sequence Single Bolting Circle 8 Bolts

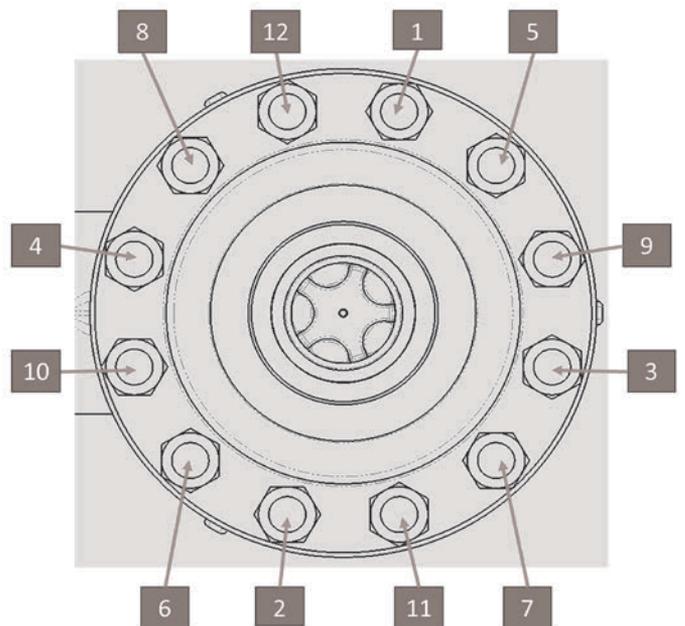


Figure 2 - Torque Sequence Single Bolting Circle 12 Bolts

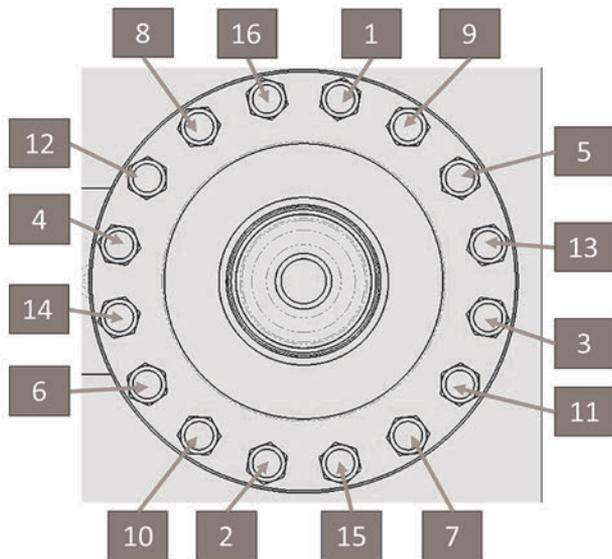


Figure 3 - Torque Sequence Single Bolting Circle 16 Bolts

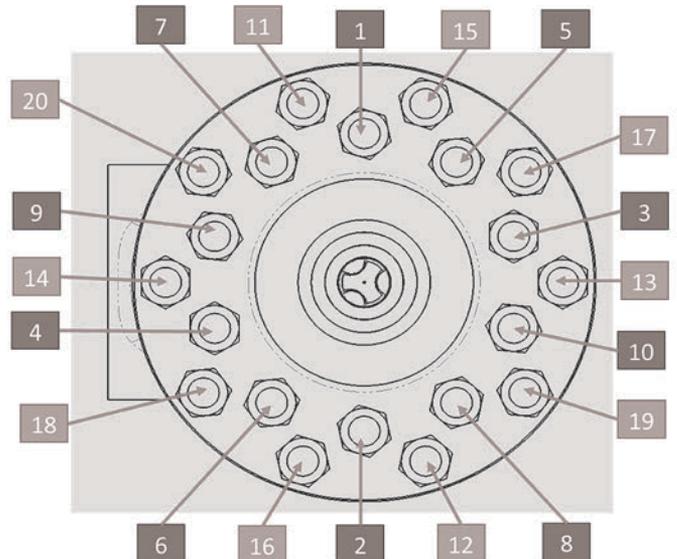


Figure 4 - Torque Sequence Single Bolting Circle 20 Bolts

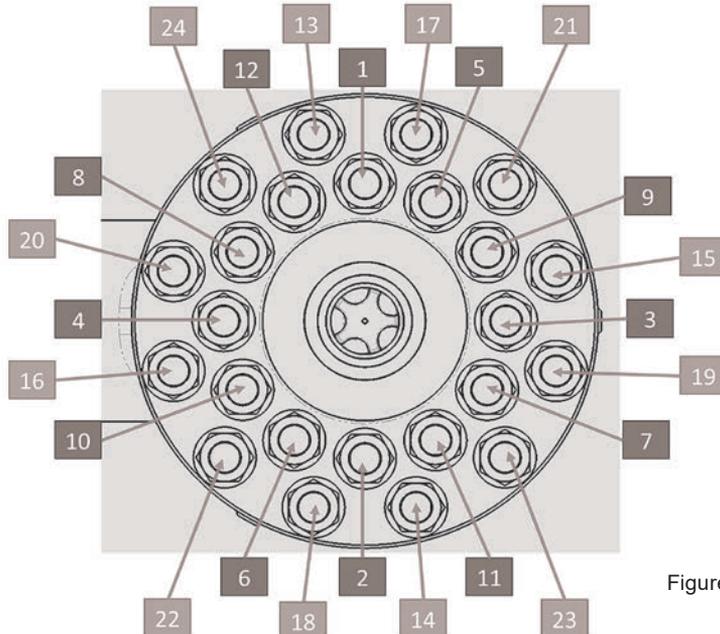


Figure 5 - Torque Sequence Single Bolting Circle 24 Bolts

## Packing Box

The 74000 Series valves have live loading as standard.

Prior to installation of the packing:

1. Inspect packing box inside diameter surface finish.
2. Inspect stem finish in the packing area.
3. Ensure there are no nicks or scratches on the stem and packing box inside diameter packing area. Any compromise of these features requires either repair or replacement of the component

**Table 1 - Torque Values for 74000 Series CL2500**

Part Description	Valve Size	2x3	3x4	4x6	6x8	8x10	8x10	10x12
	Valve Class	CL2500						
	Trim Size	2	2	3	4	4	6	8
Body studs	Thread size	1.625	1.625	1.625	2	1.875	1.875	2
	Bolt number	8	8	8	12	20	20	24
	Torque [daN.m]	220-240	220-240	220-240	510-550	400-440	400-440	480-520

**Table 2 - Torque Values for 74000 Series CL600**

Part Description	Valve Size	4x6	6x8	6x8	8x10
	Valve Class	CL600	CL600	CL600	CL600
	Trim Size	4	6	8	10
Body studs	Thread size	1.25	1.5	1.5	1.5
	Bolt number	12	12	12	16
	Torque [daN.m]	85-95	208-230	208-230	220-250

## Valves with Leak-Off Connection

1. Install Packing Spacer (B211).
2. Install Packing Set (B206).

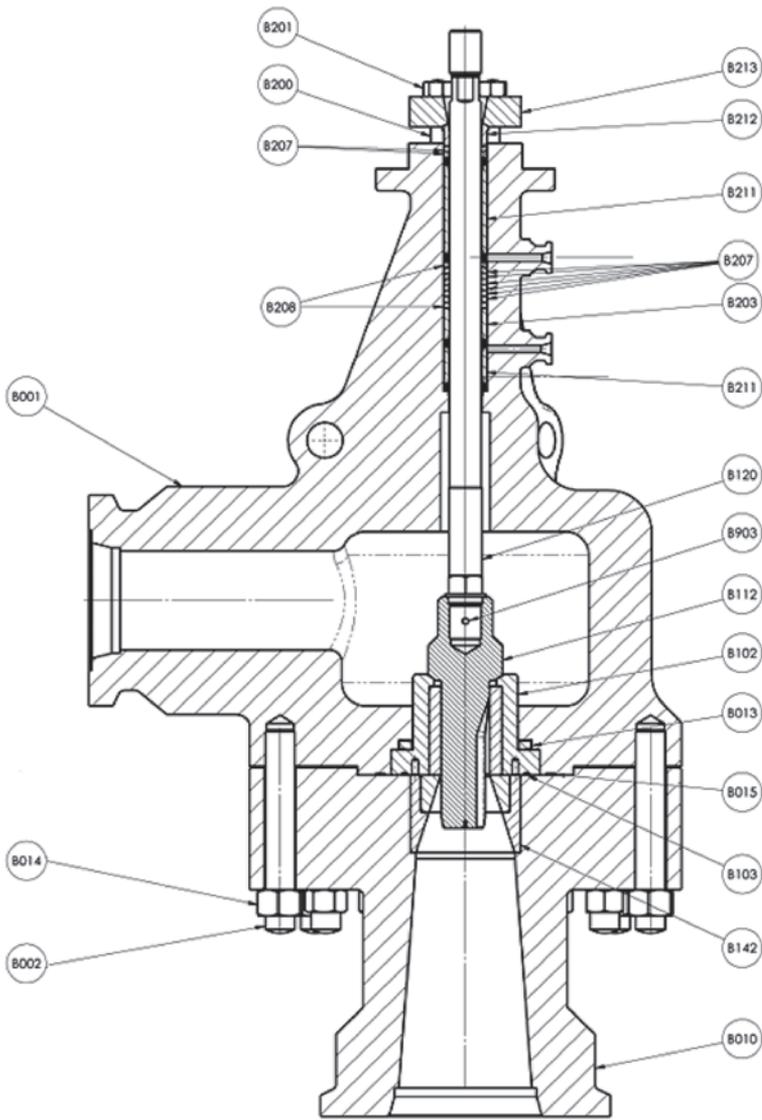
## Valves without Leak-Off Connection

1. Install Packing Studs (B200).
2. Install Guide Bushing (B203).
3. Install Packing Set (B206).
4. Install Packing Follower (B212).
5. Install Packing Flange (B213).
6. Install live load Disc Spring washers (B714) on each stud respecting the quantity and arrangement specified
7. Install the Packing Flange Nuts (B201) and hand tighten only.
8. Confirm that the Plug/Stem sub-assembly (B112) moves freely by hand.
9. Reference separate Baker Hughes Masoneilan publication for live loaded packing instructions. Gradually apply torque values indicated on live loading mounting instruction drawing. Pay attention to keep an even gap between the Plug Stem (B120) and Packing Flange (B123) or Packing Follower (B212) when torquing the Packing Nuts (B201). There must be no contact between the Plug Stem (B120) and the Packing Flange (B123) or Packing Follower (B212).

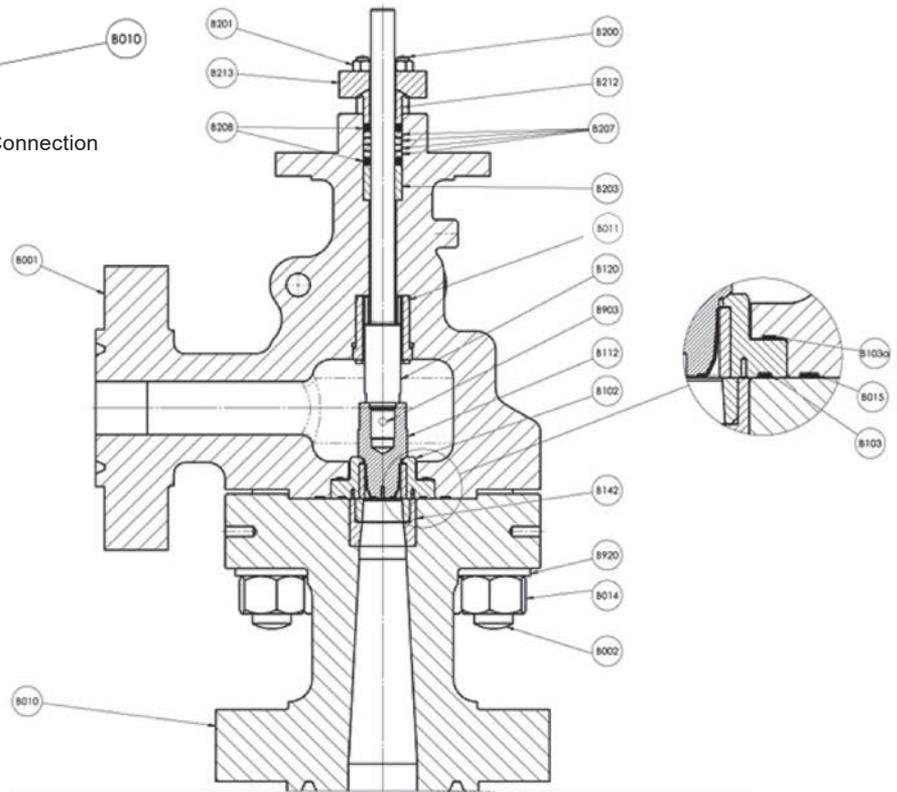
## 74000 Series Parts Reference

TAG	VALVE BODY S/A PART DESCRIPTION
B001	VALVE BODY
B002	BODY STUD
B010	LOWER FLANGE
B013	CONICAL SPRING (FOR TRIM >2")
B014	BODY NUT
B015	BODY GASKET
B707	LEAK OFF FLANGE (optional not represented)
B707	FLUSHING FLANGE
B102	SEAT RING S/A
B102a	SEAT RING HOUSING
B102b	SEAT RING INSERT
B103	SEAT RING GASKET
B103a	SEAT RING UPPER GASKET (FOR TRIM ≤ 2")
B112	FLUTED OR BULL NOSE PLUG
B119	PLUG/STEM S/A
B120	PLUG STEM
B142	VENTURI S/A
B142a	VENTURI HOUSING
B142b	VENTURI INSERT
B200	PACKING STUD
B201	PACKING NUT
B203	UPPER GUIDE BUSHING
B011	BULL NOSE GUIDE
B207	PACKING RING
B208	ANTI EXTRUSION RING
B211	PACKING/PURGING SPACER
B212	PACKING FOLLOWER
B213	PACKING FLANGE
B711	GASKET BODY CONNECTION
B714	DISC SPRING
B903	PLUG PIN
B920	BODY NUT FLAT WASHER (For CL2500)

**Table 3: 74000 Series Valve Parts List**



74111 Fluted Plug Construction with Leak-Off Connection



74211 Bull Nose Plug Construction

Figure 6 - 74000 Series Control Valve

# Actuation

## Type 87/88 Multi-Spring Diaphragm Actuators

### Connecting Type 87 (Air to Extend) No. 6 Actuator (Figure 9)

1. Tightly assemble the hex nuts (1) onto the plug stem.
2. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2). As soon as it becomes possible, insert the valve stem into the actuator stem (10). The stem must be inserted far enough so that when there is no air in the actuator, the valve plug does not touch the seat.
3. Tighten the yoke nut (33).
4. Supply air to the actuator at the final pressure.
5. Use the pointer (7) to set the travel scale (9) to the valve open position.
6. Supply the actuator with air at a sufficiently high pressure to obtain a travel equal to the nominal travel of the valve.
7. Unscrew the plug stem until the valve plug is in contact with the seat. Do not turn the valve plug on the seat as this could damage the sealing surfaces.
8. Screw the hex nuts (1) as far as they will go and check that operation is correct.

### Connecting Type 88 (Air to Retract) No. 6 Actuator (Figure 9)

1. Tightly assemble the hex nuts (1) onto the plug stem.
2. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2). As soon as it becomes possible, insert the valve stem into the actuator stem (10). The stem must be inserted far enough so that when there is no air in the actuator, the valve plug does not touch the seat.
3. Tighten the yoke nut (33).
4. Unscrew the valve plug stem until the valve plug comes into contact with the seat. Do not turn the valve plug on the seat as this could damage the sealing surfaces.
5. Supply air to the actuator until the stem has travelled at least .40 inches (10 mm).
6. Unscrew the plug stem by the number of turns N1 specified in Table 2.
7. Screw the hex nuts (1) as far as they will go and check that operation is correct.
8. Use the pointer (7) to set the travel scale (9) to the valve closed position.

Plug Stem Diameter	N1 (turn)	in	mm
1"	1.25	0.09	2.3
3/4"	1.25	0.08	2.0
5/8"	1.5	0.08	2.0
1/2"	1.5	0.075	1.9

**Table 4 - Type 88 Actuator, Air to Open - Valve Seating**

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

1. Tightly assemble hex nut (1) onto the plug stem.
2. Screw the top stem connector (4) assembly tightly onto the actuator stem (10).
3. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2) assembly by screwing until it comes into contact with the hex nut (1).
4. Push down the actuator and tighten the yoke nut (33).
5. Supply the actuator with air at the initial pressure indicated on the spring scale.
6. Position the stem connector assembly at distance "X" indicated in Table 4.

7. Use the pointer (7) to set the travel scale (9) to the valve open position.
8. Supply the actuator with air at a high enough pressure to obtain a travel equal to the nominal travel of the valve.
9. With the plug correctly positioned on the seat, unscrew the bottom stem connector (2) assembly until it comes into contact with the top stem connector (4). Tighten the socket head cap screws (5), hex nut (1) and lock nut (32) and check that the operation is correct.

**Connecting Type 88 (Air to Retract) No. 10, 16 and 23 Actuator (Figure 9)**

1. Supply the actuator with air to retract stem.
2. Unscrew the top stem connector (4) in accordance with dimension "X" in Table 5.
3. Tightly assemble hex nut (1) onto the plug stem.
4. Tightly screw the top stem connector (4) assembly onto the actuator stem (10).
5. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2) assembly by screwing until it comes into contact with the hex nut (1).
6. Push down the actuator and tighten the yoke nut (33).
7. With the plug correctly positioned on the seat, unscrew the bottom stem connector (2) assembly to bring it into contact with the top stem connector (4).
8. Supply air to the actuator until the stem has travelled at least 0.40 inches (10 mm).
9. Unscrew the top stem connector (4) by the number of turns N1 specified in Table 2 then lock manually with hex nut (1).
10. Release the pressure in the actuator. Use pointer (7) to set the travel scale (9) to the actuator supply pressure so that the two stem connectors come into contact. Then tighten the socket head cap screws (5), hex nut (1), and lock nut (32).
11. Shut off the closed valve pressure and check that operation is correct.

Actuator Size	Travel		"X" Actuator 87		"X" Actuator 88	
	in	mm	in	mm	in	mm
10	0.8	20	5.12	130.0	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 5 - 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 <sup>(1)</sup>	Stem Connector, Top
5 <sup>(1)</sup>	Cap Screw, Socket Head
6 <sup>(1)</sup>	Connector Insert
7	Pointer
8	Screw, Pan Head
9	Scale, Travel
10	Actuator Stem
31	Yoke, Machining
32 <sup>(1)</sup>	Lock Nut
33	Yoke Nut

1. Not provided for Size 6 Actuator

**Table 6 - 87/88 Actuator Parts List**

# Type 51/52/53 Cylinder Actuators

## Connecting Double Acting (Model 51) (Figures 10 & 11)

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 8.

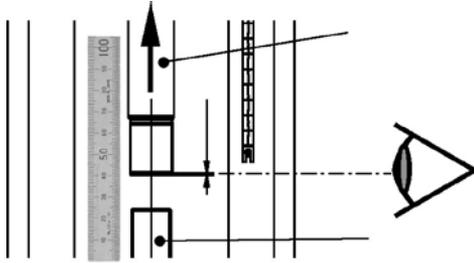


Figure 7

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.

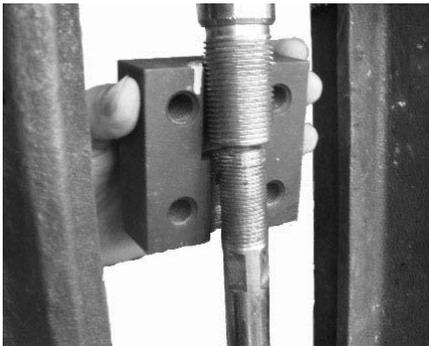


Figure 8

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 12)

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. Extend the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale as shown in Figure 8.
5. Assemble the Split Clamp (22).

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

## CAUTION

Make sure the valve is fully extended.

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 13)

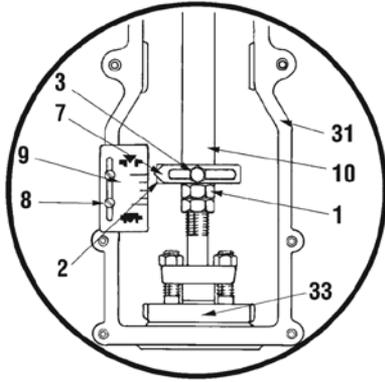
1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the yoke (1), which is integrated into the bottom plate connection.
3. Retract the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale as shown in Figure 8.
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.**

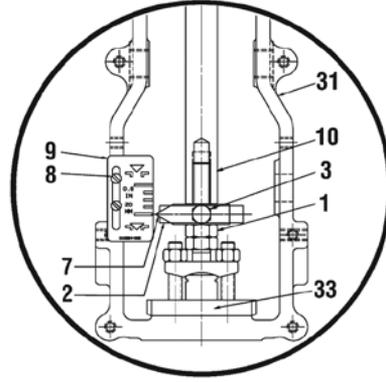
## CAUTION

Make sure the valve is fully retracted.

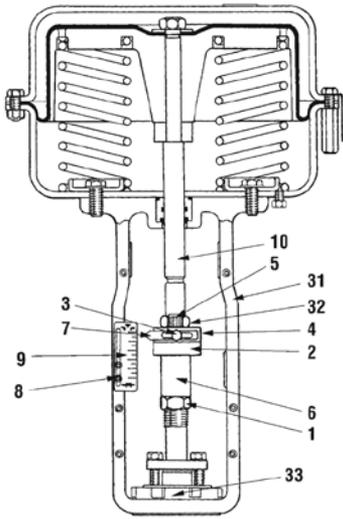
5. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
6. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.



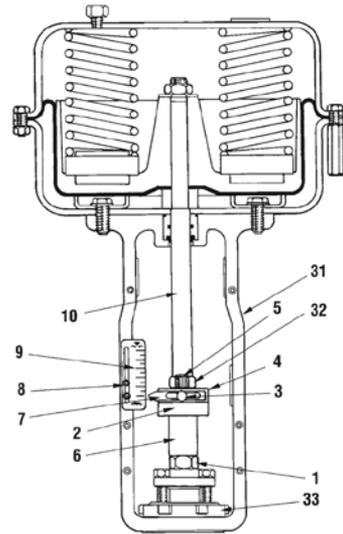
**Type 87 Air to Close  
No. 6**



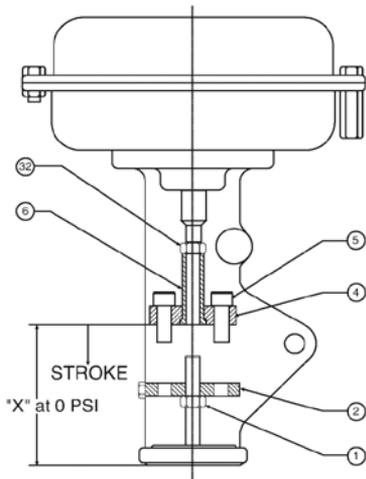
**Type 88 Air to Open  
No. 6**



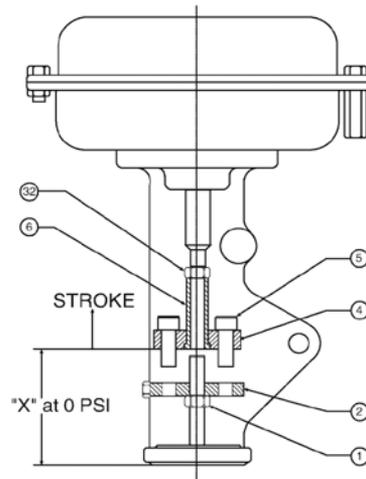
**Type 87 Air to Close  
No. 10-16-23**



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



**Model 87 Actuator  
Air to Extend (Close)**



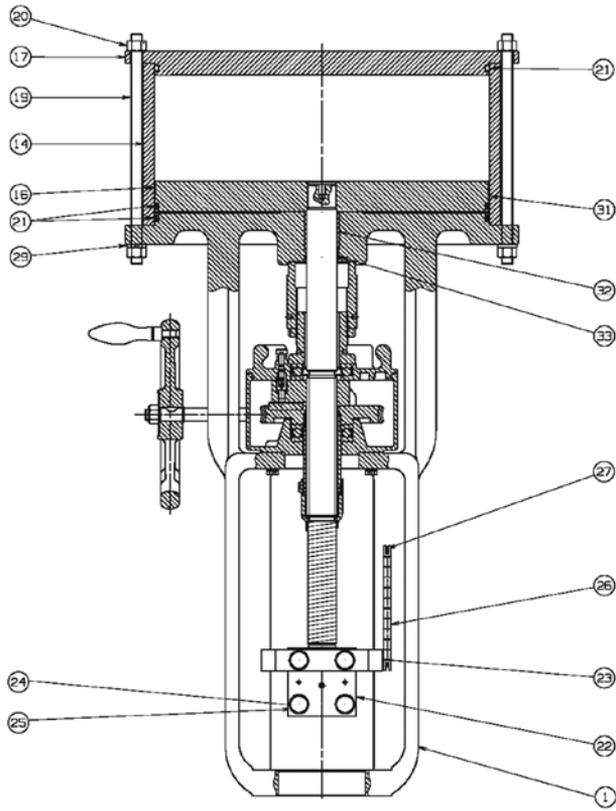
**Model 88 Actuator  
Air to Retract (Open)**

**Figure 9: 87/88 Actuators**

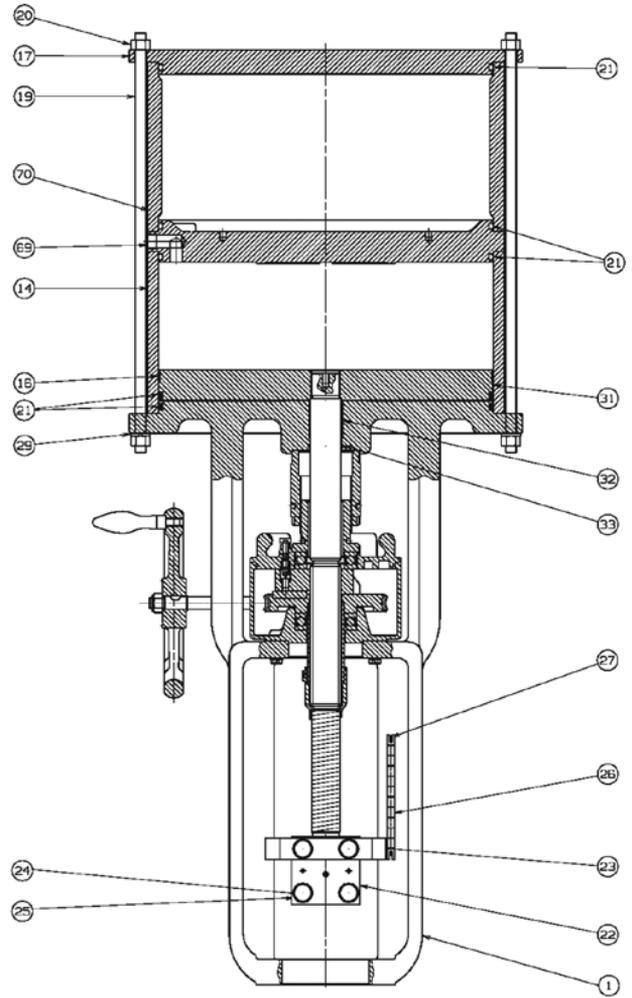
## Parts Reference Table for Models 51/52/53 Actuators

Ref No.	Description	Ref No.	Description	Ref No.	Description
1	Yoke	24	Hexagon bolt	47	Locking pin case
2	Piston rod S/A	25	Spring lock washer	48	Pin
3	Lower spring button	26	Indicator plate	49	Spring
4	Spring	27	Cross recessed head screw	50	Hexagon socket set screw
5	Hexagon socket head cap screw	28	Exhaust pipe	51	Guide key
6	Spring lock washer	29	Spring lock washer	52	Worm gear
7	Spring tube	30	Plug	53	Spacer tube
• 8	Guide bushing 3	31	Piston S/A	54	Adapter
9	Compression bolt	• 32	Guide bushing	55	Set screw
10	Upper spring button	• 33	O ring (Piston rod)	56	Worm
11	Thrust bearing	• 34	Rod scraper	• 57	Bearing
12	Compression nut	35	Hexagon bolt	58	Retaining ring
13	Separator plate Model 52/53	36	Spring lock washer	59	Hand wheel shaft
14	Cylinder tube	37	Gear box	60	Key (Worm)
15	Cylinder tube	38	Gear box cover S/A	61	Key (Handwheel)
• 16	Guide ring	• 39	O ring	62	Retaining ring
17	Top plate	• 40	Thrust bearing	63	Handwheel
18	Set screw	41	Adjustment screw	64	Grip
19	Center bolt	42	Locking nut	65	Directional plate
20	Hexagon nut	43	Adjustment nut	66	Self locking nut
• 21	O ring (Piston, Top plate)	44	Piston rod engagement	67	Operating information plate
22	Split clamp	• 45	Bearing	68	Drive screw
23	Indicator arm	46	Retaining pin	69	Separator plate (Model 51)
• Recommended Spare Parts				70	Volume chamber tube

**Table 7 - Models 51/52/53 Actuators Parts List**

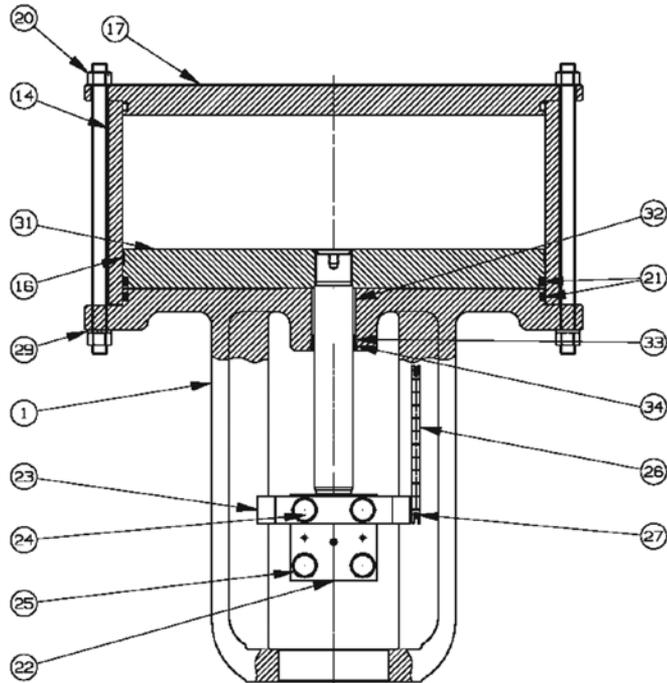


**Model 51 Double Acting  
With handwheel without volume chamber**

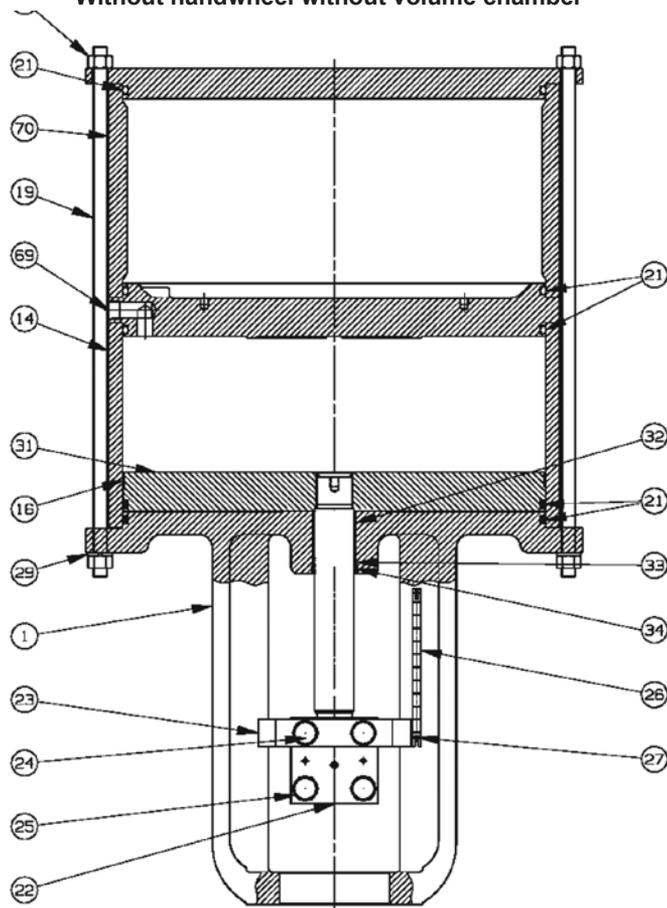


**Model 51 Double Acting  
With handwheel with volume chamber**

**Figure 10: Model 51 Actuator**

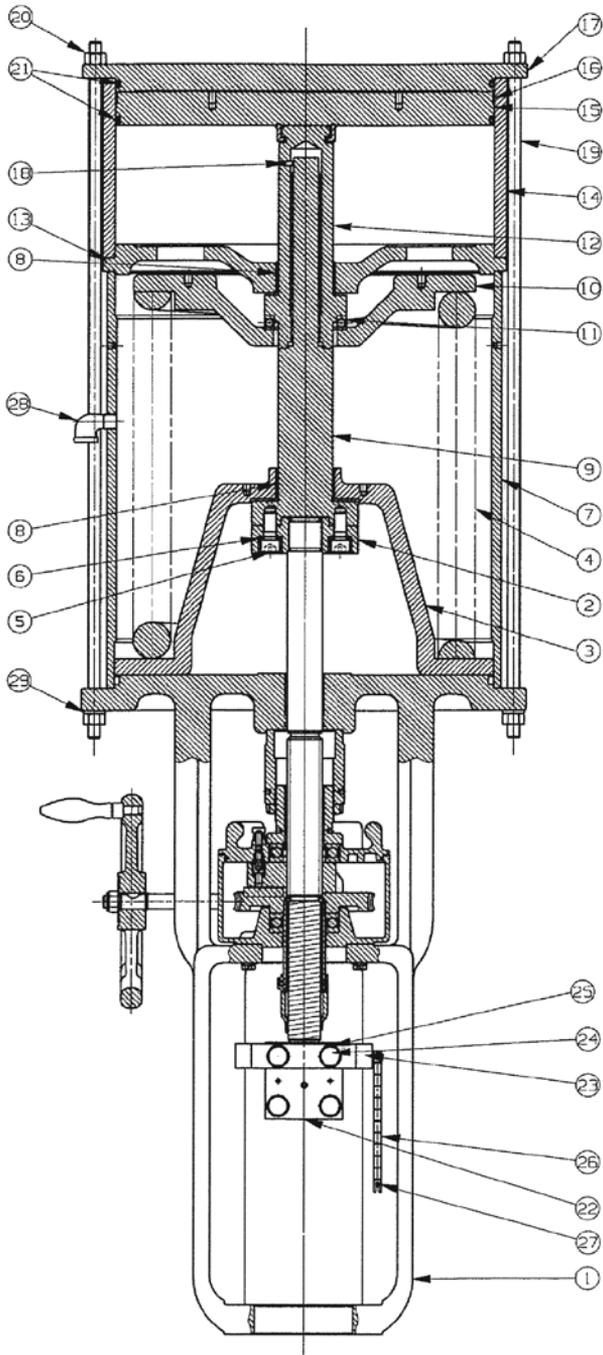


**Model 51 Double Acting  
Without handwheel without volume chamber**

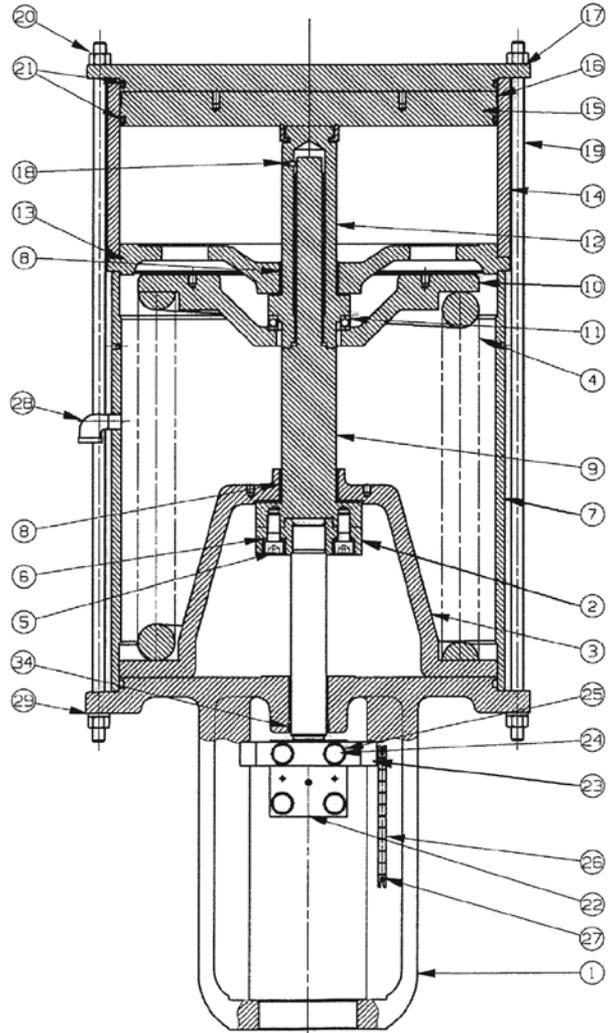


**Model 51 Double Acting  
Without handwheel with volume chamber**

**Figure 11: Model 51 Actuator**

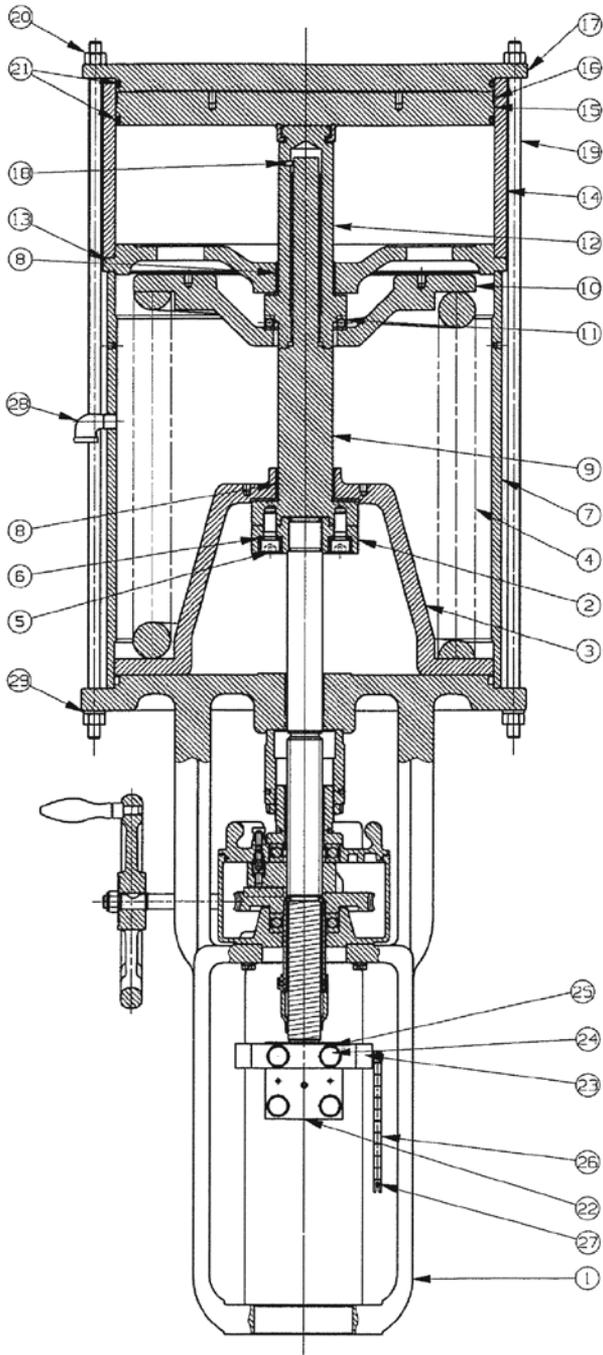


**Model 52**  
Air to extend with handwheel

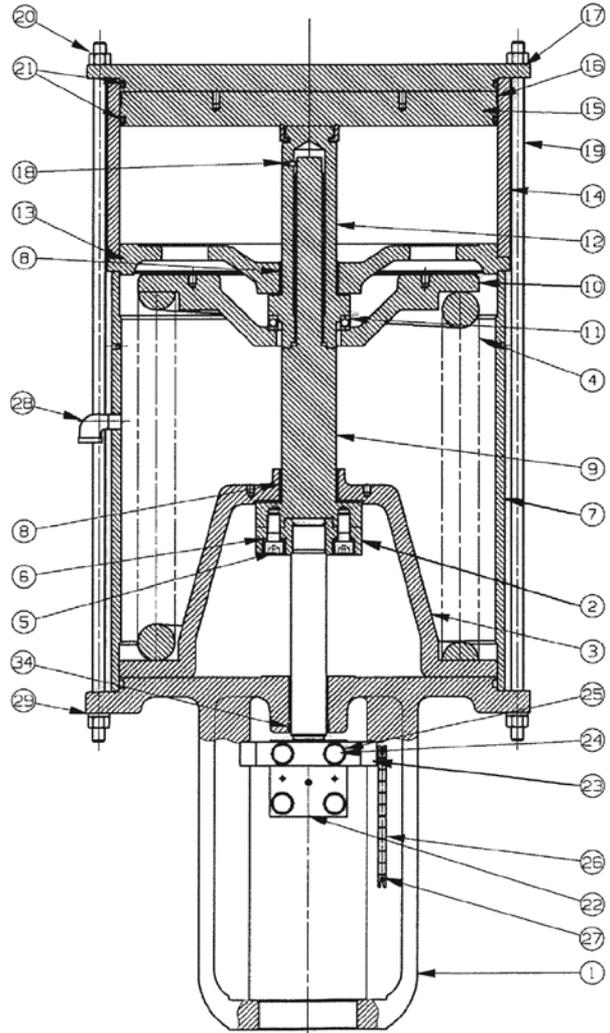


**Model 52**  
Air to retract without handwheel

**Figure 12: Model 52 Actuator**



**Model 53**  
Air to extend with handwheel



**Model 53**  
Air to retract without handwheel

**Figure 13: Model 53 Actuator**

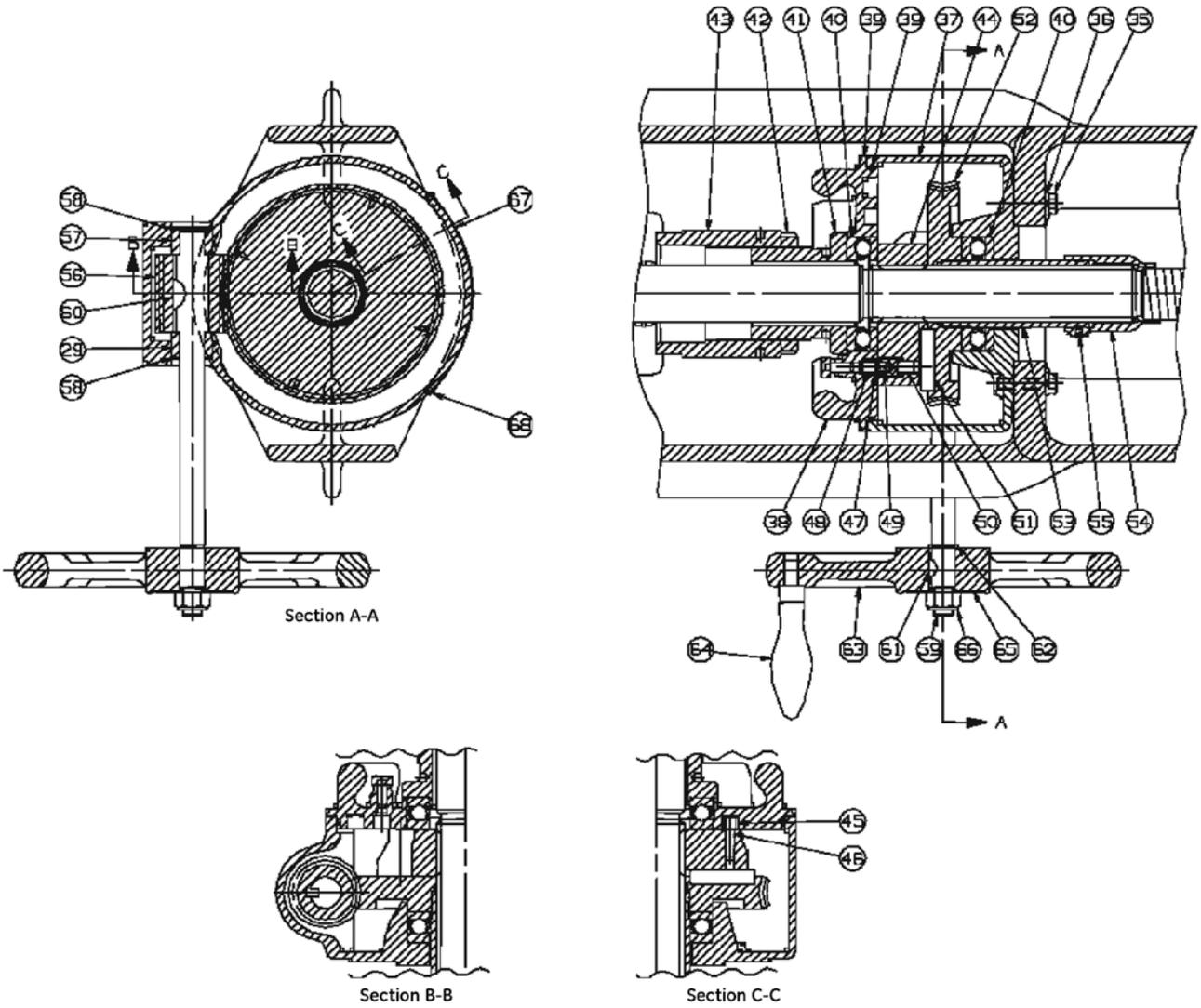


Figure 14: CM, DM handwheel - Typical for models 51/52/53

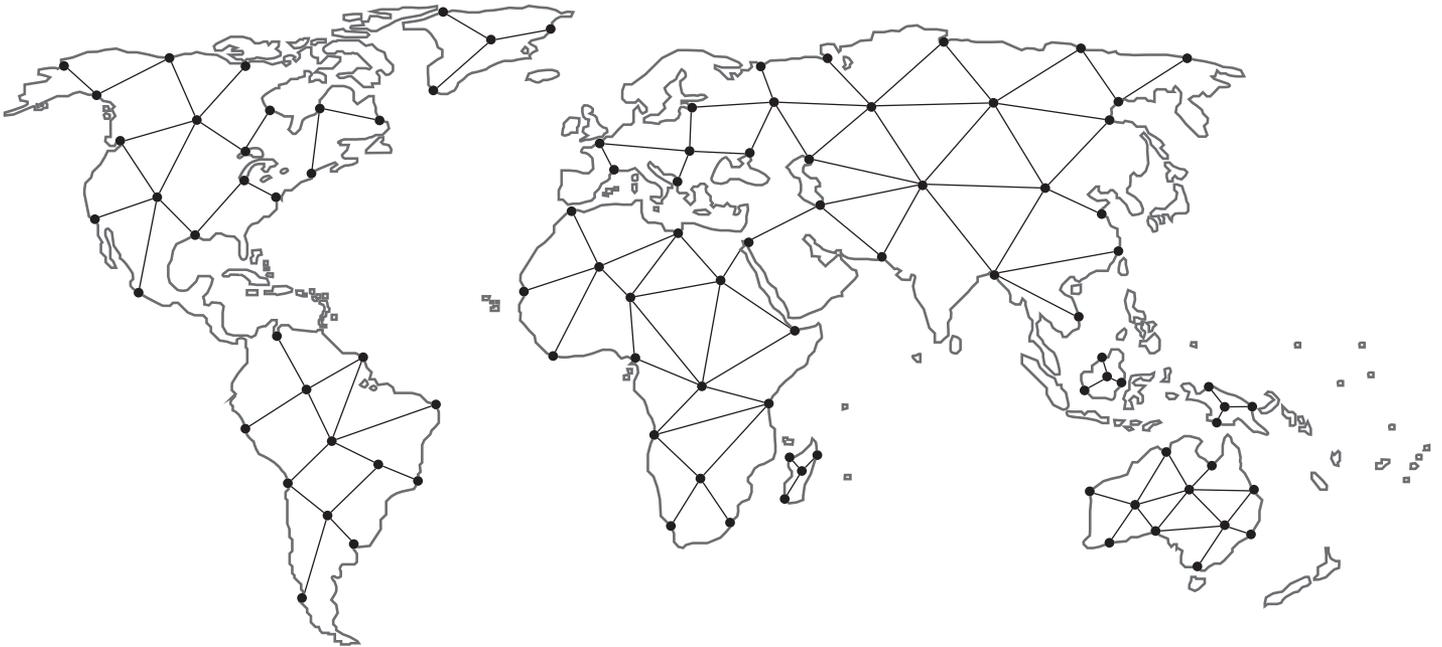






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