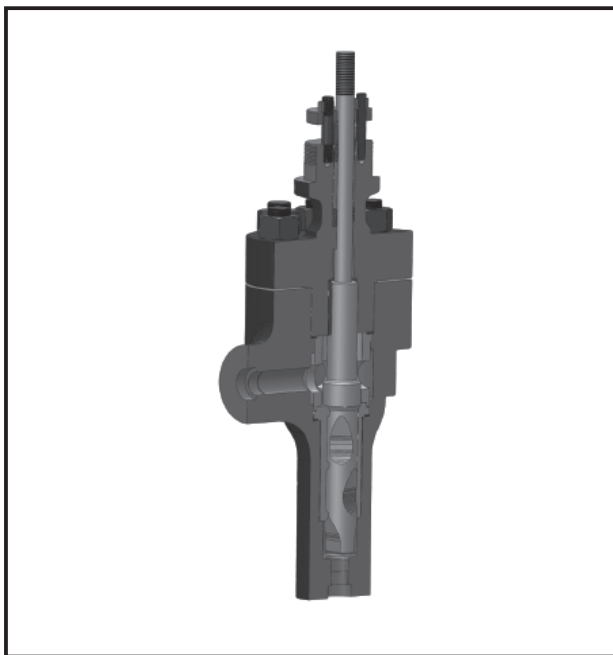


Instruction Manual

MIL 76000

High Pressure Letdown 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.



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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.

2. General

MIL 76000 series high pressure letdown valves are designed with angle body (side inlet and bottom outlet) to handle compressible fluids and flashing/two phase liquids effectively in high pressure applications, without body/ trim erosion, vibration and noise. Their angle design provides flow surfaces that slopes down permitting the valve to self-drain. Tight Shut-off Class IV leakage is standard. Optional constructions meet ANSI/FCI 70.2 Class V requirements. Optional Low Emission Packing (Eco-lock) is available to assure compliance with the fugitive emission norms. MIL 76000 has single and multi stage trim options. Single stage design allows high flow capacity with contoured plug and clamped seat ring design. Body outlet flow passage is protected by seat ring liner, which ensures long life by limiting erosion of the body flow path area. The liner is easily replaceable in case of any wear

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.

For higher pressure drop applications, Multi-stage trims are employed. Multi-stage trim incorporates a unique design, which integrates the advantage of multi-stage pressure reduction with gradually expanding area, to reduce fluid velocity and the resultant noise generation. Individual pressure drop stages in the valve trim are designed to accommodate the increased specific volume of the medium with reduced fluid velocity. Due to the unique flow path in the valve trim, the fluid is forced through a zig-zag flow path, dissipating the energy and maintaining low noise levels, when the valve is in operation. These installation and maintenance instructions apply to all sizes and ratings of the MIL 76000 series control valves regardless of the type of trim used. Recommended spare parts required for maintenance are listed in parts reference of page 9. The model number, size, rating and serial number of valve are shown on the identification tag located on the actuator. Refer to Figure 1 to identify valve nomenclature.

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.

Numbering System

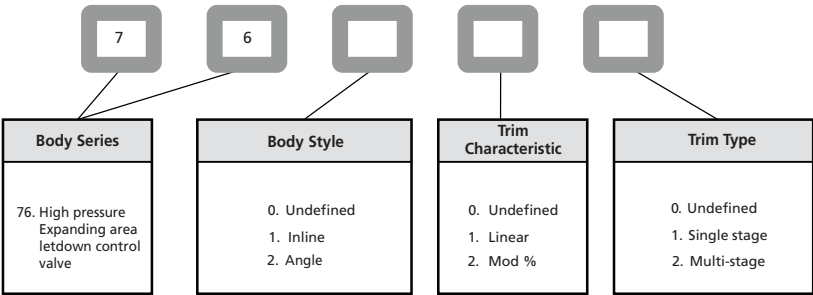


Figure 1

4. Installation

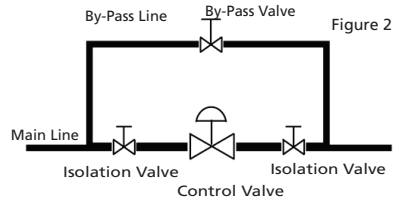
Caution: Before installing the valve in the line, clean piping and flush the line to remove all foreign material such as welding chips, scale, oil, grease or dirt. End flange gasket surfaces must be thoroughly cleaned to ensure leak proof joints.

To allow in-line inspection, maintenance or removal of the valve without service interruption, provide a manually operated stop valve on either side of the MIL 76000 series valve with a manually operated throttling valve

Caution: The valve must be installed so that the controlled substance will flow through the valve in the direction indicated by the flow arrow located on the body.

mounted in the by-pass line. (See figure 2)

Unless otherwise specified, the recommended orientations is flow to close.



Caution: Where insulation of the valve body is required, do not insulate the valve bonnet. Take necessary protective measures for personal safety.

5. Air Piping

Unless otherwise specified, the connection to the actuator tubing shall be 1/4" NPT or 1/2" NPT. Use the tubing equivalent or higher to the connection size. Refer MIL valve specification

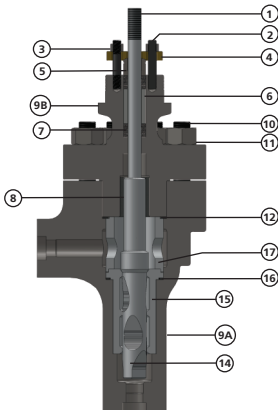
sheet of respective valves for more details. All connection joints should be free of leaks.

Warning : Do not exceed supply pressure indicated on tag plate located on the yoke of the actuator.

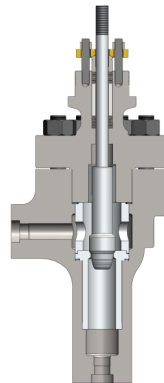
6. Body Disassembly

Caution: New packing & gaskets sets should be on hand before disassembling the valve, since it is recommended that new packing & gaskets be used during reassembly.

Access to the internal components of the body should be accomplished with the actuator removed. To remove the actuator from the body, refer to the appropriate actuator instructions.



Multistage Trim Design



Single stage Trim Design

Figure 3

Warning: Prior to performing maintenance on the valve, isolate the valve and vent the process pressure. Cut off supply air line and pneumatic or electric signal line.

Note : Spiral wound gaskets (12 & 16) are standard in the 76000 series design and it is imperative that new gaskets be installed each time the valve is disassembled.

After removing the actuator, disassemble the body using the following procedure:

- A. If there is a leak detection connection on the lateral NPT port of the bonnet, disconnect this piping as well.
- B. Remove body stud nuts (11).
- C. Remove bonnet (9B), and plug stem (1) and plug (14) sub-assembly together as one unit.
- D. Since the cage (17), seat ring (15) and seat ring gasket (16) are held in place by the bonnet, they may now be removed.
- E. Remove packing flange stud nuts (3), packing flange (4) and packing follower (5).

- F. Remove plug (14) and plug stem (1) sub-assembly from the bonnet (9B).

Caution : Care must be taken to avoid damage to the plug and plug guide.

- G. Remove existing packing (7) in the bonnet.
- H. All components may now be inspected for wear and service damage. After determining the maintenance required, proceed to the appropriate section of this instruction manual.

7. Maintenance & Repair

The purpose of this section is to assist maintenance personnel by suggesting methods of component maintenance, which is largely dependent on the tools and machine shop equipment available.

7.1 Guide Bush Removal

The guide bush (8) is press fit into the bonnet and does not normally require replacement. If necessary, it may be pulled or machined out. When machining the bush out, care must be taken to maintain proper dimensions and tolerances in the bonnet. These will be furnished upon request.

7.2 Lapping Seats

Lapping is the process of working the valve plug against the seat ring with an abrasive to produce a close fit. If valve leakage is excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or other defects, and the contact surfaces of the seats should be as narrow as possible. This may require dressing both parts in a lathe. A good grade of fine grinding compound is required for the lapping operation. The compound should be mixed with a small quantity of lubricant such as graphite. This will slow the cutting rate and prevent tearing of the seating surfaces. The amount of lapping required depends on the materials, condition of 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 excessive lapping may result in rough seats. The only remedy is replacement or re-machining of one or both parts. When lapping new plugs and seat rings, begin with a medium compound and finish with fine compound.

Note : Lapping should produce a line contact area, not the entire surface, due to the difference in seat angles. The seating surface angle of the plug is 28 degrees and the seat ring is 30 degrees (relative to the centerline axis).

Caution : Before lapping, the plug and stem sub-assembly must be concentric. (See pinning operation, section 7.3).

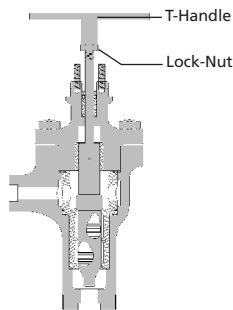


Figure 4

1. Clean body gasket surface areas.
2. Install a new seat ring gasket (16) and insert seat ring (15) in the body.

Note : Gasket (16) 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.

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

Caution: The gasket used for lapping should not be reused for the body reassembly.

3. Apply lapping compound at several spots equally spaced around the seating area of the seat ring.
4. Insert the cage (17) into the body (9A).
5. Insert the stem and plug sub-assembly carefully into the body until it is seated.
6. Place bonnet (9B) on the body (9A).

Caution : Ensure that the seat ring (15), cage (17) and bonnet (9B) are properly aligned.

7. Fasten the bonnet to the body using four body stud nuts (11) spaced equally apart. Apply slight pressure and tighten evenly.

Caution : Do not tighten nuts to final torque specifications at this time. The bonnet is used temporarily for guiding purposes only.

8. Insert two or three pieces of packing into the packing box to assist in guiding the stem and plug during lapping.
9. Screw a drilled and tapped rod with a T-handle onto the plug stem and secure with a locknut (see Figure 4).

Note : As an alternative, drill a hole through a flat steel plate and fasten to the plug stem using two locknuts.

10. Apply slight pressure on the stem, and rotate the stem in short oscillating strokes (around 8 to 10 times). Repeat this step as necessary.

Caution: Avoid over-lapping as this can cause damage to the seating surface rather than improve leakage performance.

Note : The plug should be lifted and turned 90° each time before repeating Step (10). This intermittent lifting is required to keep the plug and seat ring concentric during lapping.

11. After completion of the lapping operation, remove bonnet and internal parts. The seating area of the seat ring and the plug must be cleaned of all lapping compound in preparation for reassembly.

7.3 Plug Stem Pinning

Plug stem pinning in the field may be required for the following:

- Replacing of existing plug and stem, or
- Replacing of existing stem only

7.3.1 Replacing of Existing Plug and Stem

If it is necessary to replace the plug, then the plug stem must be replaced at the same time. The original pin hole in an existing stem will not provide the necessary fit, and might seriously impair the strength of the assembly.

A. Reference Marking on the Plug Stem

Measure the depth of the pilot recess in the plug (Dimension X in Figure 5), and make a reference mark on the plug stem at the same distance from the thread.

Note: While pinning is being performed, care must be taken not to damage the seating surface or plug guide. Always use a soft metal or plastic vice jaws with cylindrical features to hold the plug guide area (see Figure 5).

B. Screwing Stem to Plug

Hold the plug (with vise jaw assembly) in a vise.

Lock two nuts against each other on the end of the new plug stem, and screw the stem solidly into the plug using a wrench on the upper nut. When properly assembled, the reference mark (see Section A above) should be flushed with the end

of the plug guide.

C. Drilling the New Parts

If the plug is already fully drilled (typical for 440C hardened stainless steel material or solid stellite), then drill the stem to the same diameter (diameter C in Figure 5) as the plug shank hole.

If the plug guide area has a center mark,

- Place the plug guide on a V-block and use a suitable drill size to either:
- Match the hole size in the plug, or match diameter C (see Figure 5)
- Drill through the plug-stem assembly.

If the plug guide area does not have any

hole or any center mark,

- Measure dimension D based on the plug guide diameter and stem diameter (see Figure 5).
- Place the plug guide on a V-block, and make a center mark on the plug guide area using a center punch.
- Drill through the plug-stem assembly using a suitable size drill bit.

In all cases after drilling : Remove any burrs from the plug guide hole by making a slight chamfer.

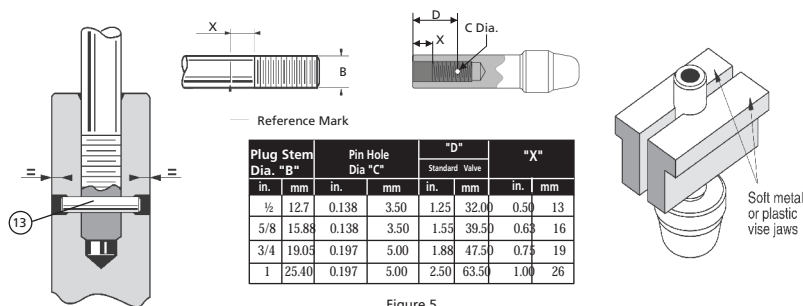


Figure 5

Plug Stem Pinning

D. Pinning the Plug-Stem Assembly

Select the correct size pin based on the plug guide diameter and stem diameter (see Figure 5). Apply a small amount of grease on the pin and hand assemble it into the hole in the plug.

Press fit the pin into the hole using a hammer. Complete the pinning operation by taking care to ensure that the pin is recessed by the same amount at both sides (see Figure 5).

After the plug has been pinned, it should be placed in a lathe to insure it is concentric with the stem. If the assembly is not running true, then the stem should be placed in a collet with the plug guide against it and the plug should be adjusted. Alignment of plug stem can be performed by means of a soft faced mallet.

Note : If it is necessary to drill out the pin, use a drill bit slightly smaller than the pin diameter.

Hold the plug guide in a vise.

Lock one nut against another at the end of the plug stem. Using a wrench on the lower nut, unscrew the stem from the plug. The stem is removed by turning it counterclockwise.

B. Screwing Stem to Plug

Refer to step B of the previous section on 'Replacing Plug and Stem'.

C. Drilling the New Stem

Place the plug guide on a V-block and use a suitable size drill bit to drill the stem (use the hole in the plug as a guide).

Note : If the hole in the plug guide has been slightly damaged while removing the old pin, choose a drill bit and a pin with a slightly larger diameter than the normal pin.

7.3.2 Replacing of Existing Stem Only

A. Removing Existing Pin and Stem

Place the plug guide on a V-block and use a drift punch to drive out the old pin.

D. Pinning

Select the correct size pin based on the plug guide diameter and pin hole diameter. Proceed as described in part D of the previous section 'Replacing Plug & Stem', taking care not to damage the plug guide area. Ensure plug stem alignment following the pinning operation.

7.4 Packing Box (Figures 6 to 8)

Packing box maintenance is one of the principal actions in routine servicing. Tightness of the packing is maintained by packing compression. Compression is achieved by evenly tightening the packing flange nuts (3) against the packing flange (4). Care must be taken not to over tighten as this could

prevent smooth operation of the valve. If all compression is used up and the valve leaks, then new packing is required. The packing is available as a set of lower and upper packing. The height of the lower and upper packing set is same for standard packing. Due to the difference in the height for Eco-lock packing, the packing sets are labeled as lower packing and upper packing. The upper packing set will be larger than lower packing set for Eco-lock.

Note: While replacing packing, replace the upper packing set completely

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

Proceed as follows :

- Disconnect the actuator stem from the valve to maintain a gap to insert the packing set
- Loosen and remove packing flange nuts (3).
- Raise packing flange (4), and packing follower (5) up the valve stem.

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

- By means of a hooked instrument, remove packing (7) ensuring not to damage the sealing surfaces of the packing box or plug stem.

- Replace packing (7) referring to Figure 6 for correct amount of packing to place above the spacer.

Note : Assemble and compress rings one at a time into packing box. If rings are skive cut, the skive cut of each packing ring must be placed about 120 degrees apart.

Note: For any type packing do not change the sequence of packing arrangement. Use the packing as a set only.

Note: MIL Ecolock packing (Fig 7) is a high performance system to keep fugitive emissions within allowable limits. The packing is provided with the inner packing and outer packing as a set. It consists of V and double V packing rings with varying density, which is designed to prevent fugitive emission from the packing effectively.

Caution: For Eco-lock packing, inner and outer packing to be replaced as a set only.

- Replace packing follower (5) and packing flange (4).
- Replace and tighten packing stud nuts (3).

Caution: Do not over-tighten.

- 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.

Note: A spring loaded follower assembly is used to maintain a constant load on the packing, and is necessary for thermal cycling applications. As the definition of thermal cycling can vary, and processes are potentially subject to unpredicted thermal gradients. Both standard and Eco-Lock systems are available with the spring loaded follower (Figure 8).

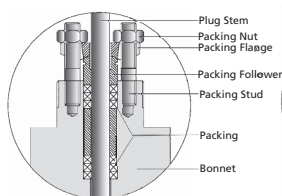


Figure 6
Standard Packing Box

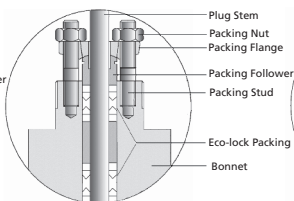


Figure 7
Eco-Lock

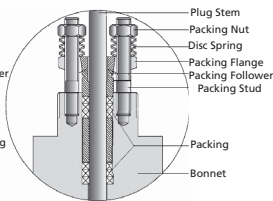


Figure 8
Standard Packing Box With Live Loading

Caution: Packing box should be clean and free of burrs, rust, and any foreign matter. Parts can be cleaned with denatured alcohol.

8. Valve Body Reassembly

After completion of the required maintenance, the valve should be reassembled using the following procedures:

Note: If any of the following steps were completed during maintenance, then proceed to the next step.

- Clean all gasket mating surfaces.
- Install seat ring gasket (16) and seat ring (15).

Note: Spiral wound gaskets (12 & 16) are standard in the 76000 series design. It is imperative that a new gasket be installed each time the valve is disassembled.

- Install cage (17).
- Carefully install plug and stem assembly.
- Install body gasket (12).
- Assemble bonnet (9B) and body stud nuts (11) and tighten. Bonnet must be

Note: Valve should be lapped before final assembly. See Section 7.2 on 'Lapping Seats'.

positioned so the packing flange studs are at 90° to the flow center line.

Caution: Care must be taken to ensure that the cage, seat and bonnet are properly aligned in the body. Tighten nuts (11) until metal to metal contact is obtained with proper bolt torque. Refer to Figure 9 for proper bolt torque and tightening sequence specifications.

Note: Cage should be installed in such a way that, any one of the hole in the cage (17) and body inlet bore shall be inline.

Valve size (inch)	ASME Rating Class	Stud size	Qty (Nos)	Torque (Nm)
1 to 2	150-600#	M16x2	8	60
	900-1500#	M24x3	8	170
	2500#	M27x3	8	320

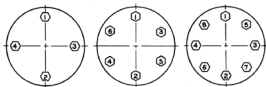
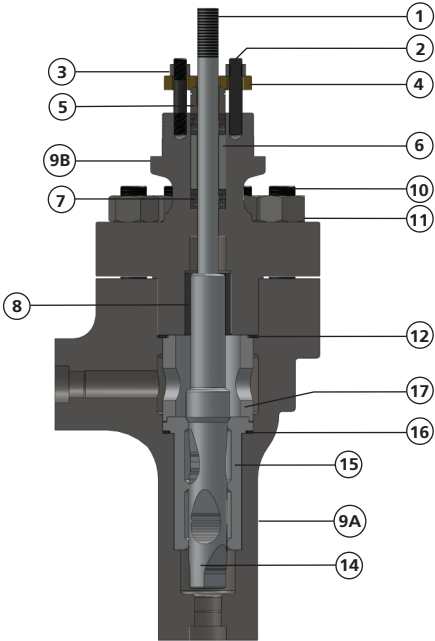


Figure 9 - Bolting Torques And Tightening Sequence

- G. Insert lower packing set (7) and lantern ring or spacer (6). Refer to Section 7.4 for proper packing assembly procedure for standard or optional designs.
- H. Install upper packing set and packing follower (5) and packing flange (4).
- I. Install packing flange stud nuts (3).

Caution: Do not overtighten (See Section '7.4. Packing Box').

- J. For actuator assembly and plug stem adjustment, proceed to the actuator instruction manual.



Parts List

Sl No	Part List
1	Plug Stem ^
2	Packing Flange Stud
3	Packing Flange Nut
4	Packing Flange
5	Packing Follower
6	Packing Spacer
7	Gland Packing ^
8	Guide Bush
9A	Body

Sl No	Part List
9B	Bonnet
10	Body Stud
11	Body Nut
12	Body Gasket ^
13	Plug Pin ^
14	Valve Plug ^
15	Seat Ring ^
16	Seat Ring Gasket ^
17	Retaining Cage

^ Recommended Spare Parts

IMPORTANT

In normal process control applications, expected life cycle of a control valve is 25 years with periodic maintenance and replacement of wear parts. We recommend inspection of valves in critical loops during all plant shutdowns.

Soft parts like gland packing, gaskets, seal rings etc are recommended to be replaced with OEM parts every time valve is opened for maintenance. Metallic Wear parts like plug, seat ring, cages etc are to be inspected in the event of performance deterioration and should be replaced if found necessary. Damage, if any, noticed to valve body and bonnet also should be replaced or repaired.

After the life-cycle, we recommend to dispose the parts as per your established procedures, through approved agencies only.



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