

77000 & 77003 Series

Axial Flow, Labyrinth Trim Control Valves

Instruction Manual (Rev.D)



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Safety Information

Important - Please read before installation

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



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



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



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



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



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

Note: Indicates important facts and conditions.

About this Manual

- The information in this manual is subject to change without prior notice.
- The information contained in this manual, in whole or part, shall not be transcribed or copied without Baker Hughes's written permission.
- Please report any errors or questions about the information in this manual to your local supplier.
- These instructions are written specifically for the 77000 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 77000 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™ 77000 Series** control valves.

The Masoneilan 77000 Series is part of Baker Hughes's severe service portfolio, and may be 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 77000 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

Numbering System

closest to you.

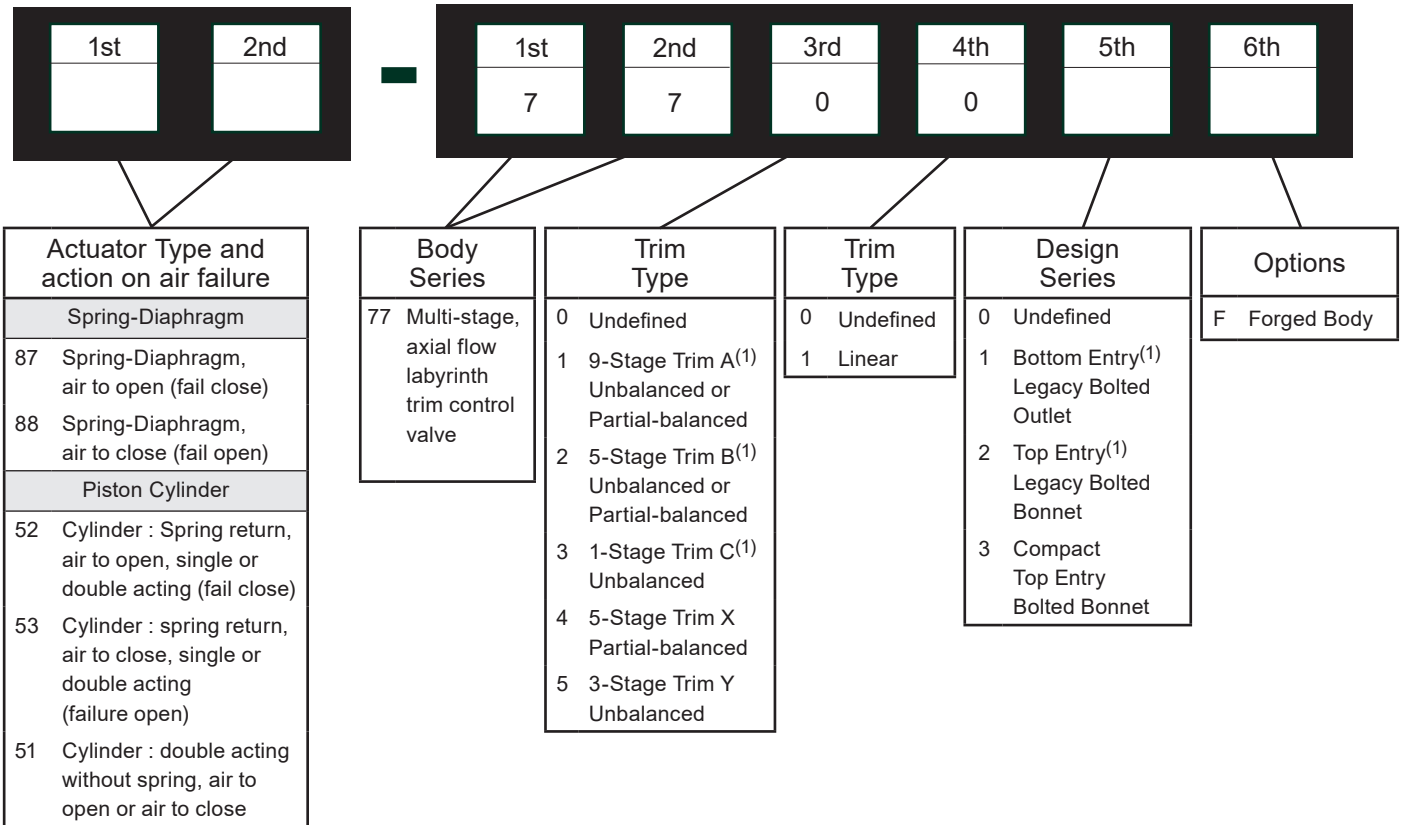
Spare Parts

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

When ordering spare parts, the model and serial numbers indicated on the manufacturer's serial plate must be given. The serial plate is on the side of the actuator yoke.

Actuator and Accessories

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



Unpacking

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

Installation

CAUTION

The 77000 Series valve must always be installed with the flow tending to open the valve plug. For applications where insulation of the valve body is required, do not insulate the valve bonnet when possible.

Recommended Installation

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.

For best acoustical performance provide a minimum of 10 pipe diameters of straight pipe length at the exit of the valve before installation of any pipe bends or additional equipment.

For applications involving flashing or erosive service it is highly recommended to include a minimum of 20 pipe diameters for best system performance.

Handling

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

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.

WARNING

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.

If major system or piping modifications (or repairs) are performed, thorough flushing and blowdown of the system will be required prior to reinstalling the 77000 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

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

Hydrostatic Testing and Line Cleaning

During this operation, the control valve must not be used as an isolating valve. This means that the valve must always be opened before carrying out pressure tests in the process line, cleaning of pipes, etc. Otherwise equipment damage or failure of the seal rings could result. Flushing and hydrostatic test equipment can be purchased from the Masoneilan 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

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

CAUTION

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 damaging any soft goods. 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.

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, actuator stem, and lever connectors as described in the following sections.

Note: *The 77000 Series is an up-seating control valve design, which is the opposite action of most reciprocating control valves. For this design air-to-extend actuators will use the plant supply air to open the valve and air-to-retract actuators will use the plant supply air to close the valve.*

Air-to-Extend (Open) Actuators

Lever and Linkage Removal

Apply sufficient air pressure to the actuator to extend the stem completely and take the plug off of the seat. Remove the Body Clevis Retaining Rings (22) and Actuator Link Retaining Rings (29); along with the respective link pins (21) and (28). Unscrew the actuator connector link (27) from the actuator stem connection. Disengage and remove the lever (23), Body Clevis (20), and for sizes 1" to 3" remove the Actuator Link Clevis (37) from the valve assembly.

Actuator Removal

Disconnect all electrical and air connection to and from the actuator.

Disassemble drive nut (32) and attachment screws, and lift actuator off of the valve being careful not to damage the drive nut threads.

Valve Disassembly 77001 and 77002 Series

The valve must always be reassembled with new packing set and gaskets. Before disassembly, make sure the recommended spare parts are available for reassembly. Refer to Parts Reference Table (page 10) and Figures 11-12 (pages 11 and 12).

1. Disconnect the piping to the leak detector or lubrication connection on the body/bonnet (if applicable).
2. Unlock the lock nut (26) and remove the anti-rotation screw (25) then unscrew the stem pivot adapter (24) from the plug stem (5). Loosen the packing box nuts (16) to reduce the friction of the packing on the plug stem.

For Bottom Entry 77001 Series Designs follow disassembly instructions 3-8:

3. Remove the spool nuts (10) from the bottom entry spool (2) section on the valve. Remove the spool (2) from the body (1), along with the lower spider gasket (7). Remove the spider (4) from inside the valve body. If the spider is difficult to remove you may nudge it out by applying downward force on the plug stem (5). Remove the upper spider gasket (8).

Note: *Some designs may be equipped with an integral spider as part of the bottom entry spool. For these designs remove the spool and associated gaskets and proceed to step 4.*

4. Remove the plug stem (5) along with the seat ring (3).

CAUTION

Be careful not to damage the plug stem (5) or the seat ring (3) while removing these parts from the body. Scratches or damage to these parts can result in leakage and premature wear.

5. Remove the packing flange nuts (16), packing flange (14), and packing follower (13).
6. Remove the old packing set (11) and lantern ring (12).

Note: *Lantern ring is applicable only for units with the optional leak detector option.*

7. Remove the upper stem guide bushing (6).
8. Inspect the body (1), spool (2), seat ring (3), spider (4), and plug stem (5) for any visual defects or damage. Carefully inspect the dynamic sliding surfaces and seal interface areas.

Ensure all parts are clean, particularly the seating surfaces prior to reassembly.

For Top Entry 77002 Series Designs follow disassembly instructions 9-15:

9. Remove the packing flange nuts (16), packing flange (14), and packing follower (13).

- Remove the bonnet nuts (10) and pressing down on the stem remove the top entry bonnet (2) from the valve body (1). While removing the bonnet the old packing set (11) and lantern ring (12) may also pull away from the stem. These parts should be removed at this time.

Note: Lantern ring is applicable only for units with the optional leak detector option.

- Remove the bonnet gasket (34) and upper stem guide bushing (6) from the valve body.
- Using the threaded lifting holes and eye bolts remove the seat ring retainer (33) from the valve body.
- Using the threaded lifting holes and eye bolts carefully lift the seat ring (3) from the valve body while paying close attention to not damage the plug stem (5) or seat ring (3) parts. Next remove the plug stem (5).

CAUTION

Be careful not to damage the plug stem (5) or the seat ring (3) while removing these parts from the body. Scratches or damage to these parts can result in leakage and premature wear.

- Remove the lower guide bushing (35), spider (4), upper spider gasket (8), and lower spider gasket (7) from the valve body.
- Inspect the body (1), bonnet (2), seat ring (3), spider (4), and plug stem (5) for any visual defects or damage. Carefully inspect the dynamic sliding surfaces and seal interface areas.

Ensure all parts are clean, particularly the seating surfaces prior to reassembly.

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 service. Tightness of the packing set (11) is maintained by proper compression. Compression is achieved by evenly tightening the packing flange nuts (16) against the packing flange (14). Periodic re-tightening of the packing flange nuts may be required to maintain proper sealing,

CAUTION

Care must be taken to not 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.

CAUTION

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

Packing Replacement

For top entry designs, disassembly of the valve bonnet from the body is recommended before replacing the standard Teflon V-Ring packing.

Other packing types can be replaced without removal of the bonnet.

Use the following procedures to replace existing packing:

- Loosen and remove the packing flange nuts (16).
- Remove the packing flange (14) and packing follower (13).
- Remove the old packing set (11) and lantern ring (12).

Note: Lantern ring is applicable only for units with the optional leak detector option.

- Replace packing (11) and lantern ring (12) if applicable, referring to Figures 4 through 9 for correct number of packing rings.

Note: For Teflon packing, assemble new packing with the cuts in the rings 120° apart from the adjacent ring. Press rings into the packing box one at a time.

- Reassemble the packing follower (13) and the packing flange (14).
- Tighten the packing flange nuts (16) without over compressing the packing rings.
- For graphite packing, open and close the valve several times then retighten the packing as required.
- Place the valve back into service and check for leakage. Tighten packing flange nuts (16) as required.

Parts Repair

Carefully examine parts for any scratches, unusual wear, or other visual damage prior to reassembly. Always clean trim parts before reinstalling in the valve.

Guiding Surfaces

Guiding Surfaces including the upper stem guide bushing (6), plug stem (5), and lower guide bushing (35) available on the top entry design or spider guide (4) as shown on the bottom entry design must be checked. If there is only slight wear indications, then use a light abrasive to smooth out the specific guiding surface areas. Parts with greater damage or wear on the guide surfaces must be replaced.

Guiding surfaces are hard-coated and excessive removal of surface material can expose base material.

Seating Surfaces

The seat ring (3) and plug stem (5) seating surfaces shown in Figure 1 must be completely free of dents, scratches, wear, or other visual damage. If the valve demonstrates excessive leakage or shows signs of deterioration on the seating surfaces the parts may be refurbished in accordance with the following guidelines.

Seat Lapping

Seating surfaces may need to be lapped in order to restore the necessary surface integrity to meet valve leakage requirements. Prior to lapping ensure the plug and seat ring seating surfaces are free from large scratches or dents. Remachining of these surfaces may be necessary. If so a maximum of .015" (0.4mm)

metal removal from both the plug and seat seating surfaces is allowable for any valve size.

Seating Surfaces: Make sure the seating angles on the reworked parts are within the specified tolerances as shown in Figure 2 below. Parts requiring more metal removal to restore should be discarded and replaced.

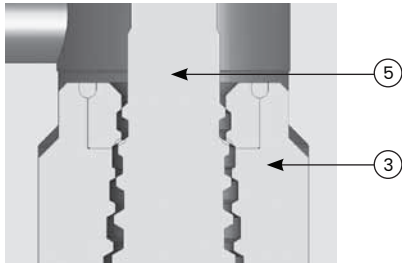


Figure 1: Plug and Seat Surfaces

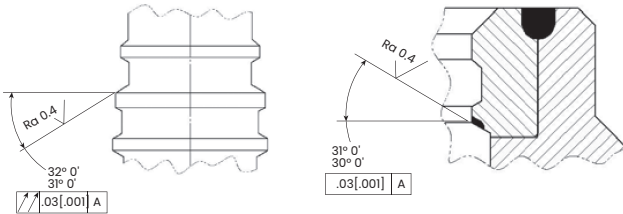


Figure 2: Plug and Seat Ring

1. Clean body gasket surface areas.
2. If lapping is to be done outside of the body ensure the seat ring (3) is set on a flat and stable surface and proceed to step 5.
3. For lapping done with the trim installed inside the body, install new gaskets into the valve to ensure the ideal geometric characteristics in order to have the correct position of the seat ring during lapping.

Note: The gaskets used during lapping must not be reused for the body reassembly.

4. Loosen the packing flange nuts (16) to remove friction and allow the plug (5) to rest against the seat ring (3) by its own weight.
5. Spread a fine layer of high quality lapping compound (600 grit) on the seating surface of the seat ring. If lapping with the trim installed inside the valve, insert the seat ring (3) into the valve body (1).

⚠ CAUTION

Do not allow the lapping compound to get onto plug or nonseating stages of the seat ring.

6. Insert the plug (5) carefully into the seat ring (3) until it is seated.

Note: It is highly recommended to assemble the valve completely including using new gaskets before lapping the valve. Assembly with the top entry bonnet or bottom spool aligns the trim parts and improves the integrity of the surface geometric characteristics.

7. Place an appropriate tool on the valve stem (5) threads to allow for manual rotation. Options for creating a manual resurfacing tool include using a T-handle secured with a locknut, or using a flat piece of steel with a drilled hole and two locknuts to fasten to the valve stem (5).
8. Lapping of the seat ring (3) is accomplished by rotating the plug (5) in short oscillating strokes. After 8 to 10 strokes, lift the plug (5) and repeat the operation three or more times in increments of 90°, 180°, and 270°, from the original position.

Note: Performing the operation at various increments is critical in maintaining concentricity between the parts during lapping.
9. Lapping can be repeated, but should be limited as much as possible so that the seat line remains sufficiently narrow to guarantee tightness.
10. After lapping, disassemble the parts to clean them and then reassemble, making sure the seating angles are within tolerance as shown in Figure 2.

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 (items 7, 8 and 34 for top entry designs) must always be replaced after disassembly.

Valve Reassembly

After completing the recommended maintenance and repair actions noted above, reassemble the valve using the following procedure.

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

Make sure any recommended lubricants or sealing compounds are compatible with the process fluid. Use acceptable substitutes as required.

For Bottom Entry 77001 Series Designs follow disassembly instructions 1-4:

1. Install the upper stem guide bushing (6) into the top end of the body (1).
2. Install the seat ring (3) into the body and carefully lower the plug stem (5) into the seat ring using caution to not damage any surfaces.

⚠ CAUTION

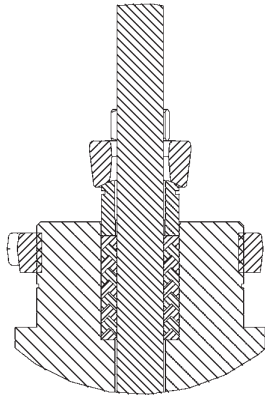
Be careful not to damage the plug stem (5) or the seat ring (3) while removing these parts from the body. Scratches or damage to these parts can result in leakage and premature wear.

3. Coat the upper spider gasket (8) lightly with gasket compound and secure on top of spider (4). Insert spider into the valve body over the plug (5) until it makes contact with the seat ring (3). Install the lower spider gasket (7) over the spider.

Note: Some designs may be equipped with an integral spider as part of the bottom entry spool. For these designs there will not be a lower spider gasket as it is a one piece construction.

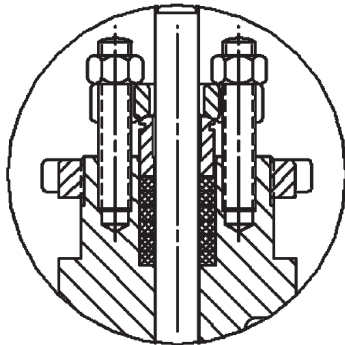
Packing Box Assembly

Visually inspect the stem & packing box for cleanliness and proper surface finish. Lubricate the I.D. of the packing box with Never-Seez or equivalent. Assemble the packing box components per the maintenance instructions on page 5.



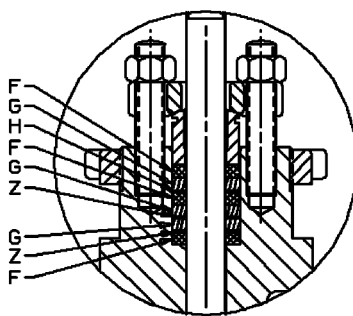
1 V-Ring Packing Adapter 7 Pieces: V-Ring Packing

Figure 4: Standard Packing



6 Pieces: 285C 6 Pieces: Latty 326.1

Figure 5: 285C or Latty 326.1M Packing



F-3 Pieces: Filament Graphite
G-3 Pieces: Graphite Ring
Z-3 Pieces: Zinc Washer

Figure 6: Graphite Packing

Low-E Packing (Optional)

The Masoneilan Low-E (Low Emissions) Packing is a high performance packing system capable of containing fugitive emissions well below the specifications of the most severe recommendations. It is also available in a firesafe configuration.

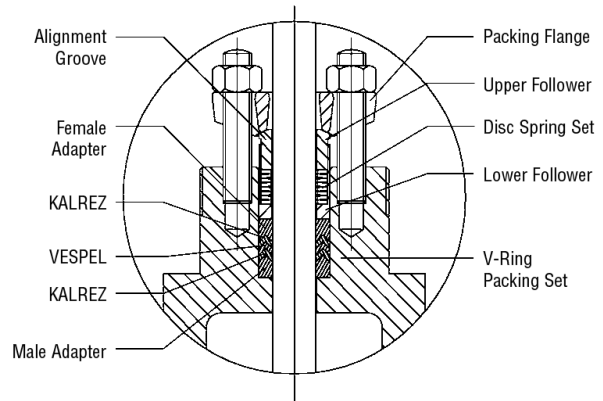


Figure 7: Low-E Packing Configuration (Shown in Loaded Position)

Packing Set		Follower Assembly	
Part	Qty	Part	Qty
VESPEL Female Adapter	1	Upper Follower	1
KALREZ V-Ring	2	Disc Spring	8
VESPEL V-Ring	1	Lower Follower	1
VESPEL Male Adapter	1		

The packing is provided as a set of five pieces. It consists of two adapter rings and three V-rings. An alternating pattern of Perfluoroelastomer (PFE) and long carbon fiber filled Teflon (PTFE) V-rings are used.

Applied properly, this packing exhibits very little cold flow (or creep). Consequently, it can effectively prevent fugitive emissions leaks from a control valve. The Low-E Packing system can directly replace conventional packing, requiring no modification to the control valve or actuator.

A spring loaded, two-piece 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, Low-E Packing is only available with the spring loaded follower.

Installation should be performed as detailed in the following paragraphs.

Preparation

Stem

Inspect stem for any nicks or scratches on the surface finish. Reject the stem for any of these reasons as they may damage packing.

Note: A properly etched part number on the stem in the packing area will have no adverse effect on the performance of the packing.

Stem finish should be 3-7 AARH (Ra 0,1/0,2).

Packing Box

Note: Bonnets that have a lube hole require installation of a lantern ring within the packing arrangement shown in Figure 8.

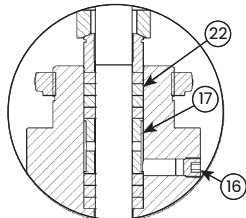
⚠ CAUTION

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

Note: Packing box finish should be 125 AARH (Ra 0.8) or better.

The packing box may be bored or honed oversize by up to 0.015" (0.38 mm) above the nominal diameter to improve the finish. For instance, a nominal 0.875" (22.22 mm) packing box may be bored or honed up to 0.890" (22.60 mm) and the Low-E Packing will still seal properly.

Packing box must be finished to the bottom of the bore.



View shown with graphite packing option and lantern ring with lube hole

Figure 8 - Packing Box

Packing

Inspect packing rings. DO NOT use packing if any nicks or scratches on packing are observed. Check packing and ensure that it is in the proper arrangement (see Figure 9). PFE material can be identified by the gloss black molded finish. PTFE material has a dull black machined finish.

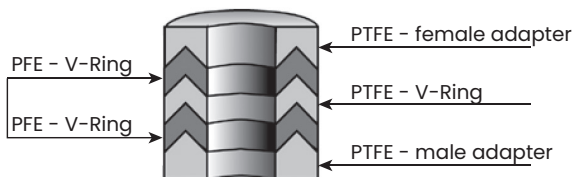


Figure 9

Spring Loaded Follower

The spring loaded follower (available for applications rated ANSI 300 and below) consists of an upper and lower follower and eight (8) disc springs (see Figure 10). The springs are installed inside the lower follower and positioned alternately. The assembly is held together by tape, which must be removed before installation.

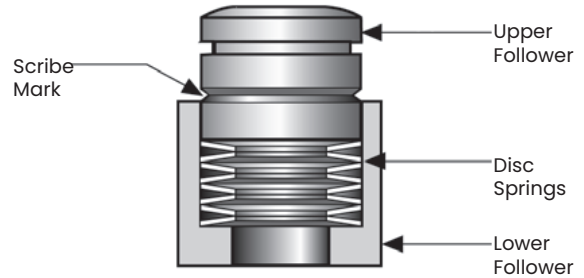


Figure 10 - Spring Loaded Follower

Packing Installation

1. The packing must be lubricated with Krytox® fluorinated grease prior to installation (Krytox GPL206 or equivalent).
2. Packing should be lubricated as a set (not individually) to minimize getting lubricant between the rings.
3. Packing should be lubricated with a generous application to the O.D. and I.D. of the packing set.

Note: All exposed surfaces of the packing set must be covered with the lubricant.

4. PFE/PTFE is to be installed as a set. Carefully slide the packing set down the stem. Do not cock or force the packing on the threads.

If the packing set separates while on the stem, do not remove. Continue installing the remaining pieces to put the set back together.

5. Gently press the packing into the packing box. Do not tap the packing down into the box.
6. The spring loaded follower is installed on top of the packing. This follower is installed as an assembly held together by tape. This tape should be removed after assembly. Proper assembly of the packing box will leave the top of the Lower Follower 0.25 - 0.50 inches (6 to 13 mm) above the bonnet.

A groove is scribed into the O.D. of the upper follower. The packing flange is tightened evenly until the top of the Lower Follower aligns with the scribe mark (groove) in the Upper Follower.

Note: This is the optimum loading for this packing. Further tightening will shorten life of the packing. Thread locking compound can be used on packing nuts.

7. The packing should be checked for leakage.
8. Packing load should be checked after the valve has cycled approximately 500 times. Adjust if necessary. No further adjustment should be required for the life of the packing.

Valve Travel Requirements

See table below for rated travel by specific valve size.

Valve Size		Travel	
inches	DN	inches	mm
1	25	0.25	6
2	50	0.25	6
3	80	0.38	10
4	100	0.50	13
6	150	0.50	13
8	200	1.00	25

Table 2: Valve Travel

Note: Actuator over travel of 0.12" (3 mm) past the rated travel noted above is necessary to achieve required seat loading.

Parts Reference Table

Item No.	Description
1	Body
2	Bonnet (Top Entry) or Spool (Bottom Entry)
3	Seat Ring
4	Spider
5	Plug Stem
6	Stem Guide Bushing
7	Lower Spider Gasket
8	Upper Spider Gasket
9	Body Stud
10	Bonnet/Spool Nut
11	Packing Set
12	Lantern Ring
13	Packing Follower
14	Packing Flange
15	Packing Flange Stud
16	Packing Flange Nut
17	Actuator Toggle Bracket
18	Bracket Stud
19	Bracket Nut
20	Body Clevis
21	Body Clevis Pin
22	Body Clevis Retaining Ring
23	Lever
24	Stem Pivot Adapter
25	Anti-rotation Screw
26	Locknut
27	Actuator Link Connector
28	Actuator Link Pin
29	Actuator Link Retaining Ring
30	Travel Stop Stud
31	Travel Stop Nut
32	Drive Nut
33	Seat Ring Retainer (Top Entry Design Only)
34	Bonnet Gasket (Top Entry Design Only)
35	Lower Guide Bushing (Top Entry Design Only)
36	Spud Adapter (Bottom Entry Design Only)
37	Actuator Link Clevis (Sizes 1" - 3")
38	Conical Spring (Top Entry Design Only)

•Recommended spare parts for each maintenance interval

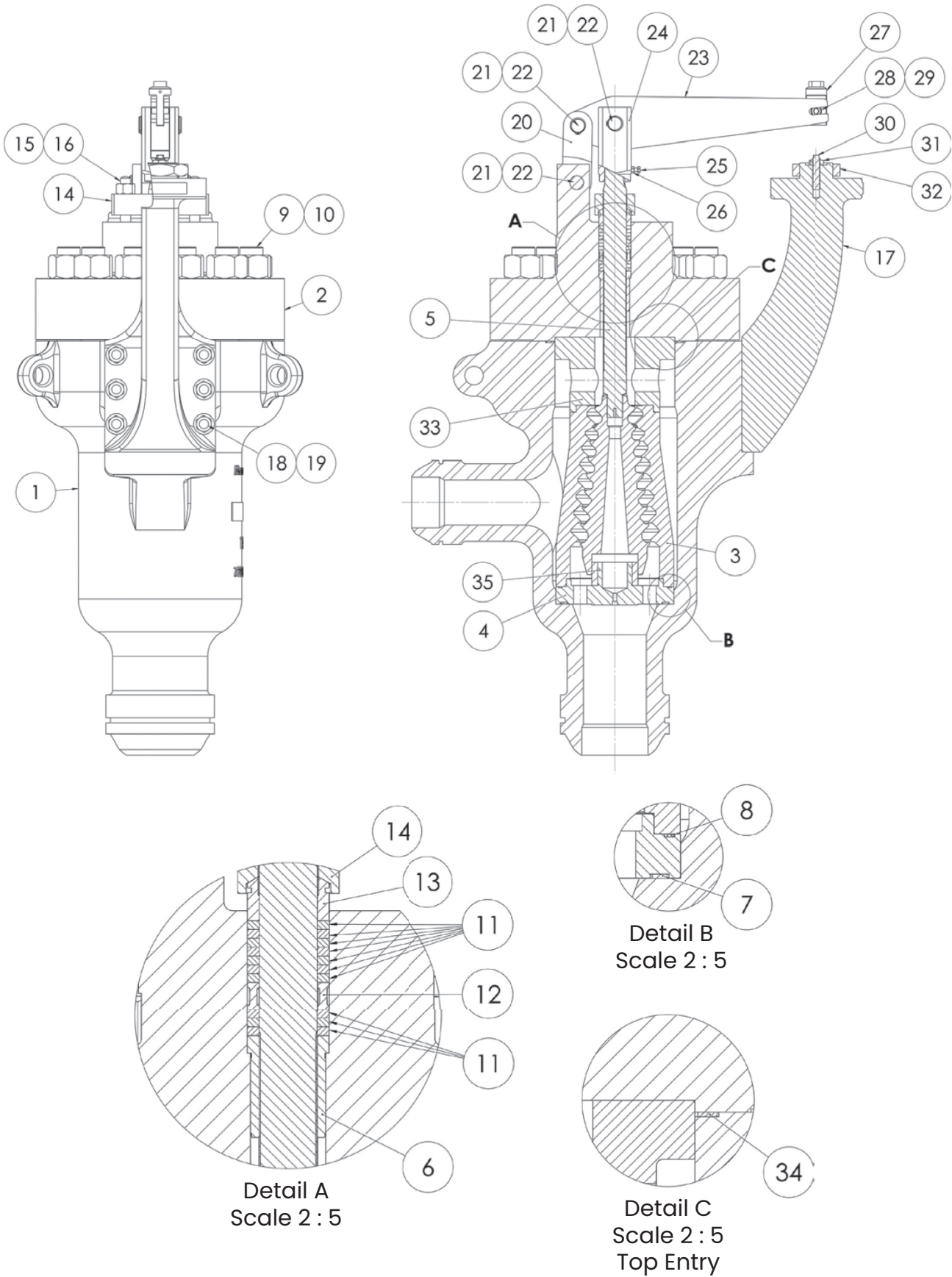


Figure 11: Parts Drawing for Bottom Entry 77001 Series

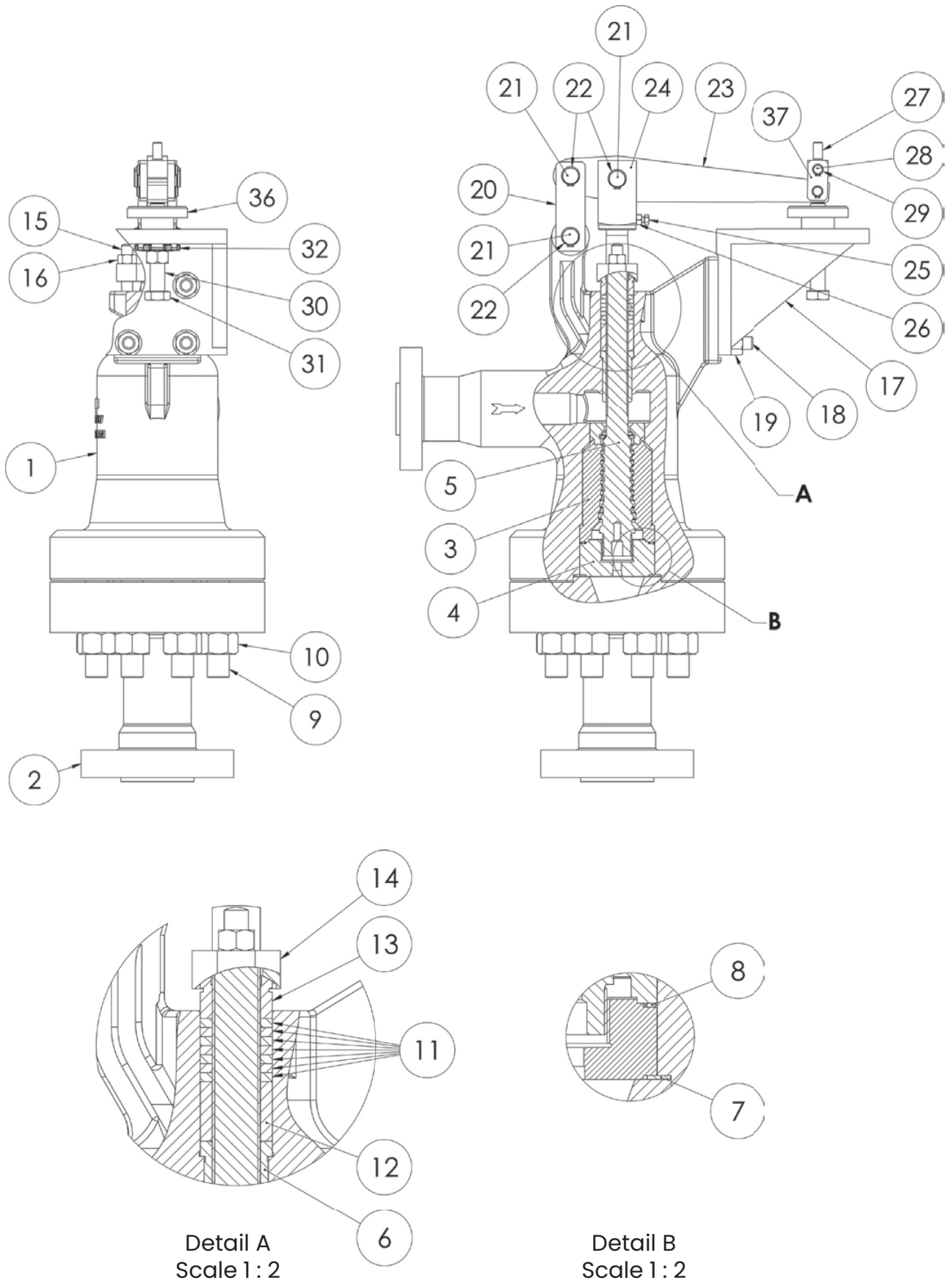


Figure 12: Parts Drawing for Top Entry 77002 Series

77003 Series Disassembly

Valve Disassembly

Refer to Figures 14 & 15 for disassembly and assembly.

Actuator and Linkage Disassembly

1. Remove linkage snap rings (A900) & (A900a) from both ends of bracket link pins (A090) and actuator link pins (A090b).
2. Remove clevis cap screw (A915) from valve stem clevis (A033).
3. Disconnect actuator connector (A044) and actuator link arms (A734a) by removing qty 2 of 2 actuator link pins (A090b).
4. Disconnect the valve stem clevis (A033) from main lever arm (A026) by removing qty 2 of 2 valve link pins (A090a).
5. Disconnect actuator link arm (A734a) from main lever arm (A026) by removing qty 1 of 2 valve link pins (A090a).
6. Disconnect main lever arm (A026) from valve link arm (A734) by removing qty 1 of 2 valve link pins (A090a).
7. Disconnect valve link arm (A734) from bracket body (A035) by removing bracket link pin (A090).
8. Remove actuator spud adapter (A060) from bracket body (A035) by removing actuator bolts (A915a).
9. Dismount actuator.
10. Remove valve stem clevis (A033) from plug stem (B122).
11. Remove bracket body (A035) from bonnet flange (B003) by removing cap screws (A915b).

Bonnet/Trim Disassembly

1. Remove the Packing Nuts (B201), Packing Flange (B213), and Packing Follower (B212).
2. Remove the Bonnet Nuts (B014) by un-torquing them in stages to equally unload the bonnet and trim gaskets. When the Bonnet Nuts are removed, while pressing down on the stem, remove the Bonnet (B003) from the valve body. Once Bonnet is removed, be certain to sit loose Bonnet on a surface that does not damage critical internal sealing surfaces. While removing the Bonnet, the Packing Set (B207) may also pull away from the stem. The Packing Set should be removed at this time and discarded.
3. Remove Body Gasket (B105) and discard after examination.
4. Remove Stem Bushing (B011) and Retainer (B107).
5. Attach a lifting mechanism to the Plug and Stem Sub-assembly (B122), and remove the Plug and Stem Sub-assembly and the Liner/Seat (B106) from the valve body in a single lifting operation.
6. For the 77003 Series 5-Stage Partially Balanced (Trim X), reach into the valve body and lift out the Liner Spider (B106A).
7. For the 77003 Series 3-Stage Unbalanced (Trim Y), reach into the valve body and lift out the Spacer (B127).
8. Make certain to remove both Trim Gaskets (B103) noting that one may be attached to the Liner Spider and one may remain inside the valve body.

77003 Series Maintenance & Repair

Parts Repair

Carefully examine parts for any scratches, unusual wear, or other visual damage prior to reassembly. Always clean trim parts before reinstalling in the valve.

Guiding Surfaces

Guiding surfaces include the following parts:

For the 77003 Series 5-Stage Partially Balanced (Trim X):

- Stem Bushing (B011)
- Liner Spider (B106a).
- Plug and Stem Sub-assembly (B122)

For the 77003 Series 3-Stage Unbalanced (Trim Y):

- Stem Bushing (B011)
- Plug and Stem Sub-assembly (B122)
- Liner/Seat (B106)

These guiding parts must be checked. If there is only slight wear indications, then use a light abrasive to smooth out the specific guiding surface areas. Parts with greater damage or wear on the guide surfaces must be replaced. Guiding surfaces are hard-coated and excessive removal of surface material can expose base material.

Seating Surfaces

Seating surfaces are found on the Plug and Stem Sub-assembly (B122) and Liner/Seat (B106). These surfaces must be completely free of dents, scratches, wear, or other visual damage. If the valve demonstrates excessive leakage or shows signs of deterioration on the seating surfaces the parts may be refurbished in accordance with the following guidelines

77003 Series Reassembly

Valve Body Assembly

See specified valve assembly drawing Figures.

Trim / Bonnet / Body Assembly

77003 Series 5-Stage Partially Balanced (Trim X) (see Figure 14)

1. Place (1 of 2) Trim Gaskets (B103) into the Body (B001)
2. Install Liner Spider (B106a) into the valve Body (B001) making sure that it locates on the Trim Gasket (B103).
3. Place (2 of 2) Trim Gaskets (B103) onto the Liner Spider (B106a).
4. Place plug and stem sub-assembly (B122) vertically on stable surface. Carefully lift Liner/Seat (B106) and lower over plug and stem sub-assembly (B122).
5. Attach lifting eye to stem thread. Lift plug and stem sub-assembly (B122) and Liner/Seat (B106) together using lifting eye.
6. Carefully lower plug and stem sub-assembly (B122) and Liner/Seat (B106) into the Body (B001) until the Liner/Seat (B106) contacts the Liner Spider (B106a). Continue to lower the assembly until seated. Remove hoist and lift eye.

77003 Series 3-Stage Unbalanced (Trim Y) (see Figure 15)

1. Place (1 of 2) Trim Gaskets (B103) into the Body (B001)
2. Install Spacer (B127) into the valve Body (B001) making sure it locates on the Trim Gasket (B103).
3. Place (2 of 2) Trim Gaskets (B103) onto the Spacer (B127).
4. Place plug and stem sub-assembly (B122) vertically on stable surface. Carefully lift Liner/Seat (B106) and lower over plug and stem sub-assembly (B122).
5. Attach lifting eye to stem thread. Lift plug and stem sub-assembly (B122) and Liner/Seat (B106) together using lifting eye.
6. Carefully lower plug and stem sub-assembly (B122) and Liner/Seat (B106) into the Body (B001) until the Liner/Seat (B106) contacts the Trim Gasket (B103). Continue to lower the assembly until seated. Remove hoist and lift eye.

Body / Bonnet / Body Gasket / Bolting Assembly

1. Install retainer (B107) and Stem Bushing (B011)
2. Lubricate Body Gasket (B105) and install into dedicated groove in Body (B001).
3. Carefully lower Bonnet (B003) over the Plug/Stem (B122) and into position of body (B001).

Note: For stud sizes > 1 1/2", washers are required to prevent potential damage to the bonnet flange face during the torquing process. When required, install washers on the Body Studs (B002) before the Body Nuts (B014). Install the Body Nuts (B014) and hand tighten only.

4. Lubricate Body nut (B014) contact surface and body stud (B002) with Molykote G Graphikote No 143 or equivalent.
5. Install Body Nut (B014) and hand tighten only.
6. Install side mounting linkage or direct mount actuator.
7. Tighten the Body Nuts (B014) to the appropriate torque value found in Table. Tighten in sequence using at least 5 equal increments of torque. (See Figure 13 for torque sequence and recommended torque steps). It is important to ensure that the Bonnet is tightened down evenly to ensure proper alignment and fit of the internal components required for smooth valve operation and performance.

Note 1: After each torquing interval the stem shall be stroked to ensure proper alignment of trim parts. The bonnet must contact the body around the entire 360 degrees of contact area. Also ensure that the minimum torque value listed below is obtained.

Note 2: Verify proper stud and nut installation by visual inspection. Less than one stud thread exposed above the nut after final torquing is cause for rejection. With the correct studs and body machining this inspection assures that the proper engagement between stud and body has been achieved.

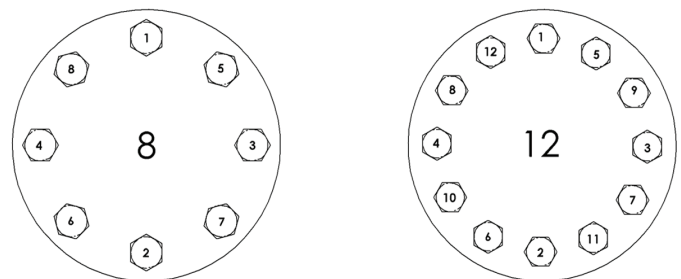


Figure 13: Torque Sequence

Note: Tighten bonnet nuts in five equal steps.

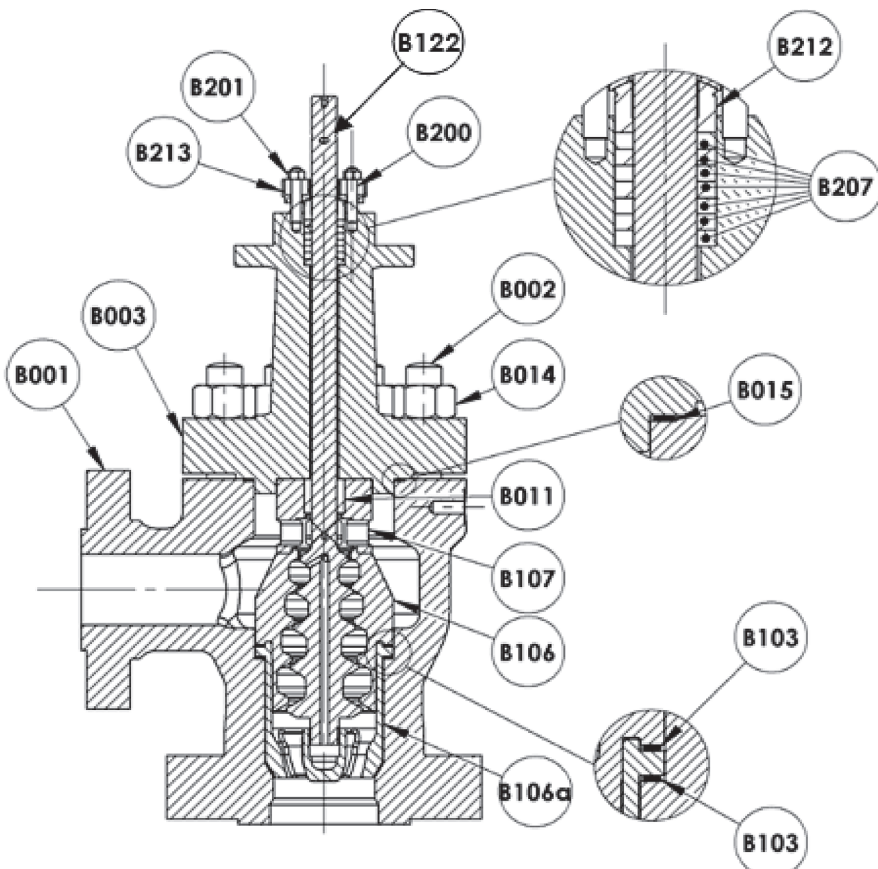


Figure 14: 77003 Series 5-Stage Partially Balanced (Trim X)

Ref. No.	Description
B001	BODY
B003	BONNET
B002	BODY STUD
B014	BODY NUT
B015	BODY GASKET
B122	PLUG/STEM
B106	LINER/SEAT
B106a	LINER SPIDER
B107	RETAINER
B103	TRIM GASKET
B011	STEM BUSHING
B213	PACKING FLANGE
B212	PACKING FOLLOWER
B207	PACKING SET
B200	PACKING STUDS
B201	PACKING NUTS

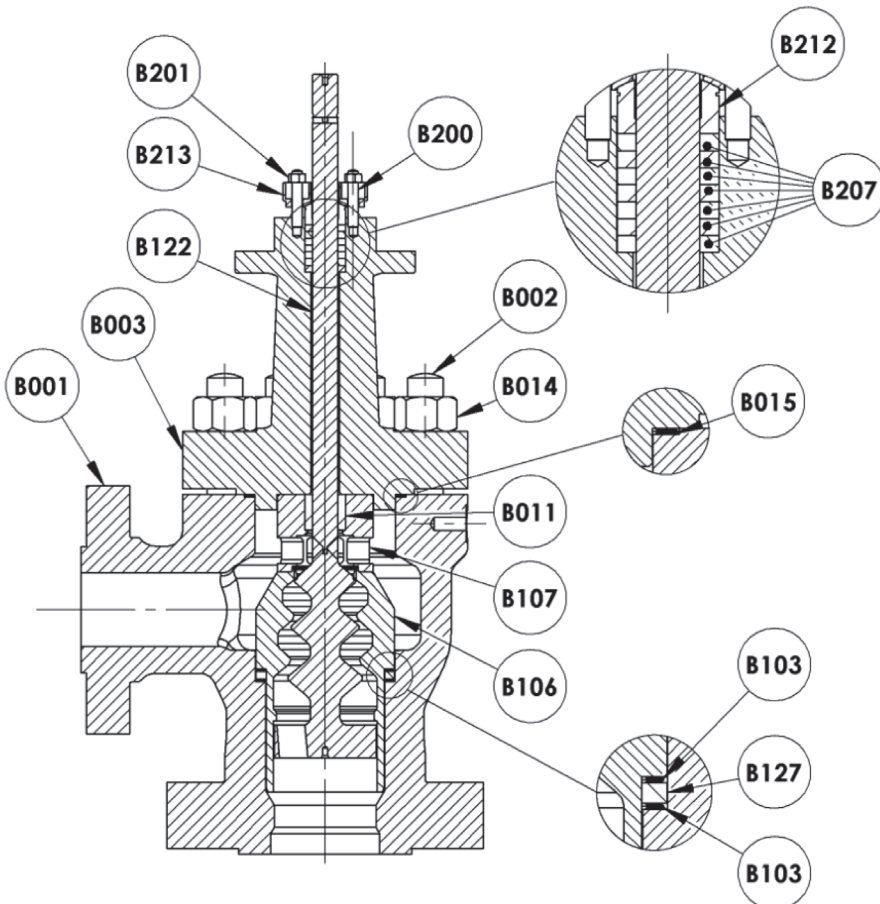


Figure 15: 77003 Series 3-Stage Unbalanced (Trim Y)

Ref. No.	Description
B001	BODY
B003	BONNET
B002	BODY STUD
B014	BODY NUT
B015	BODY GASKET
B122	PLUG/STEM
B106	LINER/SEAT
B107	RETAINER
B103	TRIM GASKET
B011	STEM BUSHING
B213	PACKING FLANGE
B212	PACKING FOLLOWER
B207	PACKING SET
B200	PACKING STUDS
B201	PACKING NUTS
B127	SPACER

BODY		BOLTS		TORQUES in ft-lbf			
Size	Rating	Sizes of Studs	No. of Studs & Nuts	A193 Gr B7		A193 Gr B7M	
				Min	Max	Min	Max
2	1500	1.250-8 UN-2A	8	610	770	470	590
	2500	1.625-8 UN-2A	8	1500	1800	1100	1400
3	1500	1.500-8 UN-2A	8	1200	1400	850	1100
	2500	1.875-8 UN-2A	8	2300	2900	1800	2200
4	1500	1.750-8 UN-2A	8	1900	2300	1400	1800
	2500	2.250-8 UN-2A	8	4100	5100	3100	3900
6	1500	2.000-8 UN-2A	8	2800	3500	2200	2700
	2500	2.500-8 UN-2A	8	5700	7100	4300	5400
8	1500	2.000-8 UN-2A	12	2800	3500	2200	2700
	2500	2.500-8 UN-2A ⁽¹⁾	12	5700	7100	4300	5400

1. Body Bolting Torque Requirements For 77003 only

Packing Box / Standard Packing Assembly

Visually inspect Plug/Stem & Bonnet packing box for cleanliness and proper surface finish. Consult Figures 16 & 17 for the proper number of packing rings and their arrangement. Assemble the packing box parts (Packing Rings, Packing Follower/Flange, and Packing Nuts). The skive cuts should be staggered between consecutive pieces of Packing Rings (approx. 120 degrees). The Packing Nuts should only be finger tight at this time.

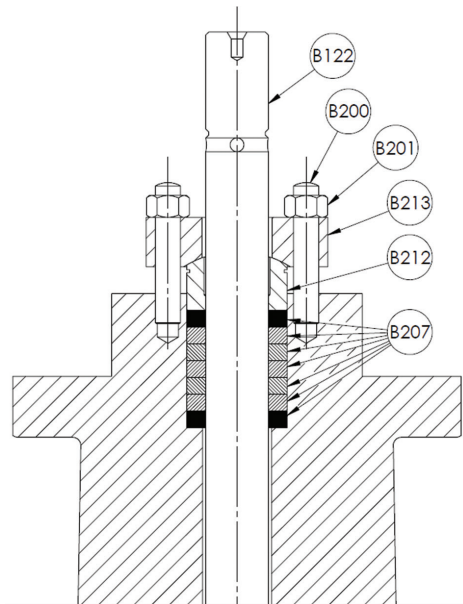


Figure 16: Standard Packing

Ref. No.	Description
B122	PLUG/STEM
B213	PACKING FLANGE
B212	PACKING FOLLOWER
B207	PACKING SET
B200	PACKING STUDS
B201	PACKING NUTS

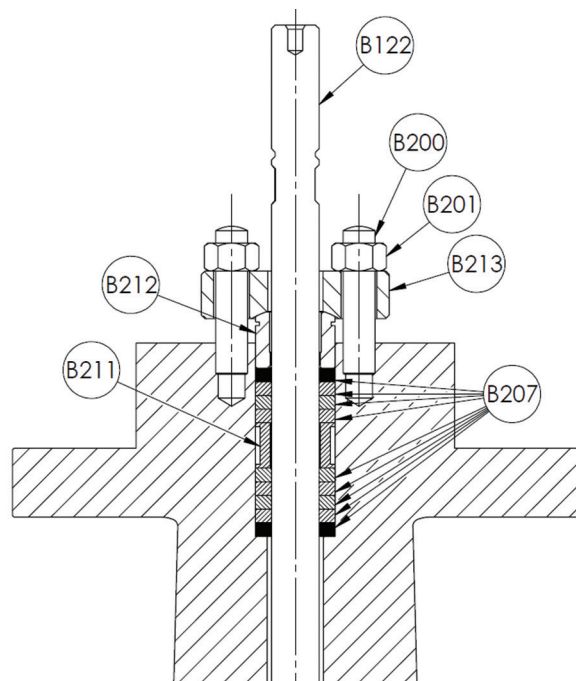


Figure 17: Double Packing

Ref. No.	Description
B122	PLUG/STEM
B213	PACKING FLANGE
B212	PACKING FOLLOWER
B207	PACKING SET
B211	LANTERN RING
B200	PACKING STUDS
B201	PACKING NUTS

Offset Actuator Mounting Linkage

- Place the bracket body (A035) on bonnet flange (B003) tight with cap screws (A915b).
- Place the valve stem clevis (A033) on plug stem (B122).
- Actuator must be mounted.
- Place actuator spud adapter (A060) on bracket body (A035) tight with actuator bolts (A915a).
- Install valve link arm (A734) with bracket body (A035) using bracket link pin (A090).
- Place main lever arm (A026) with valve link arm (A734) using qty 1 of 2 valve link pins (A090a).
- Place actuator link arm (A734a) with main lever arm (A026) using qty 1 of 2 valve link pins (A090a).
- Connect the valve stem clevis (A033) with main lever arm (A026) using qty 2 of 2 valve link pins (A090a).
- Connect actuator connector (A044) to actuator link arms (A734a) using qty 2 of 2 actuator link pins (A090b).
- It would be useful to have extended procedure for adjusting stroke while ensuring plug is seated with enough overtravel. A warning to not bottom out the lever against the spud adapter (A060) would be beneficial as well since this will cause irreparable damage to the actuator stem.
- Ensure main lever arm (A026) is horizontal when valve is in the closed position.
- After all adjustments are made, install and tighten clevis cap screw (A915) on valve stem clevis (A033) to clamp stem and prevent rotation.
- Install appropriately sized link pin snap rings (A900) & (A900a) to both ends of bracket link pins (A090) and actuator link pins (A090b).

Seat Lapping

Seating surfaces may need to be lapped in order to restore the necessary surface integrity to meet valve leakage requirements. Prior to lapping ensure the plug and seat ring seating surfaces are free from large scratches or dents. Remachining of these surfaces may be necessary. If so a maximum of .015" (0.4mm) metal removal from both the plug and seat seating surfaces is allowable for any valve size. Seating Surfaces Make sure the seating angles on the reworked parts are within the specified tolerances as shown in Figure 18. Parts requiring more metal removal to restore should be discarded and replaced.

- Clean body gasket surface areas.
- If lapping is to be done outside of the body ensure the liner/seat (B106) is set on a flat and stable surface and proceed to step 5.
- For lapping done with the trim installed inside the body, install new gaskets into the valve to ensure the ideal geometric characteristics in order to have the correct position of the seat ring during lapping.

Note: The gaskets used during lapping must not be reused for the body reassembly.

- Loosen the packing packing nuts (B106) to remove friction and allow the plug/stem (B122) to rest against the liner/seat (B106) by its own weight.

- Spread a fine layer of high quality lapping compound (600 grit) on the seating surface of the seat ring. If lapping with the trim installed inside the valve, insert the liner/seat (B106) into the valve body (1).
 - Insert the plug/stem (B122) carefully into the liner/seat (B106) until it is seated.
- Note: It is highly recommended to assemble the valve completely including using new gaskets before lapping the valve. Assembly with the top entry bonnet or bottom spool aligns the trim parts and improves the integrity of the surface geometric characteristics**
- Place an appropriate tool on the valve plug/stem (B122) threads to allow for manual rotation. Options for creating a manual resurfacing tool include using a T-handle secured with a locknut, or using a flat piece of steel with a drilled hole and two locknuts to fasten to the valve plug/stem (B122).
 - Lapping of the liner/seat (B106) is accomplished by rotating the plug/stem (B122) in short oscillating strokes.
 - After 8 to 10 strokes, lift the plug/stem (B122) and repeat the operation three or more times in increments of 90°, 180°, and 270°, from the original position.
- Note: Performing the operation at various increments is critical in maintaining concentricity between the parts during lapping.**
- Lapping can be repeated, but should be limited as much as possible so that the seat line remains sufficiently narrow to guarantee tightness.
 - After lapping, disassemble the parts to clean them and then reassemble, making sure the seating angles are within tolerance as shown in Figure 18.
 - 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 (items 7, 8 and 34 for top entry designs) must always be replaced after disassembly.

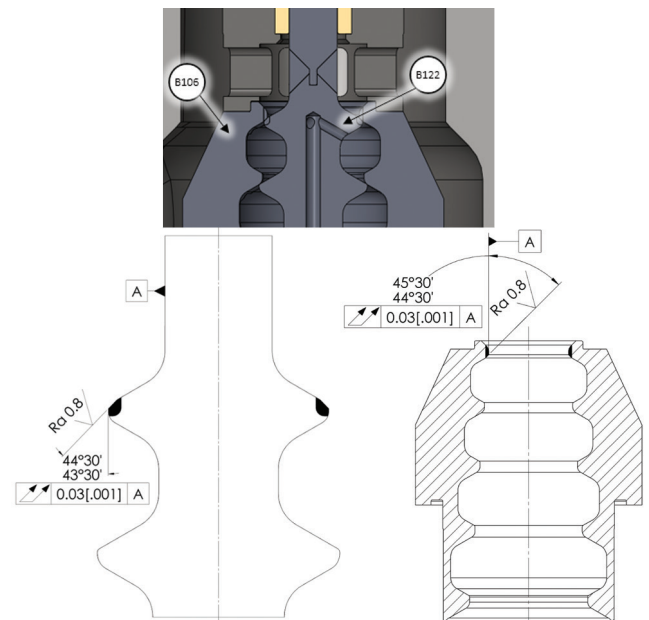


Figure 18: Seat Lapping

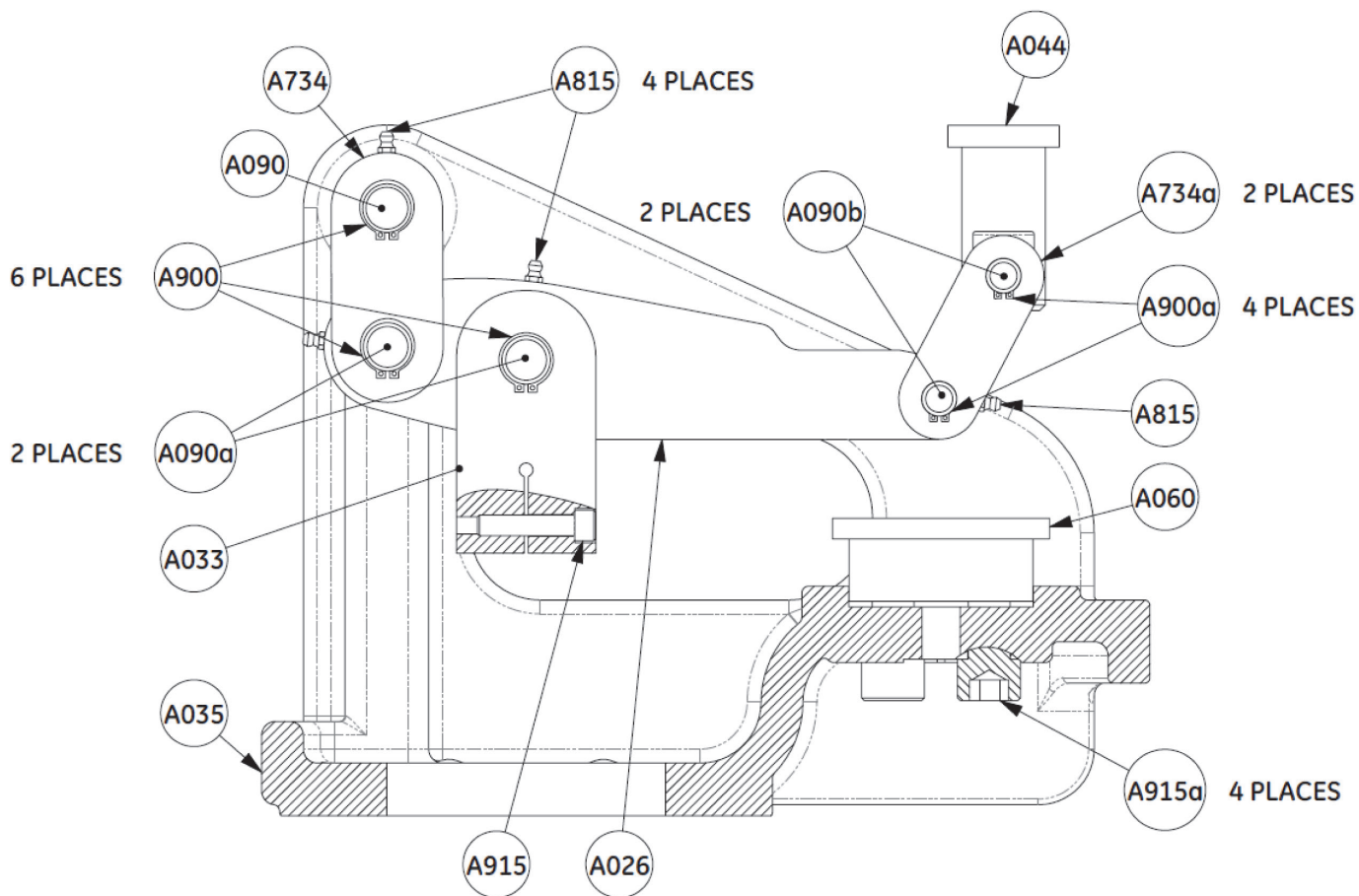
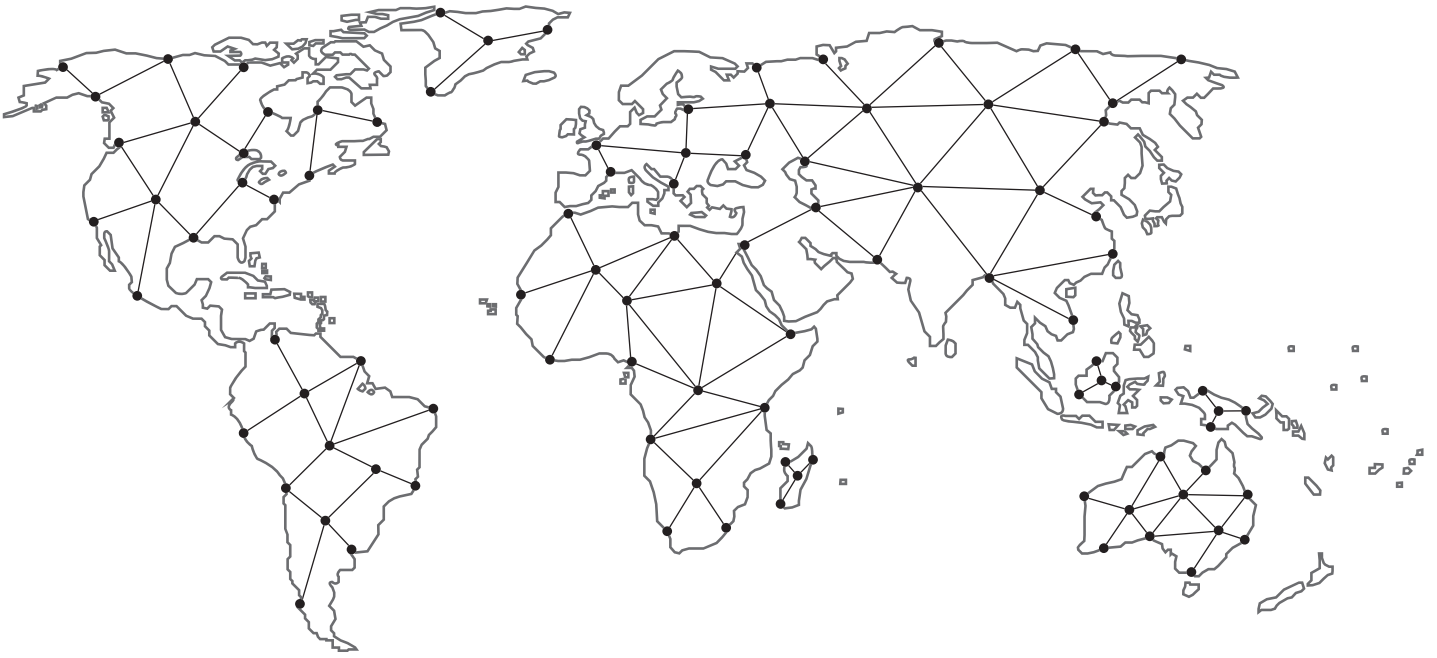


Figure 19: Linkage Assembly

Ref. No.	Description
A035	BRACKET BODY
A026	MAIN LEVER ARM
A734	VALVE LINK ARMS
A734a	ACTUATOR LINK ARMS
A090a	VALVE LINK PINS
A090b	ACTUATOR LINK PINS
A090	BRACKET LINK PIN
A033	VALVE STEM CLEVIS
A915	VALVE CLEVIS CLAMP SCREW
A900	LINK PIN SNAP RINGS
A044	ACTUATOR CONNECTOR
A915b	ACT. CONNECTOR BOLTING
A915a	BRACKET TO ACTUATOR BOLTS
A060	ACTUATOR SPUD ADAPTER
A815	GREASE FITTING

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