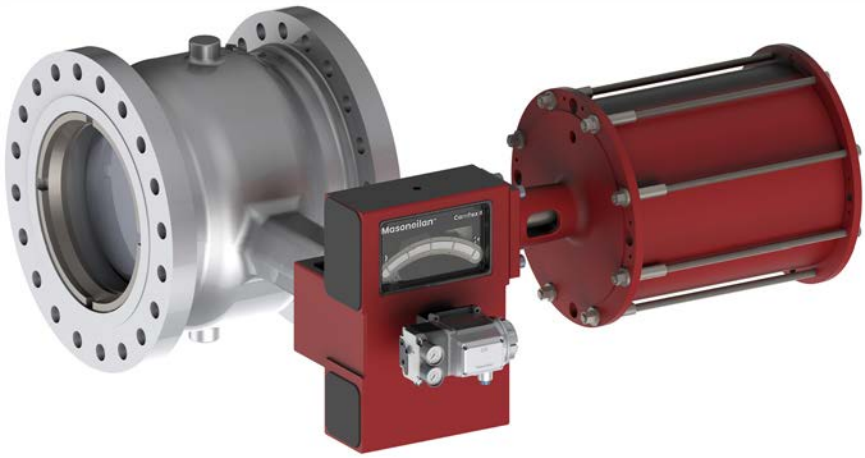
Masoneilan

a Baker Hughes business

35002 Series Camflex™ II

Rotary Control Valve

Instruction Manual (Rev.H)



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

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

THESE INSTRUCTIONS DO NOT PURPORT TO COVER ALL DETAILS OR VARIATIONS IN EQUIPMENT NOR TO PROVIDE FOR EVERY POSSIBLE CONTINGENCY TO BE MET IN CONNECTION WITH INSTALLATION, OPERATION OR MAINTENANCE. SHOULD FURTHER INFORMATION BE DESIRED OR SHOULD PARTICULAR PROBLEMS ARISE WHICH ARE NOT COVERED SUFFICIENTLY FOR THE CUSTOMER/OPERATOR'S PURPOSES THE MATTER SHOULD BE REFERRED TO BAKER HUGHES.

THE RIGHTS, OBLIGATIONS AND LIABILITIES OF BAKER HUGHES AND THE CUSTOMER/OPERATOR ARE STRICTLY LIMITED TO THOSE EXPRESSLY PROVIDED IN THE CONTRACT RELATING TO THE SUPPLY OF THE EQUIPMENT. NO ADDITIONAL REPRESENTATIONS OR WARRANTIES BY BAKER HUGHES REGARDING THE EQUIPMENT OR ITS USE ARE GIVEN OR IMPLIED BY THE ISSUE OF THESE INSTRUCTIONS.

THESE INSTRUCTIONS ARE FURNISHED TO THE CUSTOMER/OPERATOR SOLELY TO ASSIST IN THE INSTALLATION, TESTING, OPERATION, AND/OR MAINTENANCE OF THE EQUIPMENT DESCRIBED. THIS DOCUMENT SHALL NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN APPROVAL OF BAKER HUGHES.

Table Of Contents

Safety Information **1**
About this Manual **1**
Warranty **1**
1. Introduction **3**
2. General **3**
3. Principle Of Operation **3**
4. Unpacking **4**
5. Installation **4**
6. Air Supply Piping **5**
7. Placing In Service **5**
8. Disassembly **5**
8.1 Actuator Removal from Body S/A 5
8.2 Diaphragm Actuator Disassembly 6
8.3 Valve Body 7
9. Maintenance **9**
9.1 Diaphragm Replacement 9
9.2 Piston Actuator Replacement 11
9.3 Body S/A Internal Parts 11
9.4 Yoke Assembly 11
10. Reassembly Procedures **11**
10.1 Spring Diaphragm Actuator 11
10.2 Piston Actuator 11
10.3 Spring Diaphragm Actuator on Body S/A 12
10.4 Piston Actuator on Body S/A 13
10.5 Handwheel Reassembly for Diaphragm Actuator 13
10.6 Limit Stop Reassembly 14
10.7 Handwheel Reassembly for Piston Actuator 14
10.8 Limit Stop Reassembly for Piston Actuator 14
10.9 Valve Body Reassembly for Diaphrgm Actuator 14
10.10 Seat Ring Alignment 15
10.11 DVD Plate Reassembly 16

11. Actuator Stem Adjustment 16
11.1 Diaphragm Actuator 16
11.2 Piston Actuator 17
12. Changing Body Position 18
13. Changing Actuator Action 19
13.1 Diaphragm Actuator 19
13.2 Piston Actuator 20
14. Manual Actuator Option 21
14.1 Disassembly Procedure 21
14.2 Maintenance 21
14.3 Reassembly Procedure 21

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.

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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 35002 Series Camflex II, and do not apply for other valves outside of this product line.

Useful Life

The current estimated useful life period for the 35002 Series Camflex II 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.

⚠WARNING

1. **It is the end user's responsibility to ensure properly loaded and/or supported piping to avoid undesired stresses on the product which may result in damage to the product, loss of containment, or loss of functionality and resulting unsafe states or conditions.**

2. **It is the end user's responsibility to correctly identify end locations and place product in areas that may contain explosive atmospheres. The failure of properly following the test, installation, maintenance and/or disassembly/assembly instructions may result in a compromised product which in turn could result in an uncontrolled/unexpected loss of containment and release of pressure.**

3. **It is the end user's responsibility to take appropriate actions to ensure that site personnel who are performing installation, commissioning, and maintenance have been trained in proper site procedures for working with and around Baker Hughes supplied equipment, per Safe Site Work Practices, are the end user's responsibility.**

4. **The failure of properly following the test, installation, maintenance and/or disassembly/assembly instructions may result in a compromised product which in turn could result in an uncontrolled /unexpected loss of containment and release of pressure. It is the responsibility of the person conducting the tasks listed above to take great care in following such procedures.**

5. **It is the end user's responsibility to:**

    - **Recognize and safely contain any leak.**
    - **Ensure proper Personal Protective Equipment is available and used.**
    - **Follow Proper lifting techniques / equipment / procedures, per Safe Site Work Practices.**

6. **Proper Lockout/Tagout of energy sources prior to maintenance, per Safe Site Work Practices, is the end user's responsibility. This includes any potential control signals or circuits that may have a remote or automated control function over any product. Instructions to properly release spring stored energy included in IOM.**

7. **After installation or maintenance, it is the end user's responsibility to ensure the equipment has been properly inspected and returned to proper condition before being returned to service.**

1. Introduction

The following instructions are designed to assist maintenance personnel in performing most of the maintenance required on the Camflex II valve and if followed carefully will reduce maintenance time.

Baker Hughes has highly skilled Service Engineers available for start-up, maintenance and repair of our valves and component parts. In addition, regularly scheduled training programs are conducted to train customer service and instrumentation personnel in the operation, maintenance and application of our control valves and instruments. Arrangements for these services can be made through Baker Hughes products representative or district office. When performing maintenance use only **Masoneilan™** replacement parts. Parts are obtainable through your local representative or district office. When ordering parts always include **MODEL** and **SERIAL NUMBER** of the unit being repaired.

2. General

These installation and maintenance instructions apply to 1" through 16" sizes (DN 25 through 400 sizes), all available ratings, and pneumatic actuators. The model number, size and rating of the valve are shown on the serial plate. Refer to Figure 1 to identify the valve model.

3. Principle of Operation

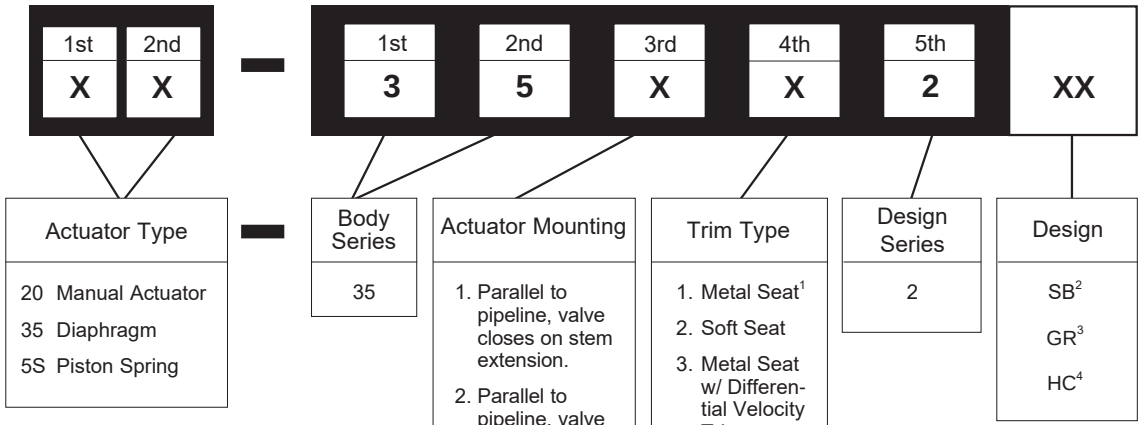
The concept of the Camflex II valve is based on an eccentrically rotating spherical plug contained in a free flow body design. The plug seating surface is joined by flexible arms to a hub which slides onto a rotating shaft. The plug is free to center itself along the axis of the shaft. A positive seal between plug and seat is achieved by elastic deformation of the plug arms. The chamfered seat ring is fixed in the valve body by a threaded retainer.

The plug and shaft are rotated through an angle of 50° or 70° by a lever linked to a powerful spring-opposed rolling diaphragm or a piston style spring return actuator.

The optional solid disk-type handwheel and locking hex nut are mounted on the yoke, opposite the actuator and may be used to manually operate the valve or as a limit stop. A threaded hole in the opposite side of the yoke is plugged but can be equipped with an optional cap screw and locknut, which may be inserted as a limit stop in the other direction, or in combination with the handwheel to lock the valve in a selected position.

Note: The handwheel on Camflex II is designed to be used for emergency action only.

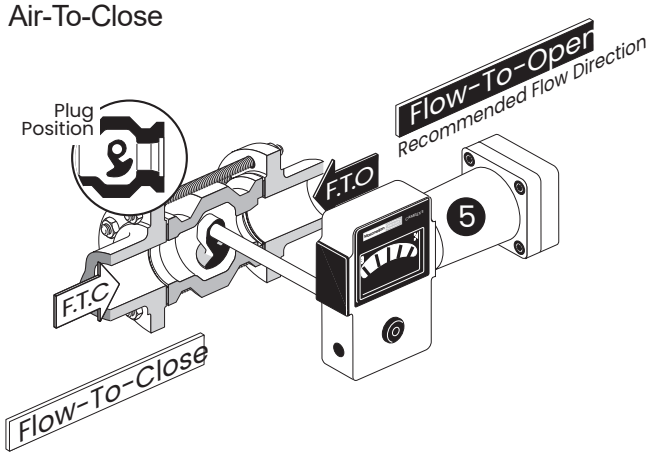
35002 Series Numbering System



1. Optional, stellite 6 hard facing.
2. Optional, Camflex with separable bonnet.
3. Globe Replacement (body with extended face to face.
4. Optional, Camflex High Capacity.

Figure 1

Air-To-Close



Air-To-Open

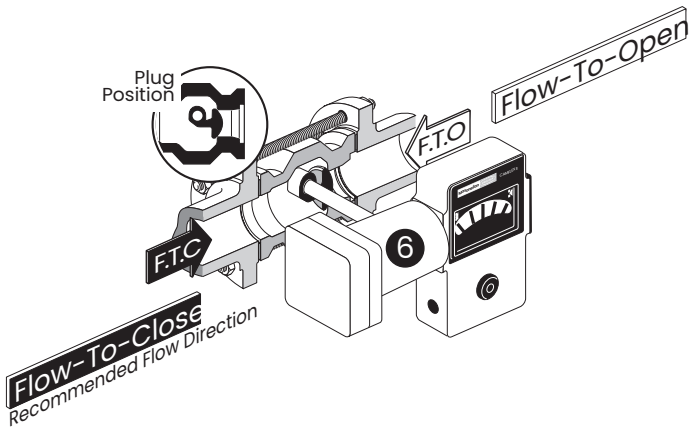


Figure 2

The actuator is preferably mounted on a horizontal pipe and can be oriented for air failure, either fail close or fail open. It is recommended to use the fluid flow to help assist the fail direction when possible. This will help alleviate actuator required torque. Refer to Figure 2.

The Camflex II valve has a modified linear flow characteristic, which is the same in either flow direction. It can be easily transformed to an equal percentage when equipping the valve with a positioner 4700 series or SVI Smart Valve Interface. Reduced TRIM factors 0.4 and 0.6 are available for all sizes. The flow capacity of a 0.4 factor is 40% of the nominal capacity of the valve and it is 60% for the 0.6 factor. Factors 0.1 and 0.2 are available on the 1" (DN 25) valve.

The ability of the Camflex II valve to handle a wide range of process fluid temperatures is due to the long integrally cast bonnet. This affords ample surface area to normalize the packing temperature. As an example, with PTFE based packing, the valve handles temperatures up to +400°C (+752°F). For Cryogenic service, temperature of -196°C (-320°F) is suitable for intermittent or short period use. For continuous service, temperatures are limited to -130°C (-200°F). For continuous service, and for temperatures between -196°C (-320°F) and -130°C (-200°F), a cryogenic extended bonnet should be used. When insulating the valve, do not insulate the valve bonnet (see Figure 3).

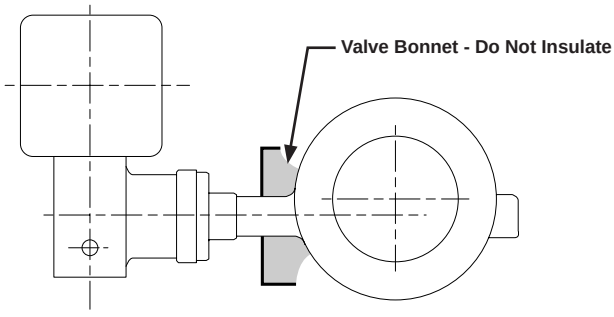


Figure 3

4. Unpacking

Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts. Should any problems arise, contact your sales representative.

Note: For ease of shipment and to prevent damage, valves equipped with the spring diaphragm actuator are shipped with the handwheel unassembled. Refer to Section 10.5 for handwheel assembly procedures. The 5S actuator will include the handwheel mounted and shipped on the actuator.

5. Installation

The Camflex II valve has been assembled at the factory in accordance with specific instructions concerning flow direction and actuator mode. The valve must be installed so that the fluid will flow through the valve in the direction indicated by the flow arrow (25), which is located on the upper part of the valve bonnet. The valve actuator should be installed so the actuator is above the centerline of the shaft. To install the valve in the line, proceed as follows:

CAUTION

Any change in flow direction or actuator mode must be accomplished as outlined in Section 7 on page 5, and Section 10 on page 11 of this manual. Failure to follow these instructions could result in personal injury and equipment malfunction.

A. Check the model number on the serial plate (56) against the numbering System described in Figure 1 to determine valve configurations.

B. Clean piping and valve of all foreign material such as welding chips, scale, oil, grease or dirt. End connection gasket surfaces should be thoroughly cleaned to ensure leak proof connections.

C. To allow for in-line inspection, maintenance or removal of the valve without service interruption, provide a manually operated isolation valve on each side of the Camflex II valve with a manually operated throttling valve mounted in the by-pass line.

Note: With exception to the GR option, Camflex II up to 12" complies with the IEC 60534-3-2 (rotary globe valve). If DIN or ANSI face to face is required, spool pieces may be required to meet the distance between flanges. Gaskets and valve bolting are then installed and torqued using standard flange and line bolting criteria.

D. For flangeless valves, refer to Figure 24 on page 28 and determine the correct size and quantity of bolts to be used for the valve and flange rating.

E. If the valve is to be installed in a horizontal position, install the bolting on the lower portion of the flange, this will help support the valve while installing the remaining bolts.

F. Place the valve in the line.

G. Select and install correct gaskets.

Note: Spiral wound gaskets, suitable for service conditions are recommended.

H. Insert remaining flange bolting ensuring that the bolts align with the special bosses on the body, which assure the valve is centered in the line and also prevent rotation.

Note: For certain flange standards, through bolting is not possible because of the valve body neck or bonnet. To accommodate flange bolting, guide arms with threaded holes or slots are provided on the valve body to receive flange bolts (refer to Figure 23 on page 27).

I. Tighten flange bolts evenly and firmly.

CAUTION

If the valve is to be insulated, do not insulate the valve bonnet.

Note: If the valve is equipped with a manual handwheel, it may now be placed in service.

6. Air Supply Piping

Air is supplied to the diaphragm actuator through the 1/4" NPT tapped connection and a 3/4" NPT for the piston actuator. Refer to serial plate (56) on the valve to determine the correct supply pressure and to Figure 13 on page 19 for recommended tubing size, then connect air supply piping.

CAUTION

Do not exceed maximum air pressure indicated on the serial plate (56). Personal injury and equipment malfunction could result.

Note: When the valve is equipped with regulators or other accessories supplied by Baker Hughes, only connections to those accessories are required since the piping to the actuator is connected at the factory. Some valves equipped with electrical accessories will require appropriate wiring. Refer to manufacturer's instructions for correct wiring information.

7. Placing in Service

With the valve properly installed in line and all air or electrical service connected, it is recommended that the valve be run through one cycle to ensure proper functioning. Proceed as follows:

A. Rotate the handwheel (53) counter clockwise so that it will not interfere with the operation of the valve and tighten the handwheel lock (52).

Note: If the valve is equipped with the optional limit stop (77), first loosen the nut (78) and then loosen the limit stop (77), rotating it counter clockwise until it cannot interfere with the operation of the valve. Then tighten the nut (78) to hold the limit stop in place. it should also be backed off to prevent interference with the operation of the valve.

B. Apply air pressure to the actuator. Refer to serial plate (56) on the valve.

Note: Valve should function smoothly and with maximum pressure, the valve indicator (6) should show full open or full close depending on valve mode. Refer to Figure 18 on page 25.

C. Decrease air pressure and return valve to normal mode.

D. Gradually open isolation valves to place the valve in service.

E. Check for leaks. Repair as required.

CAUTION

Always ensure process pressure, air pressure and electrical service are off and the valve is isolated and depressurized before performing maintenance on the valve.

F. If desired, the handwheel may be used as a limit stop. Set in desired position and lock using the handwheel lock (52).

G. If the optional limit stop (77) is used, set and tighten locknut (78).

8. Disassembly

8.1 Actuator Removal From Body S/A

(Refer to Figures 15 and 16 on page 22 and Figure 17 on page 23)

Maintenance required on the internal components of the valve or re-orientation of the actuator and body, requires that the actuator and yoke be removed from the valve. On actuators, for ease of handling and reassembly, it is recommended that the spring barrel be removed from the yoke and then the yoke separated from the valve body.

CAUTION

Prior to performing maintenance on the valve, isolate the valve, vent the process pressure and shut off supply and signal air lines to the actuator.

Note: If the valve will be reassembled in the same orientation, it is recommended that the body to yoke orientation and the actuator to yoke orientation be marked in relation to each other. This will simplify reassembly.

A. If required, remove the valve from the line.

B. Remove rear cover (29) and front cover (32) by removing the two cover screws (30).

C. Remove bottom cover (11) and spring barrel boss cover (58).

D. Remove the adjustable indicator (88) by removing the two screws (89).

E. Loosen handwheel lock (52) and turn handwheel (53) so it does not interfere with the movement of the lever (34).

Note: On valves supplied with the optional limit stop, (Figure 16 on page 22 and Figure 17 on page 23) loosen nut (78) and back off the limit stop screw (77) so it will not interfere with the movement of the lever (34).

F. For standard pneumatic diaphragm actuator, connect an external air line to the actuator supply port and using regulated air supply, apply enough air pressure to the actuator so the lever will move to an intermediate position.

CAUTION

Do not exceed pressure listed on serial plate (56) for actuator used. Do not use handwheel to move the lever.

Note: If the valve is to be reassembled using the same orientation, it is recommended that the yoke (33) and lever (34) alignment, in the closed position, be marked to simplify reassembly and alignment of the lever and shaft to ensure proper valve functioning. See Figure 16 on page 22 and Figure 17 on page 23.

G. Remove clevis pin clips (5).

H. For diaphragm actuators, remove clevis pin (7). For piston actuators, remove clevis pin (7), then remove the lever pin clip (129), the lever pin (127) and turnbuckle (110) with its ball joint (108, 109).

I. Decrease air pressure from actuator enabling clevis (35) to disengage from lever (34).

Note: If the valve is equipped with a positioner, refer to the appropriate positioner instruction for procedures on cam or lever removal. Then proceed to step K.

J. Remove shaft cover (9) by removing cover screw (10).

CAUTION

Depending on the size and weight of the actuator. It is recommended that proper lift and support procedures be utilized when removing the spring barrel (38) or yoke (33).

K. Ensure spring barrel (38) is properly supported.

L. Loosen and remove cap screws (36) and lock washers (37), then remove spring chamber S/A.

M. Loosen lever capscrew (49).

N. Loosen the stud nuts (94) and disengage the packing flange (14).

O. Loosen the stud nuts (27) to separate the actuator from the body S/A. In case of piston actuator, remove also the cap screws (71).

Note: With body (1) secure, grasp lever (34) and yoke (33) and separate. Yoke, lever (34) and packing flange (14) are removed at the same time. The yoke (33) may have to be struck with a soft face mallet to break it loose.

8.2 Diaphragm Actuator Disassembly

8.2.1 Pneumatic Diaphragm Actuator

The spring diaphragm actuator used on the Camflex II valve was designed as a low cost non-replaceable item and therefore disassembly is not recommended. However, in some instances and for emergency purposes, disassembly may be required. Proceed as follows.

A. If the actuator is not removed from the body proceed to paragraph 8.1 A. to 8.1 L.

B. Loosen locknut (46) then remove the clevis (35) and the locknut (46).

C. Loosen and remove capscrew (41) and remove diaphragm case (42) and diaphragm (40).

D. Using a deep socket, loosen and remove locknut (45) and washer (44).

E. Remove piston (43) and spring (39) and inspect all components.

F. Proceed to section 10.1 for reassembly.

8.2.2 Piston Actuator

A. Loosen the locknut (46) then remove the clevis (35), washer (44) and locknut (46).

WARNING

POTENTIAL LOSS OF CONTAINMENT / PRESSURE: The failure of properly following installation, maintenance and/or assembly / disassembly instructions may result in unsafe conditions. It is the responsibility of the end user to ensure instructions are properly followed.

LINES and FITTINGS: All lines and fittings must be properly connected and secured, and as required anchored to restrict movement.

The cylinder actuator is a spring loaded device and the disassembly instructions must be adhered to as unit or bodily damage can occur.

B. Loosen and remove compression nut (114), cylinder screws (115) and washers (116).

C. Remove the top plate (126), then the springs (119,120).

Note: Threaded holes are provided on the tube cylinder to help lifting it (for 5S size 12 : M4x0.7 and for 5S size 16 : M6x1).

D. Remove the tube cylinder (118).

E. Remove the piston S/A (117).

F. Inspect components.

G. See section 10.2 for reassembly.

8.3 Valve Body

(Refer to Figure 4 on page 7 and Figure 15 on page 22)

Maintenance to the internal components required on the Camflex II valve can be easily determined since the seat ring (2) and plug (4) can be seen once the valve is removed from the line. It is recommended that both seat ring (2) and plug (4) be replaced if one or the other is damaged due to service.

After the actuator has been removed from the body (1), disassemble the valve using the following procedure:

CAUTION

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

A. For 35002 SB (Separable Bonnet) versions, remove bonnet nuts (104) and lift off bonnet (102) complete with packing (17) and packing follower (15) from the body (1) as an assembly. Proceed to step D.

B. Remove packing follower (15).

C. Remove safety pin (16).

CAUTION

The purpose of the safety pin is to prevent the shaft from being pushed out if the yoke is removed while the valve is under pressure. The internal components of the valve cannot be removed without first removing the safety pin.

D1. For Camflex II standard and high capacity, pull on the shaft (19) out to remove it.

Note: Difficulty is sometimes encountered when removing the shaft (19) from the plug (4) mainly due to an excessive accumulation of deposits between the plug splines and the shaft (19). Application of heat to the plug shaft bore while using one of the following methods will facilitate removal.

CAUTION

When using external heating devices ensure necessary precautions are taken and allow for proper ventilation.

If the shaft (19) is not removed easily, replace the lever (34) on the splined end of the shaft (19), tighten the lever capscrew (49) and using a mallet, tap the lever (34) as close to the shaft as possible and remove the shaft (19).

Note: If the shaft cannot be removed by tapping the tightened lever, Figure 20 on page 26 illustrates an alternative method of removal. Using a pipe nipple of suitable size and length and reversing the packing flange and stud nuts as shown, the shaft may be pried out of the body. For larger valves, the use of an additional washer and nipple to assist in holding the tightened lever is recommended. The lever should be tightened at a point where the hub on the lever is flush with the end of the spline.

For Camflex HC (High Capacity) only, follow steps D2 to D4. For standard Camflex, go to step E.

D2. Disengage the shaft plug support (70) by moving the plug (4) inside the body neck bore.

Note: if the plug and shaft support cannot be easily disengaged, Figure 21 on page 26 shows a method to help disengage the plug from the plug shaft support. Using a pipe, washer, nut and stud of appropriate size, the plug can be disengaged from the shaft support.

D3. By holding the shaft support in place, rotate the plug (4) by 45° (to the open position direction) to align the plug through slots. Then either engage the plug to the shaft support key or shaft support key to the plug slots. To help rotate the plug, the shaft (19) can be insert again into the plug. Blind holes are also machining 180° apart in the shaft support to help hold or move the shaft support using a screwdriver.

D4. Remove completely the shaft support from the plug (4).

E. The components which should come out with the shaft (19) are: the packing (17), packing box ring (23 or 100), spacer tube (20) and upper guide bushing (21).

Note: The spacer tube (20) and upper guide bushing (21) may remain in the body. They should be removed. The spacer tube (20) can only be removed by pulling it out of the bonnet end of the body. The upper guide bushing (21) may be pushed through the body after removing the plug or it can be pulled through the bonnet end of the body. For valves designed for slurry or viscous services, the upper guide bushing has an inner O-ring (92) and an outer O-ring (93) and the lower guide bushing (22) has inner O-ring (95) and outer O-ring (96) (Refer to Figure 4).

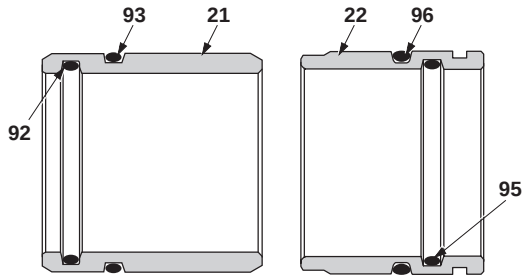


Figure 4 - Optional O-Ring arrangement

F. Remove the plug (4) through the end of the body opposite the seat ring (2).

G. Remove the lower guide bushing (22).

Note: A groove is provided in the lower guide bushing (22) for prying it out using a screwdriver. If the bushing will be pried out it should be pried from two sides to prevent jamming during removal. If it does not come out easily, fill the bushing with grease, insert the shaft (19) into the valve insuring that the machined portion of the shaft engages into the lower guide bushing. Using a soft faced mallet, strike the end of the shaft lightly until the bushing is pushed out partially. Remove the shaft and bushing by prying it out using the groove provided.

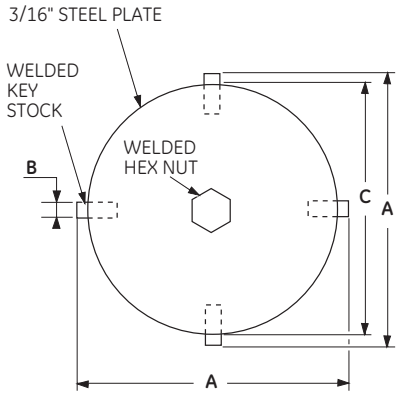
CAUTION

Do not pry the lower guide bushing (22) using the seat for leverage. If the bushing cannot be easily removed, proceed to section 8.3.1 and remove the seat ring retainer and seat ring then remove the guide bushing. Place a piece of soft stock (brass, etc.) between the inner seat shoulder and prying device to prevent damage to the seat sealing area of the body.

8.3.1 Seat Ring Removal (Refer to Figure 15 on page 22)

The following procedures outline the recommended method for removing the seat ring retainer (3) with the use of retainer wrenches. Baker Hughes manufactures and has available, for a nominal price, seat ring retainer wrenches for the Camflex II, 1" through 4" (DN 25 through 100) sizes. It is highly recommended that wrenches be purchased or fabricated to facilitate removal and reassembly of the seat ring (2) since SPECIFIC TORQUES MUST BE ACHIEVED to obtain tight shutoff and ensure proper functioning of the valve.

Figure 5 shows the recommended materials, thickness and method of construction along with specific dimensions to facilitate construction.



A = O.D. Seat Ring Retainer
B = Width of slot in Retainer
C = I.D. of Seat Ring Retainer

Valve size	A: retainer OD inches (mm)	B: width slots inches (mm)	C: retainer ID inches (mm)
1" (DN 25)	1.031 (26.19)	0.24 (6.1)	0.787 (20)
1.5" (DN 40)	1.55 (39.37)	0.24 (6.1)	1.125 (28.58)
2" (DN 50)	1.89 (48)	0.28 (7.1)	1.54 (39.12)
3" (DN 80)	2.874 (73)	0.409 (10.4)	2.545 (64.64)
4" (DN 100)	3.701 (94)	0.409 (10.4)	3.255 (82.68)
6" (DN 150)	5.63 (143)	0.469 (11.9)	5.165 (131.19)
8" (DN 200)	7.244 (184)	0.469 (11.9)	6.614 (168)
10" (DN 250)	9.37 (238)	0.52 (13.2)	8.661 (220)
12" (DN 300)	11.299 (287)	0.52 (13.2)	10.669 (271)
14" (DN 350)	13.426 (341.02)	1 (25.4)	12.13 (308.1)
16" (DN 400)	15.8 (401.32)	1 (25.4)	14.598 (370.8)

Figure 5

A. Secure the valve body in a vise or appropriate holding device with the seat ring facing up.

CAUTION

Care must be taken to avoid damage to the gasket face on the valve body.

B. Place retainer wrench so it engages retainer lugs.

C. Engage the retainer wrench with an impact wrench or suitable wrench and loosen, then remove retainer (3) by turning counterclockwise.

Note: The Camflex GR body constructions will require an extension to reach the retainer, due to the longer body pattern.

D. Lift out seat ring.

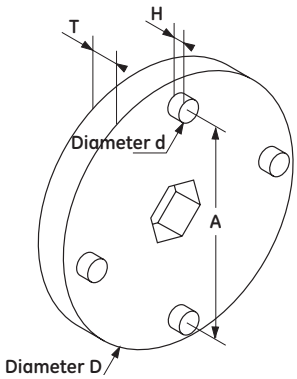
Note 1 : In an emergency, and in case dedicated retainer wrench is not available, an alternate tool can be used such as drill drift can be used. However the alternate device must be used and placed into at least two slots 180° apart.

Note 2: In case of Soft Seat design option (Class VI leakage class) for 14" and 16" valve size, a seat ring gasket is placed between body and seat ring.

8.3.2 DVD Removal (Refer to Figure 6)

In case of Camflex with the DVD option, model number 35x3x or 35x4x, the DVD is installed in the body, it is recommended to use the DVD wrenches to remove this device (105). Baker Hughes manufactures and has available, for a nominal price, DVD wrenches for the Camflex II, 1" through 12" sizes (DN 25 through DN 300). It is highly recommended that wrenches be purchased or fabricated to facilitate removal and reassembly of the DVD (105) since SPECIFIC TORQUES MUST BE ACHIEVED to ensure proper clamping of this DVD plate. Refer to Figure 12 on page 16.

Figure 6 shows the recommended thickness and method of construction along with specific dimensions to facilitate construction.



Valve Size	A inches (mm)	d inches (mm)	D inches (mm)	H inches (mm)	T inches (mm)
1" (DN 25)	1.063 (27)	0.142 (3.6)	1.236 (31.4)	0.079 (2)	0.4 (10)
1½" (DN 40)	1.496 (38)	0.157 (4)	1.772 (45)	0.118 (3)	0.5 (12)
2" (DN 50)	1.929 (49)	0.157 (4)	2.205 (56)	0.118 (3)	0.7 (18)
3" (DN 80)	2.913 (74)	0.177 (4.5)	3.248 (82.5)	0.157 (4)	0.8 (20)
4" (DN 100)	3.858 (98)	0.197 (5)	4.213 (107)	0.275 (7)	0.8 (20)
6" (DN 150)	5.905 (150)	0.236 (6)	6.260 (159)	0.354 (9)	1.0 (25)
8" (DN 200)	7.913 (201)	0.236 (6)	8.268 (210)	0.394 (10)	1.0 (25)
10" (DN 250)	9.843 (250)	0.236 (6)	10.315 (262)	0.394 (10)	1.2 (30)
12" (DN 300)	11.732 (298)	0.276 (7)	12.204 (310)	0.472 (12)	1.2 (30)

Figure 6

A. Secure the valve body in a vise or appropriate holding device with the plug side facing up (refer to Figure 15 on page 22).

CAUTION

Care must be taken to avoid damage to the gasket face on the valve body.

B. Place DVD plate wrench so it engages retainer lugs.

C. Engage the retainer wrench with an impact wrench or suitable wrench and loosen, then remove DVD (105) by turning counter-clockwise.

9. Maintenance

9.1 Diaphragm Replacement

(Refer to Figures 15 and 16 on page 22)

The recommended maintenance to be performed on the Model 35 Camflex diaphragm actuator is limited to the replacement of the diaphragm (40). Removal of the actuator from the valve is not required. To replace the diaphragm, proceed as follows:

CAUTION

The valve must be isolated and free from any service pressure. All electrical or air pressure to component parts must be off. Depressurize the actuator.

Handwheel (53) and limit stop (77) should be rotated counter-clockwise to allow lever to freely rotate.

A. Bypass the valve, close isolation valves, and isolate valve in compliance with CAUTION note listed above.

B. Shut off and disconnect air supply tubing to the actuator.

C. Remove the four capscrews (41) from diaphragm case (42) and remove diaphragm case.

D. Remove diaphragm (40).

Note: Diaphragm is glued to the top of the piston (43).

E. Remove tape or glue from the top of the piston and clean thoroughly.

F. Clean diaphragm case (42) and spring barrel (38) at the area that engages the diaphragm bead in preparation for reassembly.

Note: To hold the diaphragm in place on the piston, an adhesive disc (adhesive on both sides) or rubber cement is used. If rubber cement is used, it should be applied to both the piston and the diaphragm or in accordance with the manufacturer's directions for the adhesive being used. For recommended adhesives see Figure 14 on page 20.

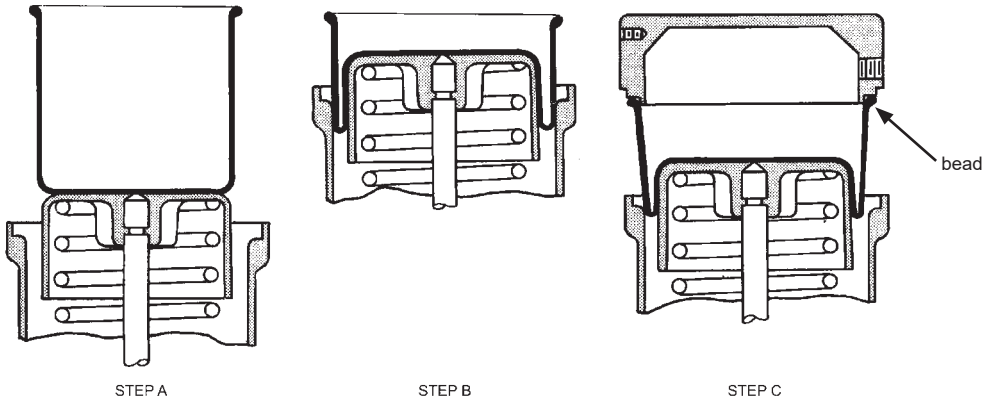


Figure 7 - Method 1

For the diaphragm replacement, use one of the two following methods:

Method 1: Points G-1 / H-1 / I-1 / J-1 / K-1

G-1. Apply adhesive tape or cement to the top of the piston.

H-1. The inscription “Piston Side” is located on the diaphragm (40). If used, apply cement to this side of the diaphragm.

I-1. Center and adhere diaphragm (40) to the top of the piston (43) (see Figure 7-Method 1, Step A).

J-1. Roll the diaphragm (40) inside the spring barrel (38) until the diaphragm is partially engaged in the spring barrel (see Figure 7-Method 1, Step B).

CAUTION

Ensure that the capscrew holes in the diaphragm case and spring barrel (38) are aligned to prevent twisting of the diaphragm (40) in aligning the holes. The diaphragm case (42) is normally assembled with the air inlet port placed on the bottom side of the actuator. Depending on the desired location, it can be placed in any desired position around the spring barrel which allows the capscrew holes to line up. However, the drain hole in the spring barrel must always be facing down to allow for draining of any moisture which may enter the spring barrel cylinder (38). If the valve is equipped with the optional purge line, that line is inserted into the drain hole.

K-1. Place the bead of the diaphragm (40) over the diaphragm case lip (42) and carefully slide the diaphragm case (42) down over the piston (43) until it seats on spring barrel (38). (see Figure 7-Method 1, Step C).

For next step, go to Point L.

Method 2: Points G-2 / H-2 / I-2 / J-2 / K-2

G-2. Apply coating of Neoprene glue (or similar) on the bead and on the inner face of the diaphragm (40), on the piston (43) and in the spring barrel lip (38).

Note: The inner face of the diaphragm in contact with the piston is marked with the inscription "piston side"; be careful to keep coating of the Neoprene to the flat part of the piston (Figure 7 on page 11 - Method 2, Step A).

H-2. Center and adhere the diaphragm (40) on the piston (43) (Figure 7 on page 11 - Method 2, Step A).

I-2. Roll the diaphragm (40) carefully inside the spring barrel (38) until the bead engages the spring barrel groove (38). Press lightly and evenly on the bead until the two Neoprene-coated parts are stuck together. Make sure that the diaphram inside the spring barrel is not twisted. (Figure 7 on page 11 - Method 2, Step B).

J-2. Adjust the diaphragm case (42) to the spring barrel (38) after checking that the air connection is on the correct side and the threaded holes of the diaphragm case (42) and the holes of the spring barrel (38) line up.

Note: The tapped air connection should be in line with the vent hole in the spring barrel (38).

K-2. Clamp the bead of the diaphragm (40) between the lips of the diaphragm case (42) and spring barrel (Figure 7 on page 11 - Method 2, Step C).

For next step, go to point L.

L. Ensure that the diaphragm case (42) is evenly seated on the spring barrel (38), insert the four capscrews (41) and tighten evenly.

M. Connect the air supply line to diaphragm case (42).

N. Turn on the air supply and check for leaks.

O. If necessary, reposition the handwheel (53) and limit stop (77) (optional) to desired location and place the valve back in service.

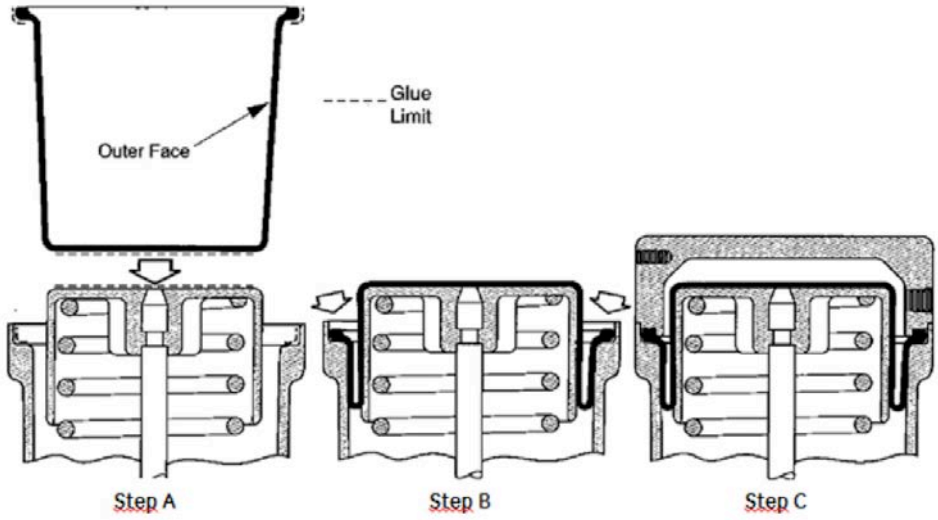


Figure 7 - Method 2

9.2 Model 5S Piston Spring Actuator Replacement

The recommended maintenance to be performed on the Camflex II spring piston Actuator includes the replacement of all wear and soft components including O-rings (125, 122, 113), guide (121), rod wiper (123) and guide ring (124). Removal of the actuator from the valve is strongly recommended for safe handling. To replace the soft and wear components, proceed the actuator disassembly following steps indicated in section 8.2.2 then 10.2.

CAUTION

The valve must be isolated and free from any service pressure. All electrical or air pressure to component parts must be off. Pressure to actuator must be relieved.

9.3 Body S/A Internal Parts

During maintenance of the Camflex II valve it is necessary to inspect all the internal parts to determine if they are worn, corroded, or damaged, especially the following seating area:

– body (1) and seat ring (2) contact area.

– the seating surface of the plug (4) and seat ring (2).

– the guide surface of the shaft (19), and the guide bushings (22, 21).

All parts which are damaged must be replaced by original spare parts.

9.4 Yoke Assembly

(Refer to Figures 15, 16, and 17 on pages 22 and 23)

Maintenance required on the yoke (33) is limited to replacement of the grommet (12) and the shaft bearing (8). To replace either, the actuator must be separated from the body. (Depending on the type of actuator used, refer to the appropriate section). Insert the grommet into the yoke with the recessed part of the grommet towards the shaft bearing. The shaft bearing (8) is slip fit into the yoke and is removed by pushing it out towards the grommet.

CAUTION

Before installing the bearing (8), ensure the bore and seat surface where it will be placed in the yoke (33) is clean. The bearing (8) should slide in easily. Do not use excessive force to push bearing in.

10. Reassembly Procedures

10.1 Model 35 Diaphragm Actuator

When the actuator has been disassembled using Section 8.2 to reassemble the actuator, proceed as follows:

A. Replace spring (39) in piston (43).

B. Replace washer (44) and locknut (45).

Note: Locknut (45) must be threaded the full length of the threads.

C. To reassemble the diaphragm and upper diaphragm case, refer to Section 9.1, steps E. through L.

D. Replace locknut (46) and clevis (35).

E. Determine correct orientation and replace actuator on yoke and replace lockwashers (37), capscrews (36) and tighten firmly.

F. Refer to Section 11. for actuator stem adjustment.

10.2 Model 5S Piston Spring Actuator

CAUTION

The valve must be isolated and free from any service pressure. All electrical or air pressure to component parts must be off. Pressure to actuator must be relieved.

A. Bypass the valve and isolate valve in compliance with CAUTION note on the previous page..

B. Shut off and disconnect air supply tubing to the actuator.

⚠WARNING

POTENTIAL LOSS OF CONTAINMENT / PRESSURE: The failure of properly following installation, maintenance and/or assembly / disassembly instructions may result in unsafe conditions. It is the responsibility of the end user to ensure instructions are properly followed.

LINES and FITTINGS: All lines and fittings must be properly connected and secured, and as required anchored to restrict movement.

The cylinder actuator is a spring loaded device and the disassembly instructions must be adhered to as unit or bodily damage can occur.

C. Loosen and remove compression nut (114), cylinder screws (115) and washers (116).

D. Remove the top plate (126), the springs (119,120), and the tube cylinder (118).

Note: Threaded holes are provided on the tube cylinder to help lifting it (for 5S size 12 : M4x0.7 and for 5S size 16 : M6x1).

E. Remove the piston S/A (117).

Note: Threaded hole is provided on the piston rod S/A to help lifting it (M8x1.25).

F. Replace O-ring (113) from base plate (112). Apply silicone grease on O-ring (or equivalent).

G. Replace O-ring (125) and guide ring (124) from piston S/A (117). Apply silicone grease on O-ring and guide ring (or equivalent).

H. Replace rod wiper (123), O-ring (122) and guide bushing (121) from base plate (112). Apply silicone grease on O-ring, rod-wiper and guide bushing (or equivalent).

Note: The guide bushing is press fit into the base plate.

I. Inspect piston rod, piston and tube cylinder for any scratches or damage on the sliding surfaces. In case of any damage, the components shall be replaced for proper operation of the actuator.

J. Grease sliding surface of piston S/A (117) with silicone grease (or equivalent) prior to installing in the base plate. Carefully assemble and be careful to not damage the guide bushing (121), O-ring (122), rod wiper (123) and the piston S/A in the base plate.

K. Grease inner surface of tube cylinder (118) with silicone grease (or equivalent). Carefully assemble the guide ring and O-rings the cylinder (118) on base plate (112), making sure not to damage any of the parts..

Note: Orient the NPT holes on base plate and cylinder tube as per Figure 17 on page 23.

L. Replace springs (119, 120) and install on the piston S/A (117).

M. Install the top plate (126) on the springs (119, 120)

N. Replace the screws (115) and the washers (116) and install them on the top plate.

Note: The larger holes in top plate and base plate are not to be used for screws but are provisions for lifting.

O. Replace compression nuts (114), install and hand tight them on the base plate. Tight in cross pattern by step the compression nuts. Finally, tight to 70 N.m.

P. Replace the washer (44) and the clevis (35) with its locknut (46) on the piston stem as far as possible. Firmly tight the locknut (46).

Q. Connect air supply line to base plate (112).

R. Turn on air supply and check for leaks

S. Refer to section 11 for actuator stem adjustment.

10.3 Diaphragm Actuator on Body S/A

(Refer to Figures 15 and 16 on page 22)

After completing the required maintenance or changing valve, actuator and yoke assembly, reassemble using the following procedure:

A. Determine correct valve to actuator orientation.

B. If required, reposition body studs (28) and packing flange studs (13).

Note: Depending on the actuator position, ensure that the body studs (short studs) when placed through the yoke holes will be positioned in the front of the yoke opening for ease of accessibility.

C. Ensure that the grommet (12) and shaft bearing (8) are in the yoke. Turn shaft so the plug is in the closed position.

D. Slide the valve shaft partly into the lower yoke opening, allowing enough room to place packing flange (14) over the shaft (19).

Note: Packing flange (14) is placed on the shaft (19) with the concave side toward the valve packing (17).

E. Ensure the slots in the packing flange (14) line up with the packing flange studs (13).

F. With the packing flange on the shaft, continue sliding the valve shaft toward the yoke (33) and through the grommet (12), in the yoke (33).

G. Place the lever (34) in the yoke and in line with the shaft so the boss on one side of the lever shaft hole is towards the shaft bearing (8) and engage the shaft to the lever splines.

Note: Lever must engage shaft in a single position so the pin in the lever shows the valve closed position on the front cover. The pin can be placed temporarily in the lever to check the correct alignment. The pin should just start touching the closed indicator position on the front cover when engaged on the shaft (refer to Figure 18 on page 25). If not, the lever must be removed and re-engaged in a different orientation so the pin touches the closed position.

CAUTION

Do not use air pressure to check alignment, since during normal operation and with full air pressure, the Indicator may overshoot the closed Indicator mark on the cover. This is acceptable.

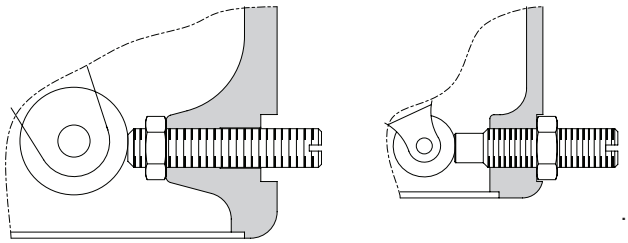
H. Slide shaft completely through lever to engage shaft bearing (8). Yoke should now be fully seated on the valve bonnet flange.

I. Replace and tighten body stud nuts (27).

J. Replace packing flange stud nuts (94) and finger tighten only.

K. Slide the lever (34) on the shaft (19) toward the valve and tighten the lever capscrew (49).

L. Pull the lever and shaft toward the bearing (8) in the yoke.



Limit Stop standard Camflex Diaphragm Actuator 6", 7" and N°9

Limit Stop standard Camflex Diaphragm Actuator 4.5"

Figure 8

CAUTION

This is required to ensure the shaft (19) is shouldered on the shaft bearing (8) and to ensure free operation of the valve.

M. Loosen lever capscrew (49) and slide lever (34) so it will shoulder against the shaft bearing (8) and tighten capscrew (49).

Note: if the actuator cylinder (38) has been removed, proceed to step N. If it has not, proceed to Section 11, Actuator Stem Adjustment.

N. Determine the desired actuator air or fail action and replace actuator cylinder (38) on the yoke (33) and secure in place with four capscrews (36) and lockwashers (37).

O. Proceed to Section 11, Actuator Stem Adjustment.

10.4 Model 5S Piston Spring Actuator on Body S/A

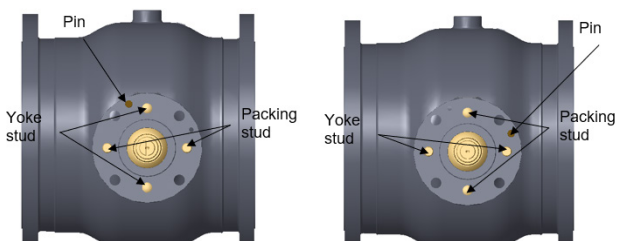
(Refer to Figures 15 and 17 on pages 22 and 23)

After completing the required maintenance or changing valve, actuator, and yoke assembly, reassemble using the following procedure:

A. Determine correct valve to actuator orientation.

B. If required, reposition body studs (28) and packing flangestuds (13).

Note: Depending on the actuator position (refer to serial plate (56) and numbering system - Figure 1 on page 3), ensure that the body studs (short studs), packing stud (long studs) and pin (72) are correctly positioned (see image hereafter).



Position 1 / 2 / 5 / 6

Position 3 / 4 / 7 / 8

C. Ensure that grommet (12) and shaft bearing (8) are in the yoke. Turn shaft so the plug is in the closed position.

D. Slide the valve shaft partly into the lower yoke opening, allowing enough room to place packing flange (14) over the shaft (19).

Note: Packing flange (14) is placed on the shaft (19) with the concave side toward the valve packing (17).

E. Ensure the slots in the packing flange (14) line up with the packing flange studs (13).

F. With the packing flange on the shaft, continue sliding the valve shaft toward the yoke (33) and through the grommet (12), in the yoke (33).

G. Place the lever (34) in the yoke and in line with the shaft so the boss on one side of the lever shaft hole is towards the shaft bearing (8) and engage the shaft to the lever splines.

Note: Lever must engage shaft in a single position so the pin in the lever shows the valve closed position on the front cover. The pin can be placed temporarily in the lever to check the correct alignment. The pin should just start touching the closed indicator position on the front cover when engaged on the shaft (refer to Figure 18 on page 25). If not, the lever must be removed and re-engaged in a different orientation so the pin touches the closed position.

CAUTION

Do not use air pressure to check alignment, since during normal operation and with full air pressure, the Indicator may overshoot the closed Indicator mark on the cover. This is acceptable.

H. Slide shaft completely through lever to engage shaft bearing (8). Yoke should now be fully seated on the valve bonnet flange.

I. Replace and tighten body stud nuts (27).

J. Replace and tighten yoke screws (71).

K. Replace packing flange stud nuts (94) and finger tighten only.

L. Slide the lever (34) on the shaft (19) toward the valve and tighten the lever capscrew (49).

M. Pull the lever and shaft toward the bearing (8) in the yoke.

CAUTION

This is required to ensure the shaft (19) is shouldered on the shaft bearing (8) and to ensure free operation of the valve.

N. Loosen lever capscrew (49) and slide lever (34) so it will shoulder against the shaft bearing (8) and tighten capscrew (49).

Note: If the actuator chamber S/A has been removed, proceed to step O. If it has not, proceed to Section 11, Actuator Stem Adjustment.

O. Determine the desired actuator air or fail action and replace actuator cylinder (38) on the yoke (33) and secure in place with four capscrews (36) and lockwashers (37).

P. Proceed to Section 11, Actuator Stem Adjustment.

10.5 Handwheel Reassembly for Model 35 Diaphragm Actuator

A. Place the valve so the position cover (11) is up.

B. Remove Truac ring (50) and handwheel washer (51) from the handwheel shaft (53).

C. Insert handwheel powerscrew with lock (52) in place into the appropriate hole in the yoke and screw in clockwise.

D. Replace the washer (51) and Truac ring (50)

E. Rotate the handwheel lightly against washer and lock in the off position with lock (52).

F. Replace bottom cover (11) by snapping in place.

Note: To use the handwheel, loosen the lock (52) and turn. The handwheel can be used as a limit stop on the valve by locking it in any position.

10.6 Limit Stop Reassembly for Model 35 Diaphragm Actuator

There are two limit stop assemblies that vary by actuator size: see Figure 8 on page 13.

10.7 Handwheel Reassembly for Model 5S Piston Spring Actuator

Install the handwheel S/A with the 4 screws (84). If the mounting plate (81) has been removed, replace it on the yoke (33)with the socket head screws (82).

10.8 Limit Stop Reassembly for Model 5S Piston Spring Actuator

Install the limit stop screw (77) with its nuts (78). If the mounting plate (80) has been removed, replace it on the yoke (33) with the screws (79).

10.9 Valve Body Reassembly

(Refer to Figure 15 on page 22)

Prior to reassembly, the valve body should be thoroughly cleaned . Upon completion of the above, proceed as follows:

CAUTION

Lubricants and sealers are required during reassembly. Figure 14 on page 20 identifies recommended products for certain service conditions. Ensure that any lubricant used is compatible with service conditions.

A. Apply a small amount of thread lubricant to the seat ring retainer threads and install seat ring retainer (3) and hand tighten only.

Note: In case of Soft Seat design option (Class VI leakage class) for 14" and 16" valve size, a seat ring gasket is placed between body and seat ring. The orientation of the lip seal shall be as indicated on Figure 16 on page 22, view Seat Ring Soft Seat for size 14" and 16". Reference to serial plate for flow direction valve installation.

CAUTION

Do not tighten the seat ring retainer to torque specification at this time.

B. Place the valve body (1) on a flat surface so that the seat is down.

C. Coat the lower guide bushing (22) with recommended lubricant and insert into the body.

Note: The groove in the guide bushing (22) must be towards the body center. Refer to Figure 9 for correct assembly sequence. If the shaft (19) is the previous design it may have a circular grove, if so, install the retaining ring (18).

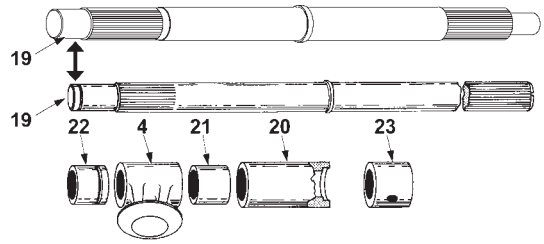


Figure 9

D. Coat the upper guide bushing (21) spacer tube (20) and the shaft splines (plug side) with recommended lubricant.

E. Insert the spacer tube (20) over the lubricated part of the shaft.

CAUTION

When a recessed groove exists in the spacer tube (20), this spacer tube (20) must be placed on the shaft (19) so that the shaft shoulder or retaining ring fits into the recessed groove on one end of the spacer tube (20).

F. Place upper guide bushing (21) on the shaft (19).

G. Place plug (4) in body so it rests on the seat.

In case of High Capacity design (split shaft option), follow step H to J. Otherwise, for standard design proceed to step K.

H. Place the Shaft support (70) into the plug (4) and then into the lower guide bushing (22). The shaft support keys feature need to be oriented with the plug slots so it is possible to slide the shaft support (70) until it contacts the lower guide bushing (22).

I. Slide the plug (4) inside the body upper guide bore so the shaft support is free to rotate. Rotate the shaft support (70) so the slot at the end is aligned with the plug key slots for locking (in some cases it may be simpler to rotate the plug while holding the support shaft).

J. Slide the plug (4) on the opposite side of the body neck to engage the plug key slots with the shaft support key feature. Rotate the plug (4) to ensure the shaft support (70) is properly engaged: the shaft support (70) should turn while rotating the plug (4).

K. Insert the shaft sub-assembly into the body (1) and engage plug (4) and lower guide bushing (22).

Note: The shaft (19) should be inserted into the plug so that when the plug is seated, the slot at the outer end of the shaft is perpendicular to the flow through the valve.

In case of 35002 SB, separable bonnet version, follow the operations described from Q to X.

L. Install the packing box ring (23), bevel side out, over the shaft (19) and into the valve bonnet being sure that the hole in the ring is aligned with the threaded port in the bonnet.

M. Apply a suitable lubricant to the threads of the safety pin (16) and screw into the body neck and tighten.

CAUTION

The Safety Pin is a safety device which must not be replaced by a plug. Use only genuine supplied safety pins. Pin must engage hole in packing box ring (23). Test by manually pulling on the shaft to verify engagement.

N. Install packing (17) insuring that the skive cut of each piece of packing is offset approximately 120° from that of the adjacent piece of packing.

Note: Sizes 1" thru 3" (DN 25 through 80) use 7 pieces of packing; sizes 4" thru 12" (DN 100 through 300) use 6 pieces of packing.

O. Install packing follower (15) rounded, bevel side out.

P. Proceed to Section 10.10 on seat ring alignment.

Q through X apply to separable bonnet design only:

Q. If necessary, install the studs (103) in the bonnet (102).

R. Install the stop ring (100).

S. Place the gasket (101) in the groove of the bonnet. The old gasket (101) must not be re-used.

T. Place the bonnet with the studs on the body and loosely tighten the nuts (104).

U. Tighten the nuts (104) according to the table in Figure 10.

Valve Size	Torque lb.ft	Torque m.N
1" (DN 25)	22	30
1½" (DN 40)		
2" (DN 50)		
3" (DN 80)	55	75
4" (DN 100)	55	75
6" (DN 150)	107	145
8" (DN 200)	107	145
10" (DN 250)	193	260
12" (DN 300)	193	260

Figure 10

Note: It is important to tighten the nuts evenly and by step of torque (i.e. 25%, 50%, 75%... of the specified torque). During tightening sequence, make sure the bonnet flange and shaft axis are kept aligned.

V. Install packing (17) making sure that the skive cut of each piece of packing is offset approximately 120° from that of the adjacent piece of packing.

Note: Sizes 1" through 3" (DN 25 through 80) use 7 pieces of packing; sizes 4" through 16" (DN 100 through 400) use 6 pieces of packing.

W. Install packing follower (15) rounded, bevel side out.

X. Proceed to Section 10.10 on seat ring alignment.

10.10 Seat Ring Alignment

Aligning the seat ring (2) and plug (4) is required whenever the seat ring or plug have been replaced or disassembled. Proceed as follows:

A. Place valve on flat surface with retainer (3) and seat ring (2) facing up.

Note: The casting marks (=) indicate the seat ring end of the body.

B. Remove the retainer ring (3) and the seat ring (2).

C. Apply a thin coat of sealant to the body where the seat ring will be placed, then insert the seat ring (2).

Note: In case of Soft Seat design option (Class VI leakage class) for 14" and 16" valve size, a seat ring gasket is placed between body and seat ring. The orientation of the lip seal shall be as indicated in figure 16 on page 22. Reference to serial plate for flow direction valve installation.

D. Apply a small amount of thread lubricant to the seat ring retainer threads and install seat ring retainer (3) and hand tighten only.

CAUTION

Do not tighten the seat ring retainer to torque specification at this time.

E. Replace lever (34) on valve shaft (19) and tighten lever capscrew (49).

F. Using the lever (34) manually close the plug with sufficient force to allow seat ring and plug to align.

G. Using the seat ring wrench, tighten seat ring retainer to the minimum torque value specified in Figure 11 on page 16.

Note: In some cases, for the valves from 3" to 16" (DN 80 to 400) with metal seat, the alignment can be improved by placing a piece of paper 0.10mm (0.004") thick and approximately 6mm (1/4") wide at a point where the leading edge and the trailing edge of the plug contacts the seat ring and close the plug. With a slight pressure on the lever, the paper strips should both be clamped in place. For the valve 8" to 16" (DN 200 to 400), the piece of paper shall be 0.20mm (0.008") thick and 12mm (1/4") wide.

Valve Size	Minimum Torque	
	lb.ft	m.N
1" (DN 25)	60	81
1½" (DN 40)	95	130
2" (DN 50)	100	135
3" (DN 80)	290	395
4" (DN 100)	365	494
6" (DN 150)	850	1152
8" (DN 200)	920	1247
10" (DN 250)	1400	1898
12" (DN 300)	2210	2996
14" (DN 350)	2880	390
16" (DN 400)	3540	480

Figure 11

H. Proceed to section 10.1 to 10.8, as applicable for body to actuator assembly.

10.11 DVD Plate Reassembly

Using the same method and tooling as described in 8.3.2, tighten the **Lo-dB™** plate at the indicated torque given in the table of Figure 12.

Valve Size	Tightening Torque	
	lb.ft	m.N
1" (DN 25)	74	100
1½" (DN 40)	81	110
2" (DN 50)	100	135
3" (DN 80)	220	295
4" (DN 100)	363	490
6" (DN 150)	780	1050
8" (DN 200)	975	1320
10" (DN 250)	1320	1830
12" (DN 300)	2250	3050

Figure 12

11. Actuator Stem Adjustment

11.1 Diaphragm Actuator

(Refer to Figures 15 and 16 on page 22)

The following procedures must be adhered to in order to ensure correct valve operation. Failure to do so could result in valve damage and equipment malfunction.

CAUTION

Correct actuator stem adjustment is imperative for proper valve functioning. With the actuator assembled to the valve in the desired location and orientation proceed as follows:

Note: If any of the following steps were completed during maintenance or reorientation of actuator to valve, proceed to the next step.

A. Remove front cover (32) and rear cover (29) by removing the two-cover screws (30).

B. Back off handwheel (53) so it does not interfere with the operation of the lever (34).

C. If applicable, rotate the limit stop (77) counterclock wise so it will not interfere with the operation of the lever (34).

D. Apply air pressure to the actuator and move lever (34) to an intermediate position.

CAUTION

Do not exceed pressure listed on serial plate (56) for actuator used. Do not use handwheel to move the lever.

E. Remove adjustable indicator (88) by removing the two screws (89).

F. Remove clevis pin clip (5), remove clevis pin (7).

G. Vent air pressure from the actuator to allow the clevis (35) and lever (34) to separate.

Note: If the unit is air-to-open, separate clevis (35) and lever (34) then loosen clevis locknut (46) and remove clevis.

H. Insert clevis pin (7) back in lever (34).

I. Manually push the lever (34) so the valve is in the closed position.

J. Temporarily replace the front cover (32) and check the location of the clevis pin (7) in relation to the closed position indicator mark on the front cover (32).

CAUTION

The position on the indicator must be in the 'acceptable' position as shown in Figure 18 on page 25. If it is not, the yoke must be separated from the body and the lever (34) repositioned on the shaft. Refer to the section 10.3. Failure to comply could result in the valve short stroking or over stroking and could damage the valve.

Note: If the unit is air-to-open, replace clevis locknut (46) and clevis (35).

K. Proceed to one of the following sections for final adjustment. Air-to-Open, Section (K-1), Air-to-Close Section (K-2).

K-1. Air-to-Open

After completing step A through J of Section 11.1, proceed as follows:

A. Mark a line on the clevis (35) in line with the inside of the yoke.

B. Apply supply pressure to the actuator so the actuator stem extend of the value specified below:

Diaphragm actuator Size	4 ½	6	7	No. 9
Value mm (in)	8 (.31)	9 (.35)	19 (.75)	15 (.59)

C. It should correspond to 8 psig (.55 barg) for size No. 9 actuators and 7 psig (.48 barg) for the others.

D. With the lever and valve plug in the fully CLOSED position, the holes in the clevis (35) and lever (34) should be in line.

Note: If holes are in line proceed to Step J. If not in line, continue to next step.

E. Move lever (34) to full open position.

F. Gradually apply sufficient air pressure to extend clevis locknut (46) to an accessible position.

CAUTION

Do not exceed pressure listed on serial plate (56) for actuator used. Do not use handwheel to move the lever.

G. Loosen clevis locknut (46).

H. Follow step B and C. Then continue to step I.

I. Screw clevis (35) in or out on actuator stem so that the holes in the clevis (35) and lever (34) are aligned with the lever and plug in the fully closed position.

J. Insert clevis pin (7) so indicator dot is visible through front cover (32) and secure with clevis pin clips (5).

Note: On the size 6 and 7 actuators, without the adjustable indicator (88), the clevis pin (7) must be installed so it protrudes toward the front cover (32). If the indicator dot is damaged, paint may be applied to the end facing the front cover (32) to make it more visible.

K. Gradually apply sufficient air pressure to extend clevis locknut (46) to an accessible position and tighten firmly.

CAUTION

Do not exceed pressure listed on serial plate (56) for actuator used. Do not use handwheel to move the lever.

L. Exhaust air pressure.

M. If used, replace adjustable indicator (88) to lever (34) with screws (89).

Note: If required, adjust indicator to front cover indicator marks.

N. Replace front cover (32) and rear cover (29) and secure in place with cover screws (30).

O. Replace spring barrel boss cover (58) and bottom cover (11) (Snap fit).

Note: Prior to placing the valve in service, operate the valve actuator through one complete cycle to ensure proper functioning.

P. If desired, set handwheel (53) or optional limit stop (77) to desired position.

K-2. Air-to-Close

After completing step A through J of Section 11.1, proceed as follows:

A. Manually push lever (34) to the full CLOSED position.

B. Connect a regulated air supply to the actuator.

C. Gradually apply supply pressure to the actuator so the actuator stem retracts fully. Then slowly reduce the supply pressure to retract the stem with the value in the following table.

Diaphragm actuator Size	4 ½	6	7	No. 9
Value mm (in)	9 (.35)	12 (.47)	19 (.75)	45 (1.77)

D. With the lever (34) and valve plug in the CLOSED position, the holes in the clevis (35) and lever (34) should be in line.

Note: If holes are in line proceed to Step H, if not in line, continue to the next step.

E. Release air pressure so clevis (35) will separate from lever (34).

F. Loosen clevis locknut (46).

G. Screw clevis (35) in or out so that when the air pressure corresponding to the closed position mentioned in C above is applied, clevis holes and lever will be in line.

H. Insert clevis pin (7) so indicator dot is visible through front cover (32) and secure with clevis pin clips (5).

Note: On the size 6 and 7 actuators, without the adjustable indicator (88), the clevis pin (7) must be installed so it protrudes toward the front cover (32). If the indicator dot is damaged, paint may be applied to the end of the clevis pin (7) facing the front cover (32) to make it more visible.

I. Tighten clevis locknut (46).

J. Remove and exhaust air pressure in the actuator.

K. Replace adjustable indicator (88) to lever (34) with screws (89).

Note: If required, adjust indicator (88) to front cover (32) indicator marks with the valve in the closed position.

L. Replace front cover (32) and rear cover (29) and secure in place with cover screws (30).

M. Replace spring barrel boss cover (58) and bottom cover (11) (Snap fit).

Note: Prior to placing the valve in service, operate the valve actuator through one complete cycle to ensure proper functioning.

N. If desired, set handwheel (53) or optional limit stop (77) to the desired position.

11.2 Piston Actuator

(Refer to Figure 17 on page 23)

The following procedures must be adhered to in order to ensure correct valve operation. Failure to do so could result in valve damage and equipment malfunction.

CAUTION

Correct actuator stem adjustment is imperative for proper valve functioning. With the actuator assembled to the valve in the desired location and orientation, proceed as follows:

Note: If any of the following steps were completed during maintenance or reorientation of actuator to valve, proceed to the next step.

A. Remove front cover (32) and rear cover (29) by removing the two-cover screws (30).

B. Back off handwheel (83) so it does not interfere with the operation of the lever (34).

C. If applicable, rotate the limit stop (77) counter clockwise so it will not interfere with the operation of the lever (34).

CAUTION

Do not exceed pressure listed on serial plate (56) for actuator used. Do not use handwheel to move the lever.

D. Remove adjustable indicator (88) by removing the two screws (89).

E. Remove clevis pin clip (5), lever pin clip (129), clevis pin (7) and lever pin (127).

F. Insert clevis pin (7) back in lever (34).

G. Replace clevis locknut (46) and washer (44). The clevis (35) will be engaged so it leaves a gap of 3 plus or minus 1 mm (0.12 plus or minus 0.04 in) between the locknut (46) and the clevis (35) and to have the pin bore facing the front face of the yoke and then lock in place using the locknut (46).

H. Manually push the lever (34) so the valve is in the closed position.

I. Temporarily replace front cover (32) and check the location of the clevis pin (7) in relation to the closed position indicator mark on front cover (32).

CAUTION

The position of the indicator must be in "acceptable" position as shown in Figure 18 on page 25. If it is not, the yoke must be separated from the body and the lever (34) repositioned on the shaft. Refer to Section 10.4. Failure to comply could result in the valve short stroking or over stroking and could damage the valve.

J. Proceed to one of the following sections for final adjustment:

Air-to-Open, section (J-1), Air-to-Close (J-2)

J-1. Air-to-Open

After completing step A through I of section 11.2, proceed as follows:

A. Assemble the ball joint (right handed) (109) with its jam nut (111) on the turnbuckle (110) and the ball joint (Left handed) (108) on the other side. Preset the distance between ball joint axis to 165 mm (6.5 in).

Note: The ball joints will be engaged on the turnbuckle such as length of engagement should be equal.

B. Manually push lever to full CLOSED position.

C. Connect a regulated air supply to the actuator and gradually apply pressure so the piston rod will retract of the value specified in the next table.

Note: Refer to serial plate for reference size and valve option.

Stroke / Valve Capacity	50° / Standard	70° / High Capacity
Value mm (in)	16 (0.63)	10 (0.39)

D. With the lever and valve plug in the full CLOSED position, install the ball joints assembly. Holes in the clevis (35), lever (34) and ball joints (108, 109) should be in line.

E. If holes are in line proceed to next step. Otherwise adjust the ball joint distance using the turnbuckle (110).

F. Install the clevis pin (7) and lever pin (127).

Note: Full travel of the valve can be check at this step to ensure the proper setting. Front cover (32) can be replace to help. If the valve does not make its full travel, turn the turnbuckle (110) (with pins (7, 127) still in place) to slightly decrease the distance between the ball joints (108, 109).

G. Tighten firmly the jam nut (111) on the ball joint (109).

H. Relieve air pressure.

I. If used, replace adjustable indicator (88) to lever (34) with screws (89).

Note: If required, adjust indicator to front cover indicator marks.

J. Replace font cover (32) and rear cover (29) and secure in place with cover screws (30).

K. Replace spring barrel boss cover (58) and bottom cover (11) (Snap fit).

Prior to placing the valve in service, operate the valve and actuator through one complete cycle to ensure proper functioning.

L. If desired, set handwheel or optional limit-stop to desired position. If not, install the boss covers (128).

J-2. Air-to-Close

After completing step A through I of section 11.2, proceed as follows:

A. Assemble the ball joint (Right-handed) (109) with its jam nut (111) on the turnbuckle (110) and the ball joint (Left-handed) (108) on the other side. Preset the distance between ball joint axis to 165 mm (6.50in).

Note: The ball joints will be engaged on the turnbuckle such as lengths of engagement should be equal.

B. Manually push lever to full CLOSED position.

C. Connect a regulated air supply to the actuator.

D. Apply supply pressure to fully retract the piston rod. Then reduce gradually the supply pressure so the piston rod extend of the value specified below:

Note: Refer to serial plate for reference size and valve option.

Stroke / Valve Capacity	50° / Standard	70° / High Capacity
Value mm (in)	16 (0.63)	10 (0.39)

E. With the lever and valve plug in the full CLOSED position, install the ball joints assembly. Holes in the clevis (35), lever (34) and ball joints (108, 109) should be in line.

F. If holes are in line proceed to next step. Otherwise adjust the ball joint distance using the turnbuckle (110).

G. Install the clevis pin (7) and lever pin (127).

Note: Full travel of the valve can be check at this step to ensure the proper setting. Front cover (32) can be replace to help. If the valve does not make its full travel, turn the turnbuckle (110) (with pins (7, 127) still in place) to slightly increase the distance between the ball joints (108, 109).

H. Tighten firmly the jam nut (111) on the ball joint (109).

I. Relieve air pressure.

J. If used, replace adjustable indicator (88) to lever with screws (89).

Note: If required, adjust indicator to front cover indicator marks.

K. Replace font cover (32) and rear cover (29) and secure in place with cover screws (30).

L. Replace spring barrel boss cover (58) and bottom cover (11) (Snap fit).

Note: Prior to placing the valve in service, operate the valve and actuator through one complete cycle to ensure proper functioning.

M. If desired, set handwheel or optional limit-stop to desired position. If not install the boss covers (128).

12. Changing Body Position

CAUTION

Before any change in flow direction or actuator mode is made, the valve and actuator must be resized using current process conditions. Any change in the flow direction or actuator failed position or actuator air action must be accomplished as outlined in this instruction, otherwise equipment malfunction could result.

Valve size (in)	Actuator model	Actuator size	Maximum Actuator Air Supply		Recommended tubing sizes
			kPa	Psi	
1	Model 35 Standard diaphragm actuator	4.5"	310	45	⅜" (8X10 mm)
1.5					
2					
3		6"	310	45	
4					
6		7"	517	75	
8					
10					
12					
6		No. 9	517	75	
8					
10					
12					
10	Model 5S Optional piston actuator	12"	517	75	⅜" (8X10 mm)
12					
14					
16					
12		16"	517	75	
14					
16					

Figure 13

Note: Maximum Air Supply pressure refer to the max allowable supply pressure of the actuator only. Refer to serial plate (56) for the actual valve and actuator assembly supply pressure.

⚠WARNING

Recommended position for valve above 6” is horizontal..

Service	Sealant	Lubricant	Diaphragm Glue
Condensate and Steam	Silver Seal T-J, Turbo 50 or HYLOMAR SQ 32	Molykote G or GRAPHENE 702	3M High Track adhesive transfer tape (or equal)
Cryogenic -20°F to -320°F (-29°C to -196°C)	Crown N. 9008 Teflon Spray or RODORSIL CAF 730	Crown N. 9008 Teflon Spray or GRAPHENE 702	3M Pressure sensitive tape, double coated (or equal)
Oxygen	Drilube type 822 or BONNAFLON S/9	Drilube type 822 or OXIGNENOEX FF250	Eastman 910 Cement (or equal)
All Others[(1)]	John Crane Plastic lead N.2 HYLOMAR SQ 32	Molykote G or GRAPHENE 702	Goodyear Plibond Cement (or equal)

(1) Except Food Services.

Figure 14

Changing service requirements or service conditions may require a change in flow direction through the Camflex II valve. Figure 19 on page 25 illustrates the various positions and flow directions in which the valve may be placed to accommodate requirements.

CAUTION

Changing the body position and flow direction could also require relocating the actuator. Ensure that the actuator location and action are in accordance with the recommended positions and modes illustrated in Figure 19 on page 25. Illustrations are shown looking at the body through the bonnet with the actuator in front of the valve. The plug shaft is always rotated in a clockwise direction by the actuator to open the valve.

To change body position proceed as follows:

A. Refer to Figure 19 on page 25 and determine the desired valve position, flow direction and which actuator position is required.

B. Proceed to the appropriate section of this instruction for the required disassembly and assembly procedures.

13. Changing Actuator Action

13.1 Model 35 Diaphragm Actuator

CAUTION

Before any change in flow direction or actuator mode is made, the valve and actuator must be resized using current process conditions. Any change in the flow direction or actuator mode must be accomplished as outlined in this instruction, otherwise equipment malfunction could result.

A. Remove the front cover (32) and the rear cover (29) by removing the two cover screws (30).

B. Remove the spring barrel boss cover (58) (Snap fit).

C. Remove the bottom cover (11) (Snap fit).

D. Using a manual loading panel, apply sufficient air pressure to the actuator to move the lever (34) to an intermediate position.

CAUTION

Do not exceed pressure listed on serial plate (56) for actuator used. Do not use handwheel to move the lever.

E. Remove clevis pin clips (5) and remove clevis pin (7).

F. Position lever so it does not contact handwheel powerscrew assembly.

G. Remove Truarc ring (50) and washer (51) from handwheel powerscrew assembly.

H. Unscrew and remove handwheel powerscrew assembly from yoke (33).

I. Remove handwheel thread plug (48).

Note: If the actuator is equipped with the optional limit stop (77), in place of the handwheel thread plug, it must be removed.

CAUTION

Depending on the size and weight of the actuator, it is recommended that proper lift and support procedures be utilized when removing the spring barrel or yoke.

J. Ensure spring barrel is properly supported.

K. Loosen and remove capscrews (36) and lockwashers (37) then remove spring barrel (38).

CAUTION

If the orientation of the actuator to valve requires that the yoke be rotated about the valve, it is recommended that Section 12 on changing yoke position be accomplished before proceeding.

L. With the yoke assembled to the valve in the required orientation, place the spring barrel (38) on the desired yoke location and secure with capscrews (36) and lockwashers (37), then tighten firmly.

M. Screw in handwheel powerscrew assembly into the powerscrew hole of the yoke which is on the opposite side of the spring diaphragm actuator.

Note: Handwheel action is always the same as air action and opposes the spring.

N. Replace handwheel washer (51) and Truarc ring (50) and back off the handwheel so the powerscrew will not interfere with the operation of the lever.

O. Replace the handwheel thread plug (48).

Note: If the valve is equipped with the optional limit stop (77) instead of the thread plug, it must now be installed, but ensure it is unscrewed counter clockwise as not to interfere with the operation of the lever at this time.

P. Proceed to Section 11.1, on Actuator Stem Adjustment.

13.2 Model 5S Piston Spring Actuator

A. Remove the front cover (32) and the rear cover (29) by removing the two cover screws (30).

B. Remove the spring barrel boss cover (58) (Snap fit).

C. Remove the bottom cover (11) (Snap fit).

D. Remove clevis pin clips (5), clevis pin (7), lever pin clips (129), lever pin (127).

E. Remove ball joint (108, 109) and turnbuckle (110) assembly.

F. Remove the handjack S/A by untight the hex screws (84).

G. Remove the handjack mounting plate (81) by untight the cap screws (82).

H. Remove the side cover (128) or mounting limit stop plate (80) in case of optional limit-stop.

CAUTION

It is recommended that proper lift and support procedures be utilized when removing the spring barrel or yoke.

I. Ensure spring barrel is properly supported.

J. Loosen and remove cap screws (36) and lock washers (37), then remove spring barrel.

CAUTION

If the orientation of the actuator to the valve requires that the yoke be rotated about the valve, it is recommended that section 12 on changing the yoke position be accomplished before proceeding.

K. With the yoke assembled to the valve in the required orientation, place spring barrel (38) on desired yoke location and secure with cap screws (36) and lock washers (37) and tighten firmly.

L. Install the handjack mounting plate (81) with the 4 cap screws (82).

M. Install the handjack with the 4 head screws (84).

Note: Handjack action is always the same as air action and opposes the spring.

N. Replace the side cover (128) or mounting limit stop plate in case of optional limit-stop.

O. Proceed to section 11.2, on Actuator Stem Adjustment.

14. Model 20 Manual Actuator Option

The manual Model 20 type actuator is designed to close the valve by rotating the handwheel in a clockwise direction. Anti-rotation of the handwheel is obtained through a detente device located between handwheel (53) and retainer (87).

14.1 Disassembly Procedure

The disassembly procedure for manual actuator is similar to the procedure for the diaphragm actuator, see Section 8.1.

14.2 Maintenance

Routine maintenance of the manual actuator requires that a suitable lubricant be periodically applied to the handwheel powerscrew.

Bearings may require replacement due to service conditions or corrosion.

The replacement of the handwheel clutch mechanism should be required.

14.3 Reassembly Procedure

There is no specific adjustment for the reassembly of manual actuator. For details see Figure 22 on page 26.

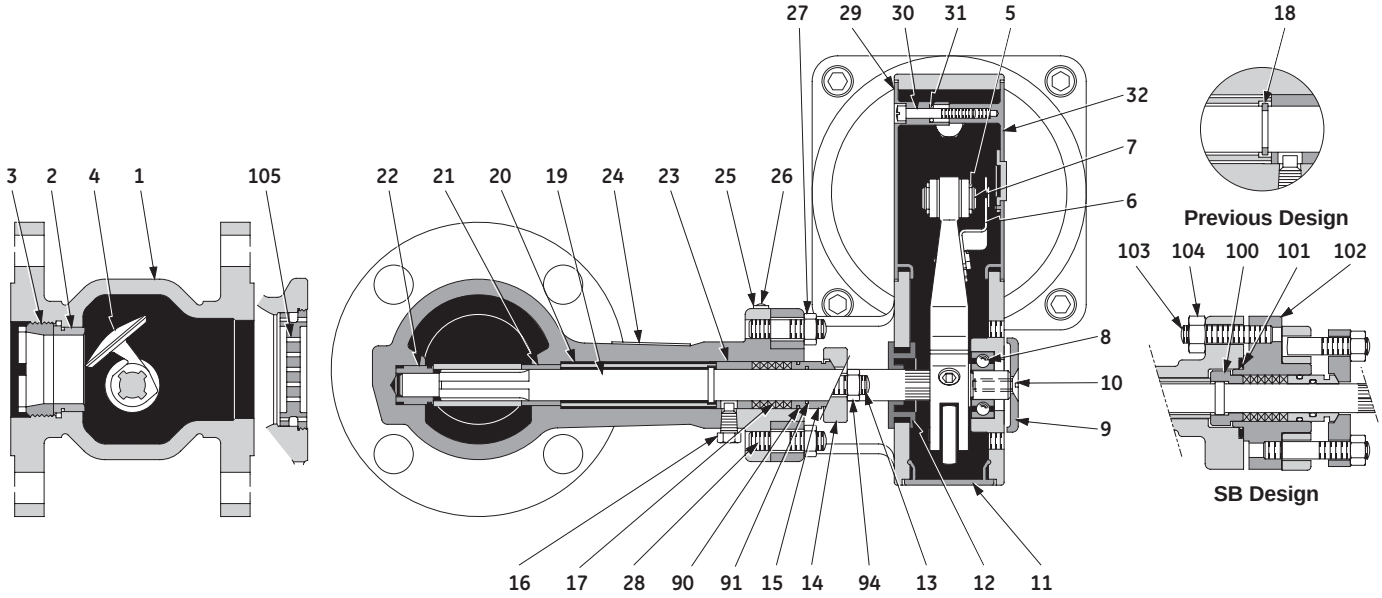


Figure 15

Nº9 Previous Design

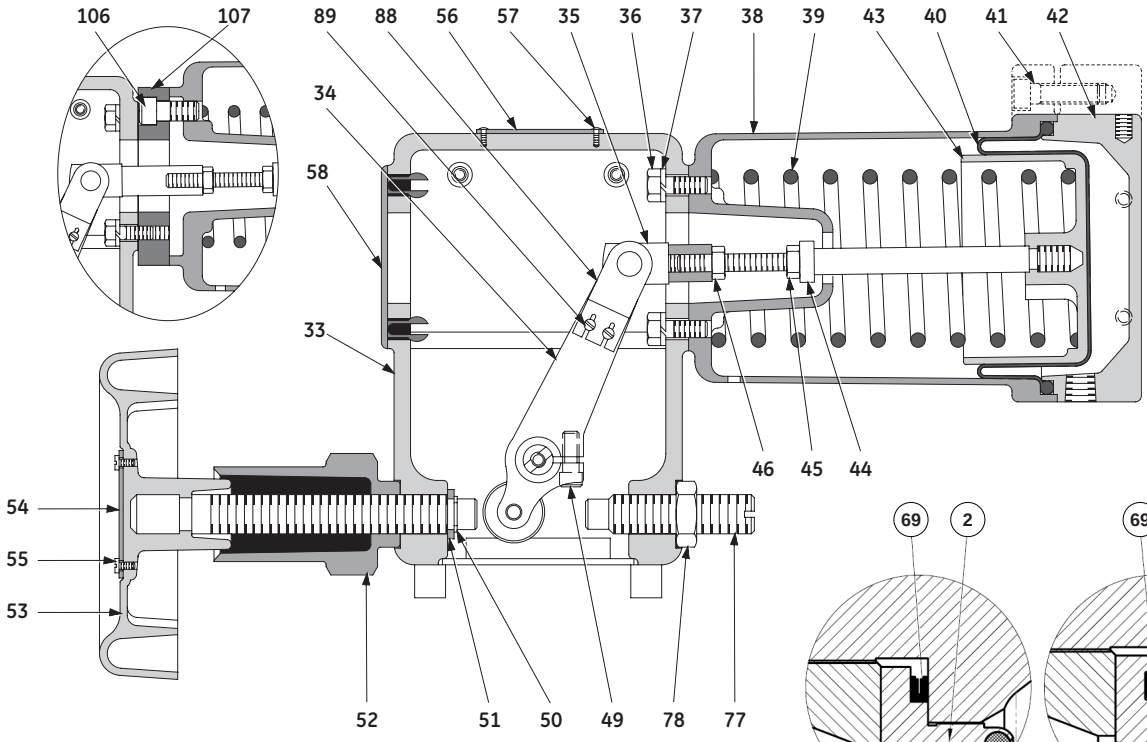
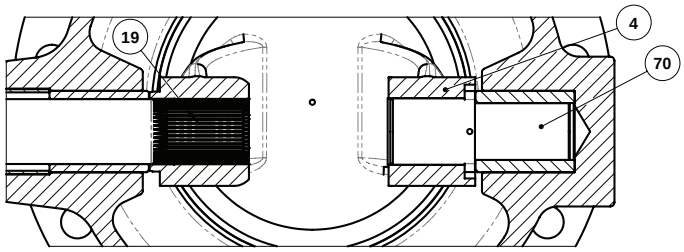


Figure 16

Flow to Open **Flow to Close**

Seat Ring Soft Seat for size 14" and 16"



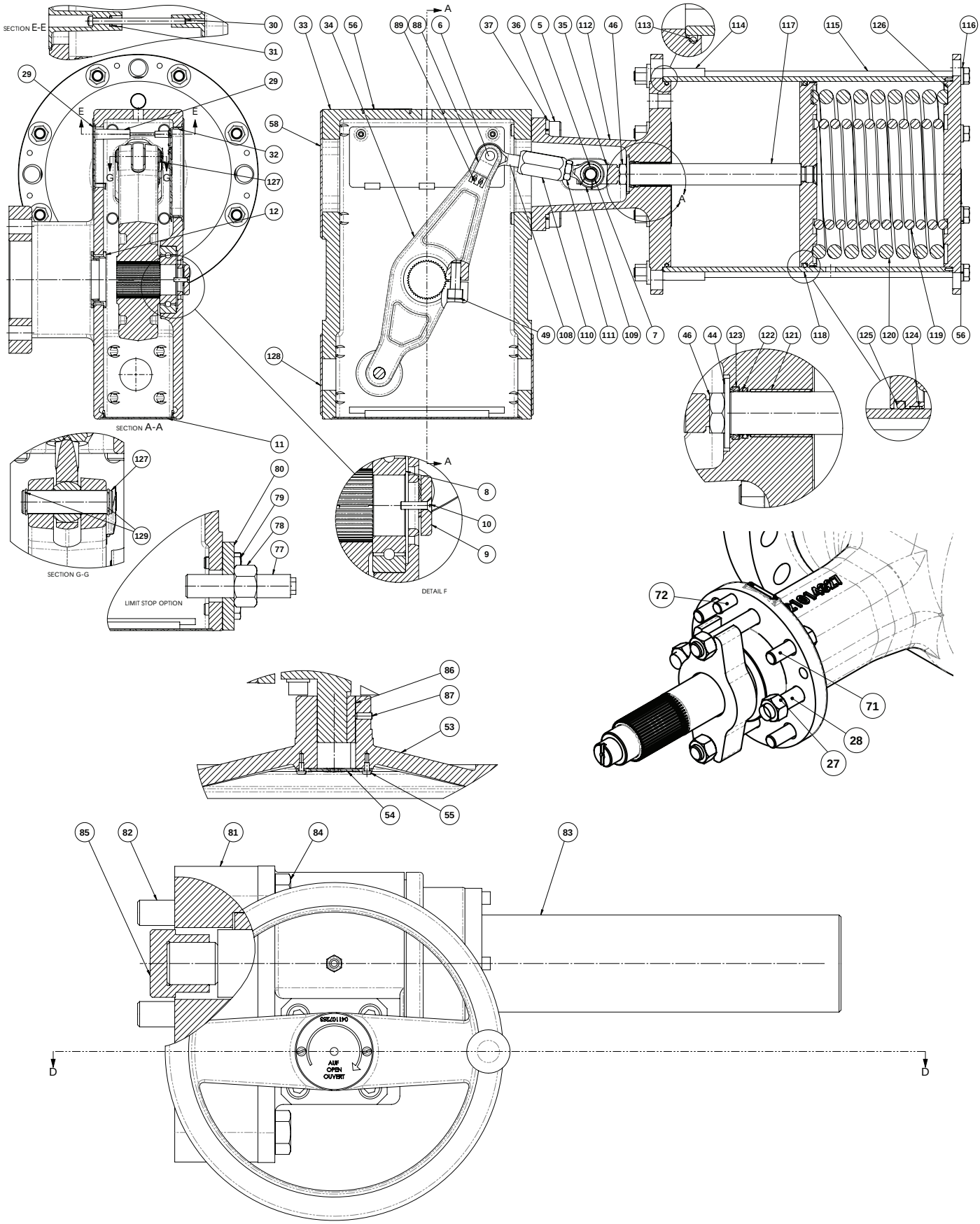


Figure 17

Parts Reference

Ref.	Qty.	Part Name
1	1	Body
2	1	Seat Ring
3	1	Retainer
4	1	Plug
5	2	Clevis Pin Clip
6	1	Indicator Dot
7	1	Clevis Pin
8	1	Bearing
9	1	Shaft Cover
10	1	Cover Screw
11	1	Bottom Cover
12	1	Grommet
13	2	Packing Flange Stud
14	1	Packing Flange
15	1	Packing Follower
16	1	Safety Pin
17	••	Packing
18[1]	1	Shaft Retaining Ring
19	1	Shaft
20	1	Spacer
21	1	Upper Guide Bushing
22	1	Lower Guide Bushing
23	1	Packing Box Ring
24	1	Warning Plate
25	1	Flow Arrow
26	2	Plate Screw
27	2	Nut
28	2	Body Stud
29	1	Rear Cover
30	2	Cover Screw
31	2	Screw Retainer
32	1	Front Cover
33	1	Yoke
34	1	Lever
35	1	Clevis
36	4	Cap Screw
37	4	Lockwasher
38	1	Spring Barrel
39	1	Spring

Ref.	Qty.	Part Name
40	1	Diaphragm
41	4	Cap Screw
42	1	Diaphragm Case
43	1	Piston-Stem
44	1	Lockwasher
45	1	Locknut
46	1	Locknut
48	•	Thread Plug
49	1	Lever Cap Screw
50	1	Truarc Ring
51	1	Handwheel Washer
52	1	Handwheel Lock
53	1	Handwheel Shaft
54	1	Handwheel Plate
55	2	Plate Screw
56	1	Serial Plate
57	2	Plate Screw
58	1	Boss Cover
60	•	Counter-Flange
61	•	Gasket
64	•	Stud
67	•	Stud
68	•	Nut
69	•	Seat Ring Gasket
70	•	Support Shaft
71	4	Cap Screw
72	1	Dowel Pin
77	1	Limit Stop
78	1	Locknut
79	4	Plate Screws
80	1	Limit-Stop Plate
81	1	Handjack Plate
82	4	Handjack Plate Screws
83	1	Handjack
84	4	Handjack Screws
85	1	Button
86	1	Key
87	1	Set Screw
88	1	Adjustable Indicator

Ref.	Qty.	Part Name
89	2	Indicator Screw
90	1	Inner O-Ring
91	1	Outer O-Ring
92	1	Inner O-Ring
93	1	Outer O-Ring
94	2	Nut
95	1	Inner O-Ring
96	1	Outer O-Ring
100	1	Stop Ring
101	1	Body Gasket
102	1	Bonnet
103	4	Bonnet Stud
104	4	Bonnet Nut
105	1	Lo-dB Plate
106[1]	4	Adaptor Screw
107[1]	1	Adaptor
108	1	Ball Joint Lef
109	1	Ball Joint Right
110	1	Turnbuckle
111	1	Ball Joint Nut
112	1	Base Plate
113	1	Cylinder O-Ring
114	8	Compression Nut
115	8	Cylinder Screws
116	8	Washer
117	1	Piston-Stem S/A
118	1	Cylinder Tube
119	1	Inner Spring
120	1	Outer Spring
121	1	Guide
122	1	Stem O-Ring
123	1	Rod Scrapper
124	1	Piston Guide
125	1	Piston O-Ring
126	1	Top Plate
127	1	Lever Pin
128	1	Boss Cover
129	2	Lever Pin Clip

1. Applies to previous design only.

• Quantity varies according to option.

•• Quantity varies according to size and bonnet type. Confirm required quantity from valve serial records.

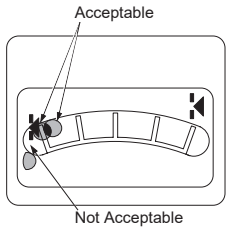
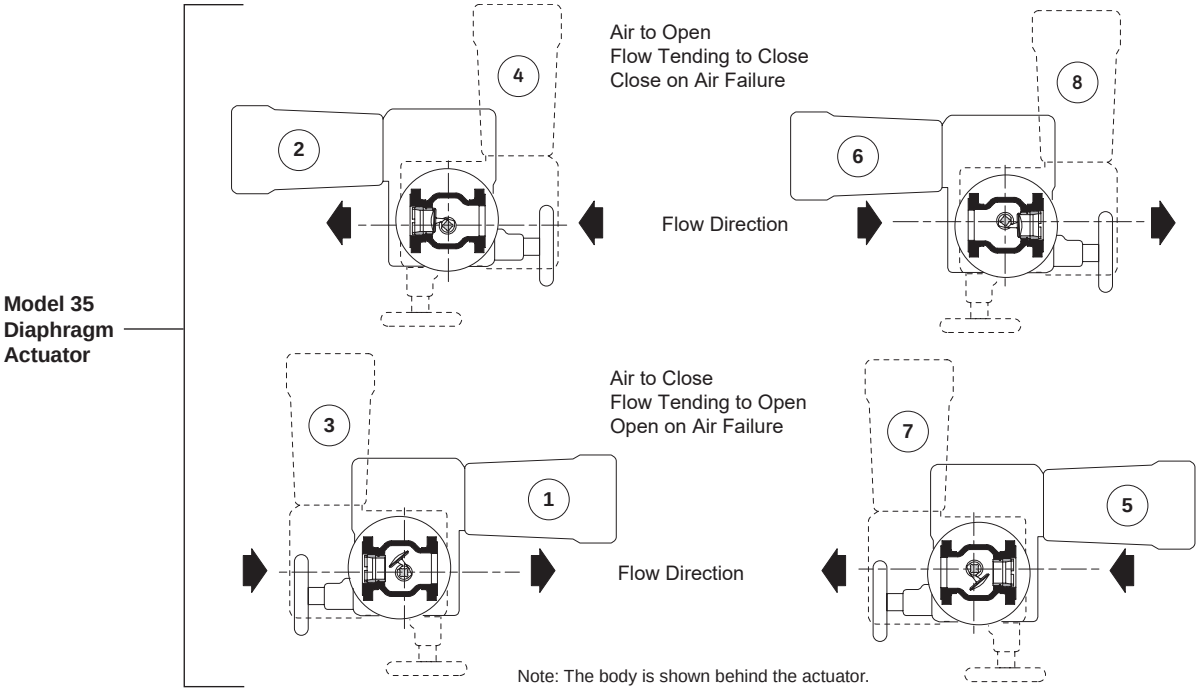


Figure 18 - Indicator Position



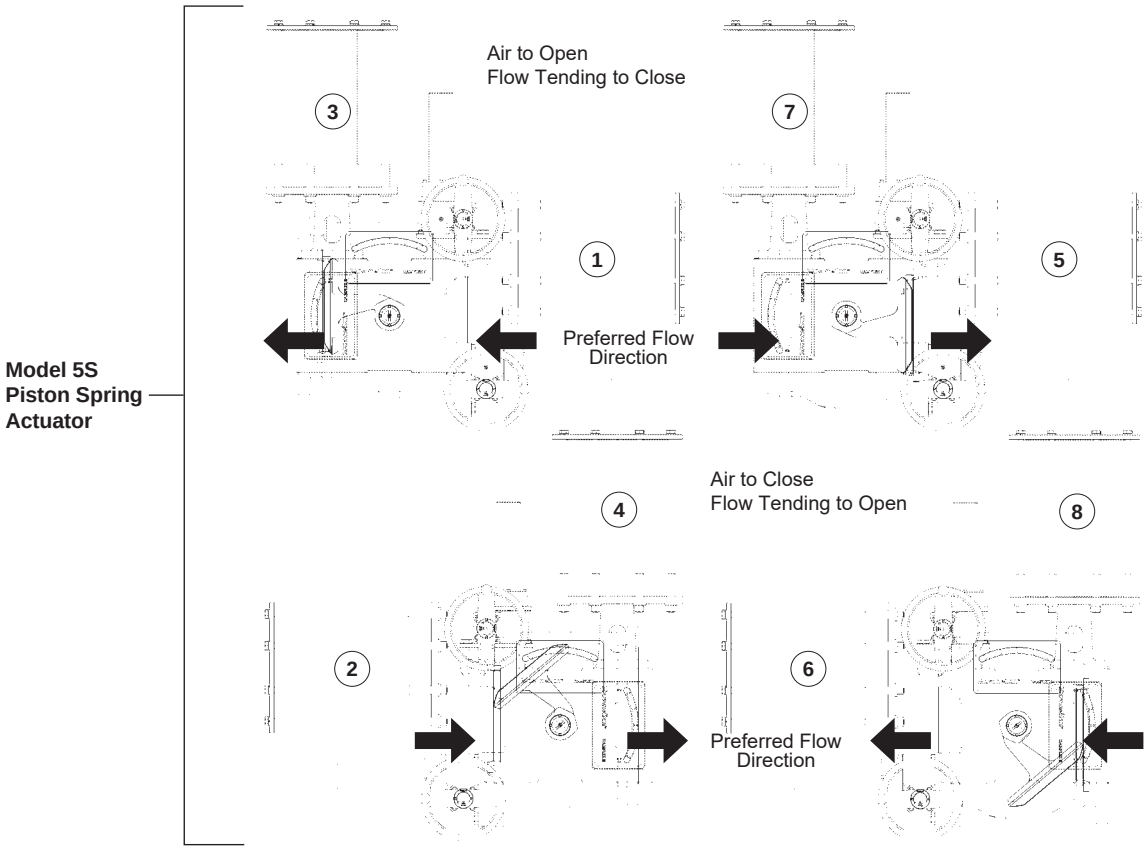


Figure 19 - Actuators Mounting Positions

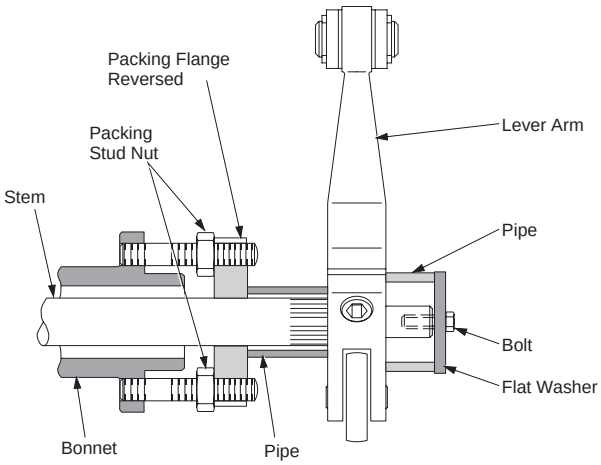


Figure 20

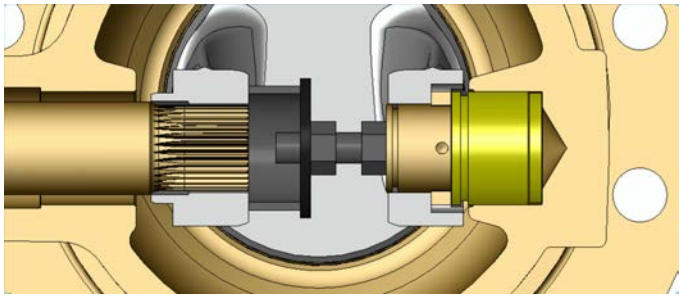


Figure 21 - High capacity shaft support disassembly fixture

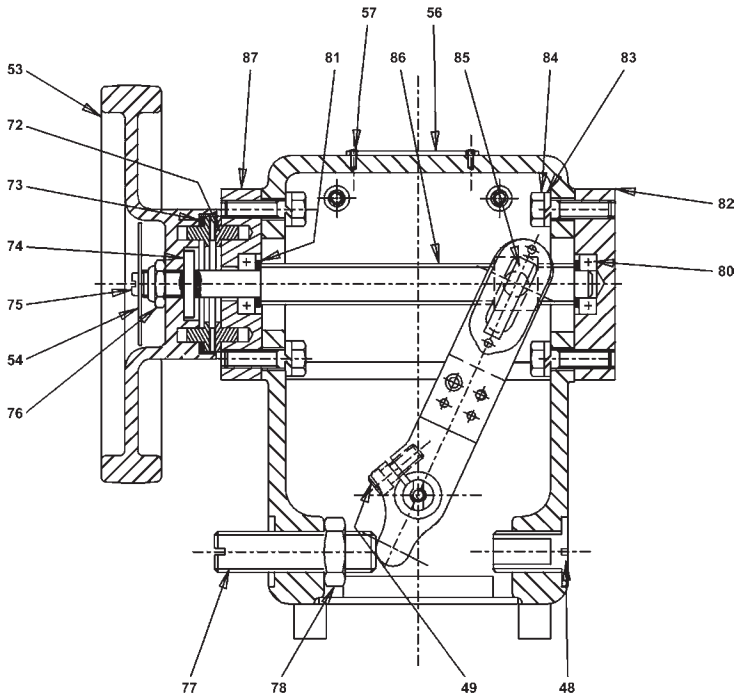
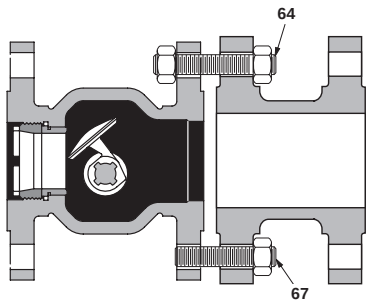


Figure 22

Flanged Bodies

Valve Rating		Long Stud (T) (64) Short Stud (G) (67)			Nuts	Long Stud (T) (64) Short Stud (G) (67)			Nuts	Long Stud (T) (64) Short Stud (G) (67)			Nuts
		Qty.	Length inches (mm)	Dia.	Qty.	Qty.	Length inches (mm)	Dia.	Qty.	Qty.	Length inches (mm)	Dia.	Qty.
		1" (DN 25)				1 1/2" (DN 40)				2" (DN 50)			
ANSI EN (ISO PN)	150 (20)	8T	2.50 (63.5)	1/2" (M14)	16	8T	2.75 (70.0)	1/2" (M14)	16	8T	3.25 (82.5)	5/8" (M16)	16
	300 (50)		3.00 (76.2)	5/8" (M16)			3.50 (88.9)	3/4" (M20)		16T	3.50 (88.9)		32
	600 (100)	8G	3.00 (76.2)		8	8G	3.50 (88.9)		8	8T + 8G	4.25 (108.0) 3.75 (95.2)		24
EN DIN	PN 10	8T	(71.0)	M12	16	8T	(84.0)	M16	16	8T	(84.0)	M16	16
	PN 16												
	PN 25												
	PN 40												
		3" (DN 80)				4" (DN 100)				6" (DN 150)			
ANSI EN (ISO PN)	150 (20)	8T	3.50 (88.9)	5/8" (M16)	16	16T	3.50 (88.9)	5/8" (M16)	32	16T	4.00 (101.6)	3/4" (M20)	32
	300 (50)	16T	4.25 (108.0)	3/4" (M20)	32	16T	4.50 (114.3)	3/4" (M20)		24T	4.75 (120.6)		48
	600 (100)	12T + 4G	5.00 (127.0) 4.25 (108.0)		28	12T + 4G	5.75 (146.0) 5.00 (127.0)	7/8" (M24)	28	20T + 4G	6.75 (171.5) 6.00 (152.4)	1" (M27)	44
EN DIN	PN 10	16T	(84.0)	M16	32	16T	(84.0)	M16	32	16T	(102.0)	M20	32
	PN 16												
	PN 25		(92.0)				(102.0)	M20			(119.0)	M24	
	PN 40												
	PN 63/64	N/A					(123.0)	M24		15T + 1G	(155.0) (120.0)	M30	31
		8" (DN 200)				10" (DN 250)				12" (DN 300)			
ANSI EN (ISO PN)	150 (20)	16T	4.25 (108.0)	3/4" (M20)	32	24T	4.50 (114.3)	7/8" (M24)	48	24T	4.75 (120.6)	7/8" (M24)	48
	300 (50)	24T	5.50 (140.0)	7/8" (M24)	48	32T	6.25 (158.8)	1" (M27)	64	32T	6.75 (171.5)	1 1/8" (M30)	64
	600 (100)	20T + 4G	7.50 (190.5) 6.75 (171.5)	1 1/8" (M30)	44	N/A				N/A			
EN DIN	PN 10	16T	(102.0)	M20	32	24T	(106.0)	M20	48	24T	(106.0)	M20	48
	PN 16	24T			48		(115.0)	M24			(115.0)	M24	
	PN 25		(123.0)	M24			(133.0)	M27			(133.0)	M27	
	PN40		(137.0)	M27			(151.0)	M30			(151.0)	M30	



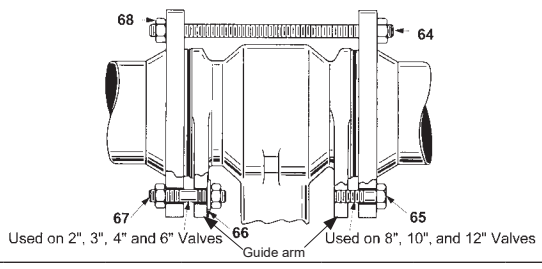
1/2" : 1/2" 13 UNC 2A/2B
5/8" : 5/8" 11 UNC 2A/2B
3/4" : 3/4" 10 UNC 2A/2B
7/8" : 7/8" 9 UNC 2A/2B
1" : 1" 8 UNC 2A/2B
1 1/8" : 1 1/8" 8 UNC 2A/2B
1 1/4" : 1 1/4" 8 UNC 2A/2B

Figure 23

Note: For 14" (DN 350) and 16" (DN 400) valve sizes, through holes are provided on the valve end connections according to flanged end size and rating standards. Nuts and bolts dimensions from relevant standard can be used.

Flangeless Bodies

Valve Rating		Long Stud (T) (64) Short Bolt (G) (67) Cap Screws (V) (65)			Nuts	Long Stud (T) (64) Short Bolt (G) (67) Cap Screws (V) (65)			Nuts	Long Stud (T) (64) Short Bolt (G) (67) Cap Screws (V) (65)			Nuts
		Qty.	Length inches (mm)	Dia.	Qty.	Qty.	Length inches (mm)	Dia.	Qty.	Qty.	Length inches (mm)	Dia.	Qty.
		1" (DN 25)				1 1/2" (DN 40)				2" (DN 50)			
ANSI (ISO PN)	150 (20)	4T	7.50 (190)	1/2"	8	4T	7.50 (190)	1/2"	8	4T	9.0 (230)	5/8"	8
	300 (50) 400		7.75 (195)	5/8"			8.75 (220)	3/4"		7T 2G	9.0 (230) 3.75 (95)		18
	600 (100)												
EN DIN	PN 10	4T	7.50 (190)	1/2" (M12)	8	4T	7.50 (190)	5/8" (M16)	8	4T	9.0 (230)	5/8" (M16)	8
	PN 16 PN 25 PN 40												
	PN 63/64		8.10 (205)	5/8" (M16)			9.0 (230)	3/4" (M20)			9.50 (240)	3/4" (M20)	
	PN 100										10 (250)	7/8" (M24)	
		3" (DN 80)				4" (DN 100)				6" (DN 150)			
ANSI (ISO PN)	150 (20)	4T	10.25 (260)	5/8"	8	7T 2G	11.50 (290) 3.75 (95)	5/8"	18 D(1)	7T 2G	13.75 (350) 4.50 (115)	3/4"	18 B(1)
	300 (50)	7T 2G	12.0 (305) 4.50 (115)	3/4"	18		12.0 (305) 4.50 (115)	3/4"	18 B(1)	11T 2G			26 B(1)
	400						14.25 (360) 5.50 (140)	7/8"	18		16.25 (410) 5.50 (140)	7/8"	26 C(1)
	600 (100)										16.0 (400) 6.0 (150)	1"	26
EN DIN	PN 10 PN 16	7T 2G	10.25 (260) 3.75 (95)	5/8" (M16)	18 A(1)	7T 2G	11.50 (290) 3.75 (95)	5/8" (M16)	18 D(1)	7T 2G	14.0 (350) 4.50 (115)	3/4" (M20)	18 B(1)
	PN 25 PN 40						12.0 (305) 4.50 (115)	3/4" (M20)	18 B(1)		14.25 (360) 5.50 (140)	7/8" (M24)	18 C(1)
		8" (DN 200)				10" (DN 250)				12" (DN 300)			
ANSI (ISO PN)	150 (20)	6T 4V	13.75 (350) 3.0 (76)	3/4"	12	8T 8V	16.50 (420) 3.0 (76)	7/8"	16	8T 8V	18.50 (470) 3.0 (76)	7/8"	16
	300 (50)	10T 4V	16.25 (410) 3.5 (89)	7/8"	20	12T 8V	19.0 (480) 3.75 (95)	1"	24	12T 8V	20.50 (520) 3.75 (95)	1 1/8"	24
	400		17.0 (430) 4.0 (102)	1"			20.50 (520) 4.25 (108)	1 1/4"			22.50 (570) 4.25 (108)	1 1/4"	
	600 (100)		18.125 (460) 4.25 (108)	1 1/8"			20.50 (520) 4.75 (120)	1 1/8"		16T 8V	22.50 (570) 4.75 (120)		32
EN DIN	PN 10	6T 4V	13.75 (350) 3.0 (76)	3/4" (M20)	12	8T 8V	16.50 (420) 3.0 (76)	3/4" (M20)	16	–	–	–	–
	PN 16	10T 4V			20		16.50 (420) 3.0 (76)	7/8" (M24)		8T 8V	18.50 (470) 3.0 (76)	7/8" (M24)	16
	PN 25		14.25 (360) 3.0 (76)	7/8" (M24)			17.0 (430) 3.25 (82)	1" (M27)		12T 8V	19.0 (480) 3.25 (82)	1" (M27)	24
	PN 40		15.75 (400) 3.25 (82)	1" (M27)			18.125 (460) 3.75 (95)	1 1/8" (M30)			20.50 (520) 3.75 (95)	1 1/8" (M30)	
	PN 63/64		17.0 (430) 3.75 (93)	1 1/4" (M33)			20.0 (510) 3.75 (93)	1 1/4" (M33)			21.25 (540) 4.0 (100)	1 1/4" (M33)	



(1) Use one washer (66) for each short stud as shown on the left figure:
A: M16N (18x32x3)mm
B: M20N (22x40x3)mm
C: M22N (24x45x3)mm
D: L16N (18x40x3)mm

1/2" : 1/2" 13 UNC 2A/2B
5/8" : 5/8" 11 UNC 2A/2B
3/4" : 3/4" 10 UNC 2A/2B
7/8" : 7/8" 9 UNC 2A/2B
1" : 1" 8 UNC 2A/2B
1 1/8" : 1 1/8" 8 UNC 2A/2B
1 1/4" : 1 1/4" 8 UNC 2A/2B

Figure 24

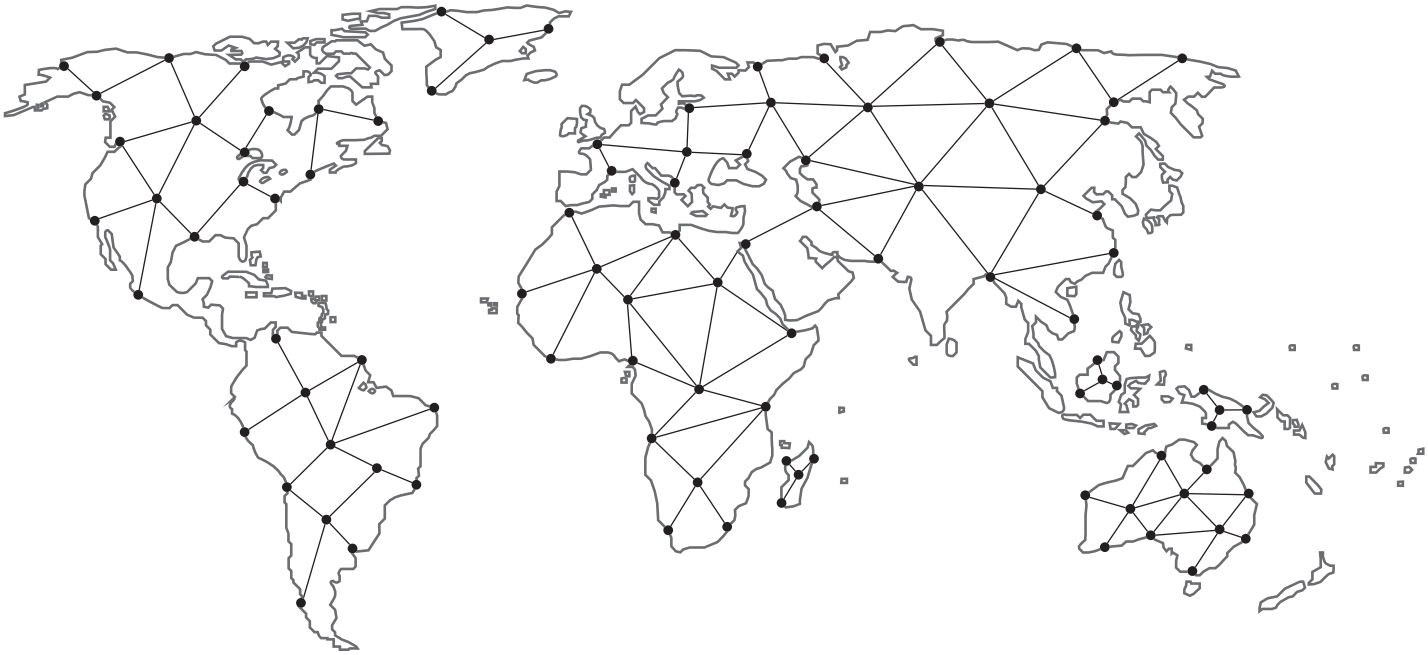
Notes

Notes

Notes

Find the nearest local Channel Partner in your area:

valves.bakerhughes.com/contact-us



Tech Field Support and Warranty:

Phone: +1-866-827-5378

valvesupport@bakerhughes.com

valves.bakerhughes.com

Baker Hughes

bakerhughes.com

BHMN-35002-IOM-19538H-1224 12/2024