

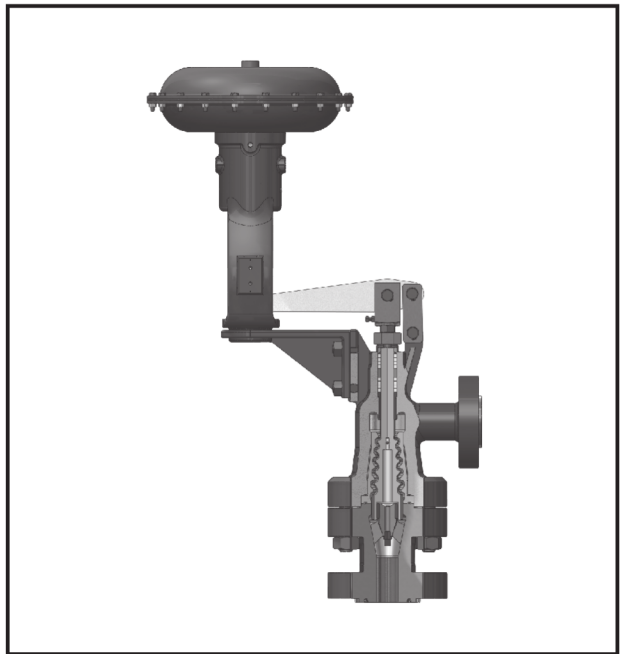


CONTROLS SUPPLY CHAIN  
VALVES ACTUATORS INSTRUMENTATIONS

## Instruction Manual

# MIL 77000

## Control Valves



Purchase Order No : \_\_\_\_\_



The following instructions should be thoroughly reviewed and understood prior to installing, operating or performing maintenance on this equipment. Throughout the text, safety and/or caution notes will appear and must be strictly adhered to, otherwise, serious injury or equipment malfunction could result.



## TABLE OF CONTENTS

1.	Introduction.....	2
2.	General.....	3
3.	Unpacking.....	3
4.	Installation .....	3
5.	Air Piping.....	4
6.	Maintenance .....	4
6.1	Valve Disassembly.....	4
6.2	Valve Reassembly.....	4
6.3	Plug Stroke Adjustment .....	5
6.4	Mounting and Adjustment of Actuator .....	6
6.4.1	No. 37 Direct Actuator (Air-to-open).....	6
6.4.2	No.38 Reverse Actuator (Air-to-close) .....	7
6.4.3	67 and 68- Piston Cylinder Double Acting Actuator .....	8
6.5	Standard Packing.....	9
6.6	Grinding Plug to Seat Ring .....	9

**Note: Easily replaceable Pressure gauges for Air sets and externally mounted Pressure gauges of positioners are normally dismantled, separately packed and bound to the actuator yoke as a precaution against transit damages. This may be noted while opening the boxes.**

**Warning: Do not lift large size valves by the actuator. Lifting lugs provided on the actuators are for lifting the actuator alone.**

## 1. Introduction

The following instructions should be thoroughly reviewed and understood prior to installing, operating or performing maintenance on this equipment. Throughout the text, safety and/or caution notes will appear and must be strictly adhered to, otherwise, serious injury or equipment malfunction could result.

MIL has a highly skilled Aftermarket department available for start-up, maintenance and repair of our valves and component parts. Arrangements for availing their service can be made through your local representative or Aftermarket department. In addition, a regularly scheduled training program is conducted at our plant, to train customer service and instrumentation personnel in the operation, maintenance and application of MIL

Control Valves and Accessories. Also when performing maintenance, please ensure that only original MIL replacement parts are used. When specifying parts, always include Serial Number of the valve.

**Caution: Skilled service personnel to be engaged for start up, maintenance and repair of the valve.**

**Caution: Always use original MIL replacement parts while performing maintenance.**



## 2. General

The MIL 77000 Series is part of MIL's severe service portfolio, and may be custom designed to fit our customer's most difficult applications.

The plug and seat ring design provides an expanding labyrinth passage in which the fluid flows through a succession of variable sections. These sections create a pressure drop by molecular friction comparable to the Fanno flow effect which occurs in long straight pipe but with one important consideration.

The increase in volume of the fluid, due to the pressure drop is counteracted by a progressive increase of flow area within the trim. This ensures a nearly constant fluid velocity

throughout the complete throttling process giving it two advantages :

1. Reduction of the noise produced by the fluid velocity to humanly acceptable levels.
2. Considerable decrease of the erosion of the plug and seat.

The bottom flange is larger than the inlet flange to retain the low velocity at the outlet and to eliminate the need for pipe reducers between the valve and the larger downstream piping.

The plug (3) and seat ring (2) incorporate a hard-faced(stellite) seating surface at the first restriction to maintain tight shutoff. The rest of the steps do not touch.

## 3. Unpacking

**Warning: Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts. Should any problems arise, contact your local representative or MIL Aftermarket department. Do not remove end protection cover before installation.**

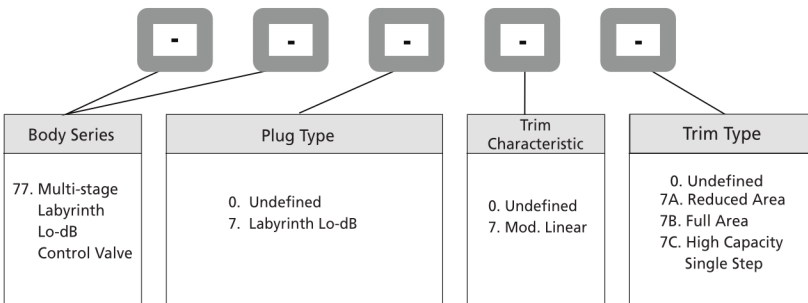
## 4. Installation

**Caution: Before installing the valve in the line, clean piping and flush the line to remove all foreign material such as welding chips, scale, oil, grease or dirt. End flange gasket surfaces must be thoroughly cleaned to ensure leak proof joints.**

- The 77000 Series valve must always be installed with the flowtending to open the valve plug(side inlet). For applications where insulation of the valve body is required, do not insulate the valve bonnet when possible.

- It is recommended to install the 77000 Series valves in the vertical position with the actuator extended up whenever possible. This orientation eliminates the need for additional pipe support, reduces the side load friction on
- the actuator, and provides ease of removal of the trim during maintenance for weld-end construction designs.
- When lifting the valve for installation it is important to never lift the valve by the actuator, lever or other assembled components. It is recommended to use lifting

## Numbering System





straps around the body or flange connection whenever picking the valve for installation or removal from the piping system.

- 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.

## 5. Air Piping

Air piping shall be as per the specification of air filter.

## 6. Maintenance

If it becomes necessary to disassemble the valve for maintenance, follow the procedure outlined below. Do not alter the position of the actuator spring adjusting screw unless the actuator is to be disassembled.

### 6.1 Valve Disassembly

- Bypass the valve and make sure that there is no pressure in the body. If the actuator is type 37 (direct), apply sufficient air pressure to take the plug off the seat.
- Remove actuator from the valve :
  - when valve is fitted with coupling type 1, (see Fig. 5):  
Remove snap rings (31) and (32) and the two links (29). Drive out pins (26) and (27) and disengage lever (33).
  - when valve fitted with coupling type 2, (see Fig. 6):  
Remove snap rings (31), drive out pins (26) and disengage lever (33).
- Shut off the air supply pressure and disconnect the air tubing from the actuator.
- Put valve out of the piping and unscrew drive nut (5) (or cap screws (34) if No 24 actuator) to separate the actuator from the body S/A.
- Unlock the nut (24), remove the anti-rotation screw (23) then unscrew the clevis (30) from the plug stem. Loosen the packing box nuts (9) to reduce the friction of the packing (10) to the plug stem.
- Remove bottom flange (4), plug (3), seat ring (2) and the two Hélicoflex ® gaskets (2A) from valve body.
- Clean all parts, particularly the seating surfaces on the seat ring (2), plug (3), and body (1). If necessary to lap the plug to seat ring.

### 6.2 Valve Reassembly

**Plug and seat ring reassembly is the reverse of the assembly sequence. Special care must be taken when reassembling to prevent damage to the plug, seat ring surfaces or the guiding surface of the plug stem.**

- Fit the first Hélicoflex® (2A) gasket in body housing and fit seat ring (2) then second Hélicoflex® gasket. Fit in plug (3) in body after light coating the two guiding parts with MolikoteG® (or its equivalent).

**Caution : When doing this, ensure not to damage the seat ring or the plug ring. When fitting plug in body, position the groove of the plug stem towards the actuator bracket.**

- Fit bottom flange (4) and ensure the guide bushing is exactly in plug axis. Screw and tighten evenly stud nuts (13) as indicated in table with torque tightening instructions.

The spacing between the body flange and bottom flange should be checked by means of feeler gauges.

Valve Size		Torque Tightening of Bottom Flange	
mm	inches	daN.m	Ft.lbs
50 x 80	2 x 3	90 to 100	664 to 737
50 x 100	2 x 4		
80 x 100	3 x 4	150 to 160	1106 to 1180
80 x 150	3 x 6		
100 x 150	4 x 6	360 to 380	2655 to 2802
100 x 200	4 x 8		
150 x 200	6 x 8	380 to 400	2802 to 2950

**Note : The above torque values are only available for carbon steel bolting. In case of stainless steel bolts, consult KSB MIL.**



**Caution :** The spacing measured around the periphery after final tightening of the body nuts must be consistent with  $\pm 0,05$  mm. This is required for a good alignment of the bushing (98) with the plug. Check this alignment by moving the plug in the valve body by hand making sure that it makes its full stroke.

- Coat the pipe plug (25) with PTFE tape before tightening. Install actuator and connect it to the lever (33).

### 6.3 Plug Stroke Adjustment

The plug stroke adjustment is an operation normally performed with the actuator removed from the valve. The plug stroke is established by the position of the clevis (30) on the plug stem.

The plug reaches its wide open position when the lever contacts the yoke adapter (21). When the lever is raised and the plug contacts the seat, the plug travel should be that value shown in table below, increased about 0,5 to 1 mm, and the actuator (end of the lever) should have traveled its rated stroke.

Valve				Actuator		
Size		Plug Stroke		Type	Stroke	
mm	inches	mm	inches		mm	inches
50 x 80	2 x 3	6	1/4	18	38.1	1 1/2
50 x 100	2 x 4					
80 x 100	3 x 4	10	3/8	18 L	63.5	2 1/2
80 x 150	3 x 6					
100 x 150	4 x 6	13	1/2	24	88.9	3 1/2
100 x 200	4 x 8					
150 x 200	6 x 8	13.7	35-64	24 HPI Direct	88.9	3 1/2

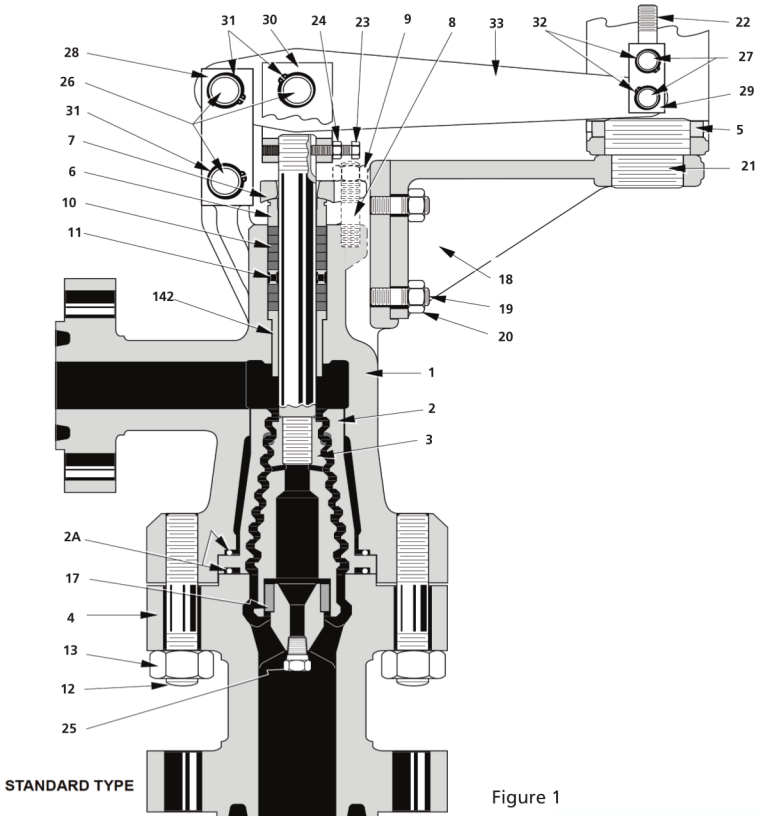


Figure 1



### Parts List

Ref. No.	Part Name	Ref. No.	Part Name
1	Valve Body	18	Actuator Bracket
2	Seat Ring	19	Bracket Stud
2A	Hélicoflex®	20	Stud Nut
3	Valve Plug	21	Yoke Adapter
4	Bottom Flange	22	Stem Adapter
5	Drive Nut	23	Anti-rotation Screw
6	Packing Follower	24	Locknut
7	Packing Flange	25	Pipe Plug
8	Packing Flange Stud	26	Pin (Valve End)
9	Stud Nut	27	Pin (Actuator)
10	Packing	28	Link (Valve End)
11	Lantern Ring	29	Link(Actuator End)
12	Body Stud	30	Clevis
13	Stud Nut	31	Snap Ring
14	Upper Guide Bushing	32	Snap Ring
* 15	Serial Plate	33	Lever
* 16	Drive Screw	* 34	Cap Screw (No. 24 Actuator Only)
17	Lower Guide Bushing		

\* Not Shown

1. Screw the clevis (30) all the way onto the plug stem.

**Note: It is important that the adjustment start with the clevis screwed as far as possible down the stem. If the adjustment starts with the clevis further up on the stem, the plug may hit the bottom flange (4) before the lever contacts the yoke adapter (21), a situation to be avoided.**

2. Replace lever (33) with links (28) and pins (26). Check the stroke of plug and end of the lever. If the stroke is less than that indicated in table above, increased about 0,5 to 1 mm, take off clevis pin (26), set aside the lever and unscrew the clevis 1/2 turn.
3. Replace the lever and pin (26), recheck the stroke and repeat step 2 if necessary.
4. Lock clevis on stem by means of anti-rotation screw (23) and nut (24). Make sure screw goes into the milled slot and does not damage the thread.

## 6.4 Mounting and Adjustment of Actuator

### 6.4.1 No 37 Direct Actuator (air to open)

#### Valves fitted with coupling device type 1, (Figure 5)

1. Insert one of the pins (27) through one link (29) and the lever (33), then mount the actuator on the bracket (18) and secure with drive nut (5).
2. Admit air pressure to actuator until the stem extends by 4 mm. Mark position of actuator stem in relation to spring adjustor (49).
3. When actuator in position : screw stem adapter (22) into clamp (58) and fit plug (3) in bearing position on its seat using lever (33). Fit link (29) towards stem adapter (22) and ensure that plate hole (29) lines up with hole of the stem adapter. If not, turn stem adapter (22) to achieve the position for coupling.
4. Screw stem adapter (22) by 6 to 12 mm more into clamp (58).
5. Apply air pressure to diaphragm until the



stem adapter and link line up. Insert the second pin (27), link (29) and snap rings (32). Fit snap rings (31) and tight nut (60) of the stem clamp (58).

- Remove air pressure from diaphragm and ensure that the marking on actuator stem returns to its position.

**Caution : If marking comes in spring adjuster (49) : Start again step 4 and screw stem adapter (22) more in stem clamp (58).**

**If marking not in correct position : Start again step 4 and screw stem adapter (22) less in stem clamp (58).**

**Note : When marking in position it ensures the entire spring force is used to tighten plug onto its seat.**

- With the help of comparator, check the plug performs its complete travel starting from the closed position, when the air pressure passes from the minimum value to the maximum value which is given on the serial plate (15). Adjust travel indicator scale such that the travel indicator (61) indicates "OPEN". Retighten packing box nuts (9). Install the valve in the line, connect air pressure tubing and put in service.

#### **Valve fitted with coupling device type 2, (Figure 6)**

- Screw stem adapter (22) into clamp (58) and fit actuator on its bracket using drive nut (5) or screws (34) and ensure to fit lower part of stem adapter (22) into vertical slot at lever end (33).
- Admit air pressure to actuator until the stem extends by 4 mm. Mark position of actuator stem in relation to spring adjuster (49).
- Seat the plug firmly by lifting the lever toward the stem adapter (22). The hole of the stem adapter should line up with the horizontal slot in the lever. If not, remove clevis pin (26), move the lever toward the back of the valve and adjust the position of the stem adapter.
- After achieving alignment, move again the lever toward the back of the valve.

Then screw stem adapter (22) by 6 to 12 mm more into clamp.

- Apply air pressure to the diaphragm to move the stem adapter down. Insert pin (27) into the hole of the stem adapter and slide lever onto the pin. Replace clevis pin (26) and snap rings (31) then screw stem clamp (58).
- Remove air pressure from diaphragm and ensure that the marking on actuator stem returns to its position.

**Caution : If marking comes in spring adjuster (49) : Start again step 4 and screw stem adapter (22) more in stem clamp (58).**

**If marking not in correct position : Start again step 4 and screw stem adapter (22) less in stem clamp (58).**

**Note: When marking in position, it ensures the entire spring force is used to tighten plug onto its seat.**

- With the help of a comparator, check the plug performs its complete travel starting from the closed position, when the air pressure passes from the minimum value to the maximum value which is given on the serial plate (15). Adjust travel indicator scale such that the travel indicator (61) indicates "OPEN". Retighten packing box nuts (9). Install the valve in the line, connect air pressure tubing and put in service.

#### **6.4.2 No 38 Reverse Actuator (air to close)**

Mounting and adjustment of the No 38 reverse actuator is done in much the same way as with the No 37 actuator.

Connection of stem adapter and lever is made with the valve closed. Air pressure is applied to the actuator to the maximum value of the spring range and the connection is

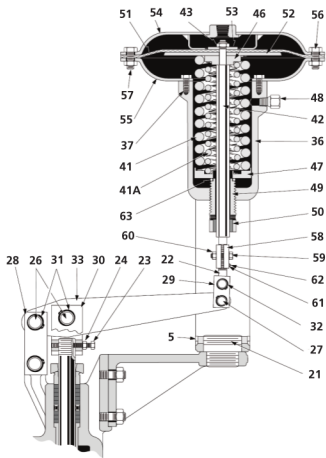


Figure 2  
No. 37 Direct Actuator  
(Increasing air extends stem)

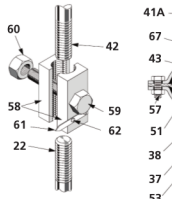


Figure 4  
Split Stem Clamp

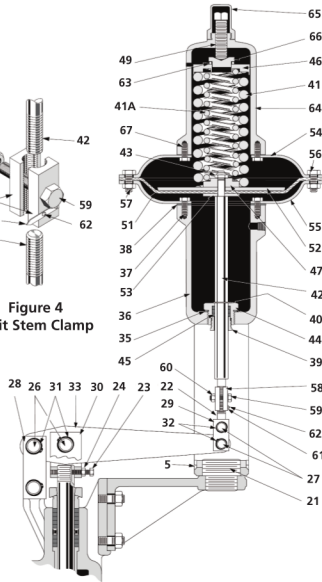


Figure 3  
No. 38 Reverse Actuator  
(Increasing air retracts stem)

Parts List

Ref. No.	Part Name	Ref. No.	Part Name
5	Drive Nut	45	Packing
21	Yoke Adapter	46	Spring Seat (Upper)
22	Stem Adapter	47	Spring Seat (Lower)
23	Anti-rotation Screw	48	Pipe Plug
24	Locknut	49	Spring Adjustor
26	Pin (Valve End)	50	Bushing(Spring Adjustor)
27	Pin (Actuator)	51	Diaphragm
28	Link (Valve End)	52	Diaphragm Plate
29	Link(Actuator End)	53	Diaphragm Washer
30	Clevis	54	Upper Diaphragm Case
31	Snap Ring	55	Lower Diaphragm Case
32	Snap Ring	56	Cap Screw (Diaph. Case)
33	Lever	57	Nut (Diaph. Case)
35	Gasket ( Packing Box)	58	Stem Clamp
36	Yoke	59	Clamp Screw
37	Cap Screw(L.Case to Yoke)	60	Clamp Nut
38	Gasket (L. Case to Yoke)	61	Travel Pointer
39	Packing Nut	62	Travel Pointer Screw
40	Snap Ring	63	Ball and Retainer
41	Actuator spring	64	Spring Barrel
41A	Actuator Spring	65	Spring Barrel Cap
42	Actuator Stem	66	Ball Bearing Race
43	Nut (Actuator Stem)	67	Cap Screw
44	Packing Box		



made. An additional 6 to 12 mm adjustment (step 4) of the stem adapter is unnecessary. With the reverse actuator, seating force is provided by air pressure above the maximum value of the spring range, so marking of the actuator stem is also unnecessary.

### 6.4.3 67 and 68 - Piston Cylinder Double Acting Actuator

Mounting and adjustment of the 67 and 68 actuator is done in the same way as with the No 38 actuator.

Air pressure is applied to the actuator to the required stroke of the valve and the connections are made. An additional 6- 12 mm adjustment of the stem adapter is unnecessary. With the DA piston cylinder actuator, seating force is provided by the air supply pressure, so making of the actuator stem is also unnecessary.

## 6.5 Standard Packing

Packing box maintenance is one of the principle choose of routine servicing. Tightness of the packing is maintained by packing compression. Compression is achieved by evenly tightening the packing flange nuts (9) against the packing flange (7). Care must be taken not to overtighten as this could prevent smooth operation of the valve. If all compression is used up and the valve leaks, new packing is required.

**Caution : Valve must be isolated and the pressure vented before performing packing box maintenance.**

Proceed as follows :

- A. Loosen and remove packing flange nuts (9).
- B. Raise packing flange (7) and packing follower (6) up the valve stem.

**Note : They may be taped in place to keep them out of the way before proceeding.**

- C. Remove old packing (10) and lantern ring (11).
- D. Replace three new packing (10), lantern ring (11) and enough new packing (10) to fill the packing box.

**Note : The skive cut of each packing ring must be placed about 180 degrees apart.**

- E. Replace packing follower (6) and packing flange (7).
- F. Replace and tighten packing stud nuts (9).

**Caution : Do not overtighten.**

- G. Put valve back in service and tighten packing only as much as is necessary to stop leaking.

**Note : In an emergency, string packing may be used as a temporary repair only. It must be replaced with the correct packing as soon as possible.**

## 6.6 Grinding Plug (3) to Seat Ring (2)

If the valve leakage becomes excessive, a hand operation called lapping is necessary. In order to facilitate this operation, the plug and seat ring seating surfaces should be free of large scratches or dents. If there is a fair amount of damage, a remachining of the seating surfaces up to a depth of 0,4 mm is possible before lapping.

1. To perform the lapping operation, turn the body over and loosen the packing box nuts (9) so that when the plug is inserted it will rest against the seat ring by its own weight.
2. Using a good grade of fine grinding compound, apply to several spots equally spaced on the seating surface on the seat ring. After placing the seat ring into the body, insert the plug carefully until it is seated.
3. Install the bottom flange. Secure bottom flange, using good installation practice, alternating bolt torquing sequence for a four bolt pattern. The spacing between flanges around the periphery should be consistent within  $\pm 0,05$ mm.
4. Remove the pipe plug (25) from the bottom flange. Insert through this hole a threaded rod which will be screwed and jammed into the tapped hole in the upper portion of the plug. This rod having a T handle on the opposite end,



will be used to lap the plug to the seat. The T handle may be made by drilling a hole through a small piece of flat stock and fastening to the threaded rod by two locknuts.

- 5. Lapping is accomplished rotating the plug in short oscillating strokes. After 8 to 10 strokes, the plug should be lifted and turned 90° before repeating the operation. This intermittent lifting is important to keep the plug and seat ring concentric during lapping. It is advisable to mix a small quantity of lubricant such as graphite with the grinding compound. This will slow the cutting rate and avoid tearing the seating surface. The amount of lapping required depends on the

materials of construction, condition of the seating surfaces and accuracy of machining.

If a short period of lapping does not visibly improve seating, there is usually no advantage in continuing as too much lapping may result in rough seats or

small ridges on the plug or seat ring. The only remedy is replacement of one or both parts. When lapping new plug and ring, begin with coarse compound and finish with fine. Old (used) parts should only be lapped with a fine grade of compound.

Disassemble and clean the seating surfaces of the plug and seat ring.

Coupling of Lever (33)  
on Actuator

