

37002 Series MiniTork™ II

Control Butterfly Valve with Actuator Model 33

Instruction Manual (Rev.B)



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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.

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Safety Information

Important - Please Read Before Installation

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



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

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 **Masoneilan™** MiniTork 37002 Series, and do not apply for other valves outside of this product line.

Useful Period

The current estimated useful life period for the MiniTork 37002 Series is 25+ years. To maximize the useful life of the product, it is essential to conduct annual inspections, routine maintenance and ensure proper installation to avoid any unintended stresses on the product. The specific operating conditions will also impact the useful life of the product. Consult the factory for guidance on specific applications if required prior to installation.

Warranty

Items sold by Baker Hughes are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment provided said items are used according to Baker Hughes recommended usages. Baker Hughes reserves the right to discontinue manufacture of any product or change product materials, design or specifications without notice.

Note: Prior to installation

- The valve must be installed, put into service and maintained by qualified and competent professionals who have undergone suitable training.
- All surrounding pipe lines must be thoroughly flushed to ensure all entrained debris has been removed from the system.
- Under certain operating conditions, the use of damaged equipment could cause a degradation of the performance of the system which may lead to personal injury or death.
- Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the product.

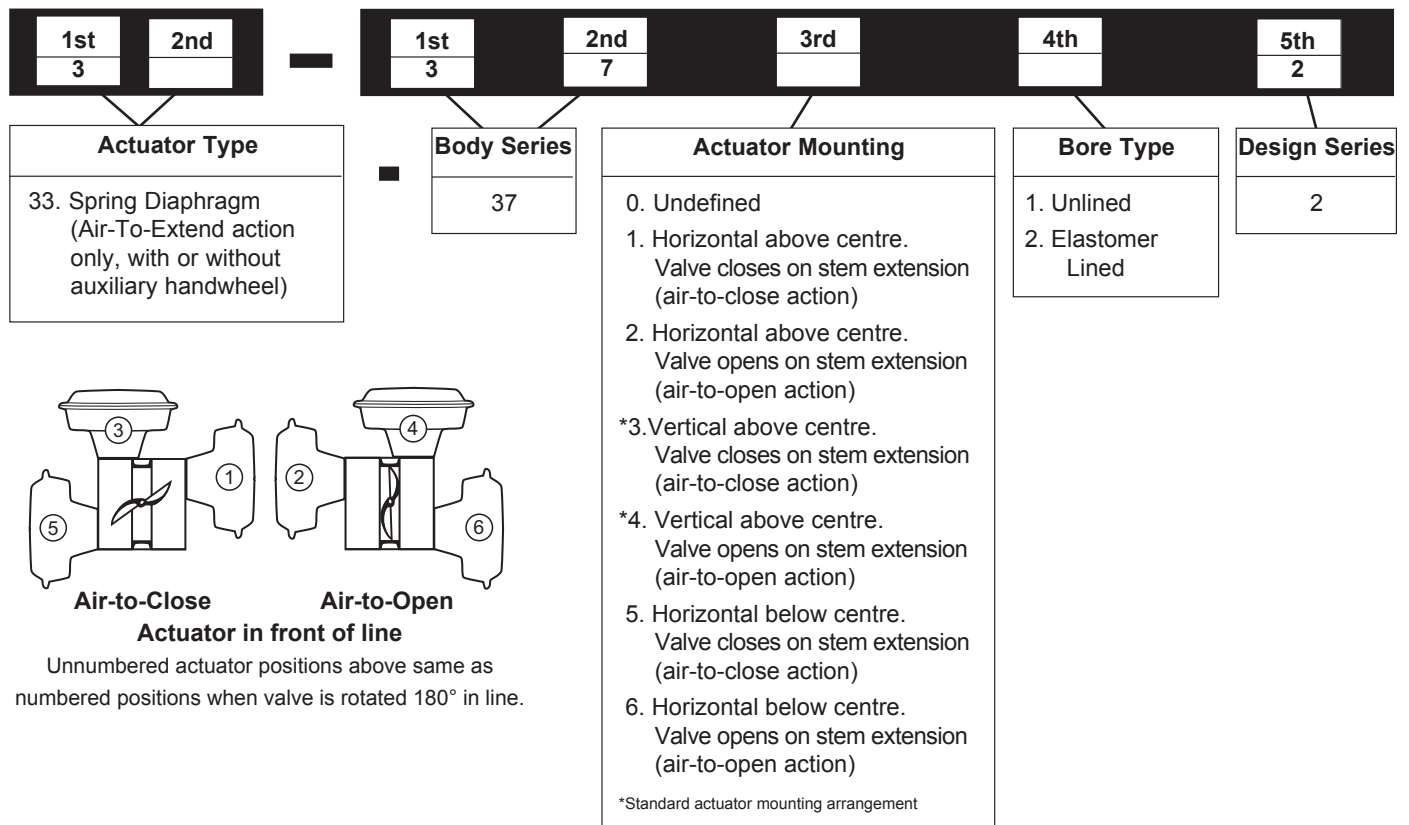
Introduction

The following instructions are designed to assist maintenance personnel in performing most of the maintenance required on the 37002 Series valve. Baker Hughes has highly skilled service people around the world available for startup, maintenance and repair of our valves and component parts. In addition, a regularly scheduled training program is 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 your local Baker Hughes Representative. When performing maintenance use only Baker Hughes replacement parts. Parts are obtainable through your local Masoneilan Representative. When ordering parts always include Model and Serial Number of the unit being repaired. These installation and maintenance instructions apply to all sizes and ratings of the Masoneilan 37002 Series control valves, regardless of the type of trim used. The model number, size and rating of the valve are shown on the identification tags located on the actuator. Refer to Figure 1 to identify valve nomenclature.

Unpacking

Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts. Should any problems arise contact your Baker Hughes Representative or Sales Office.

Numbering System



Installation

CAUTION

Prior to installing the valve in the line, this section should be completely reviewed and understood.

1. The valve is flangeless and has a rating of 300 lb ANSI. It may be installed between machined flanges of the following ANSI standards; 125 lb., 150 lb., 250 lb.. and 300 lb. ANSI flanges as well as DIN (ND) 10, 16, 25 and 40 metric flanges.
2. Before installing the valve in the line, clean piping and valve of all foreign materials, such as welding chips, scale, oil, grease or dirt. Gasket surfaces should be thoroughly cleaned to ensure leak proof joints.
3. To allow for inline inspection, maintenance and removal of the valve without service interruption, provide a manually operated stop valve on each side of the valve with a manually operated throttling valve mounted in the bypass line.
4. The valve may be installed in the line so that the control substance will flow in either direction. However, the actuator must be located in one of the recommended positions shown in Figure 1.

Figure 1

Installation - Assembly

- Where insulation of the valve body is required, do not insulate the valve bonnet. Figure 2 shows a recommended method for insulation.

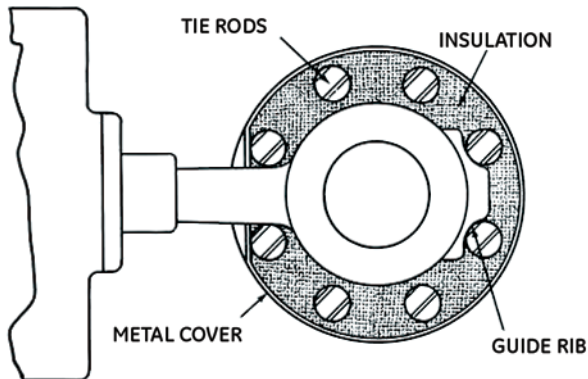


Figure 2

- Special bosses are provided on the valve body to center the valve in the line and prevent rotation prior to tightening the flange bolts. Before placing the valve in the line, install the lower flange bolting to provide a kind of cradle, this will support the valve while installing the remaining bolts.

CAUTION

Due to the different actuator to body configurations, the center of gravity for lifting the valve will change. It is recommended that the valve be test lifted to ensure it will not shift suddenly, possibly causing injury or damage.

- Where possible, use welding neck or flat face flanges with a full line bore. When the valve has an elastomer liner, the I.D. of the mating flanges must match the I.D. of the liner and cover the entire face of the liner.

Note: Refer to Installation Alignment section for the recommendations on valve alignment as well as installation in standard commercial wrought steel pipe, and tubing, and heavy wall pipe.

CAUTION

When the valve is installed in lines constructed with standard commercial wrought steel pipe or heavy wall pipe, slip-on or screwed flanges are not recommended with lined valves.

- Regardless of valve action (air to close or air to open) the valve should be installed in the line with the vane in the closed position. The following are recommended means for closing the vane for valve installation:
 - If the valve is equipped with a handwheel, close the valve using the handwheel.

Note: For lined valves, the closed position is achieved when the vane makes full contact with the liner.

- If the valve is not equipped with a handwheel, a portable regulated air supply may be used to supply pressure to the actuator and close the vane.

Note: On lined valves only enough air pressure should be supplied to ensure that the vane makes full contact with the liner.

- The following method is highly recommended and should be used whenever possible. Rotate the hand wheel to the disengaged position. Refer to Figure 19 and remove side covers (56). remove retaining rings (11) and push out pivot pin (12). The actuator is now disengaged from the valve shaft and allows for manually closing the valve by rotating lever (33) in proper direction.

Note: If the valve s equipped with a handwheel, remove spacers (10) and rotate the handwheel so that the lever arm (37) will not interfere with manual movement of the lever (33). On lined valves rotate the vane until full contact is made with the liner.

CAUTION

Ensure that the valve is operating in the quadrant shown in Figure 11.

- Center the valve in the pipe line (install gaskets if an unlined valve) and tighten bolting evenly and in criss-cross fashion.

Note: Gaskets are not used for lined valves. The elastomer liner is flangeless and acts as its own controlled compression gasket, therefore it should be tightened until the flanges meet evenly with the valve body.

- At this time the vane should be rotated manually a few times to ensure that it clears adjacent internal piping and flanges. It is not recommended that the vane be stroked, either using handwheel or actuator; it should be stroked manually so that, should interference occur, this will be readily determined and will prevent damage to the vane.
- If Step C, previously mentioned, was used, refer to Reassembly of Actuator to Bracket Section, to reassemble pivot pin (12), retaining ring (11) and spacer (10).

Installation - Alignment

Alignment Warning

This valve must be properly aligned with the piping to prevent pipe interference with the disc. After installing the valve, check disc rotation as follows:

1. Disconnect actuator from disc. To do this, refer to point 8.C. of Installation - Assembly Section to remove clevis pin from the split clamp arm. Rotate clamp arm to free pin if necessary.
2. Rotate clamp arm slowly to prevent damage to the disc sealing edge if interference occurs. If disc can rotate through 90° arc, alignment is correct.
3. Realign valve with pipe if there is interference.
4. Reassemble.

If heavy wall piping or thin wall piping or tubing is used, see other instructions from this Installation - Alignment section.

Standard Commercial Wrought Steel Pipe

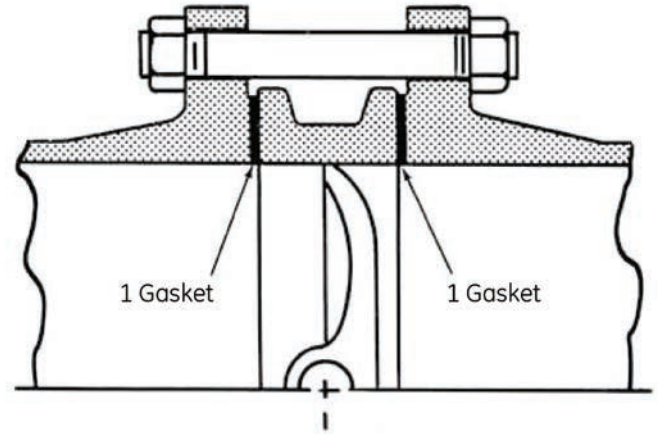
Use only flat face or raised face flanges. If using iron flanges, limit bolting torque to prevent fracture of the flange which is not fully supported by the MiniTork body. Use only carbon steel (ASTM A307 GrB or equivalent) bolting with iron flanges.

Weld Neck Flanges

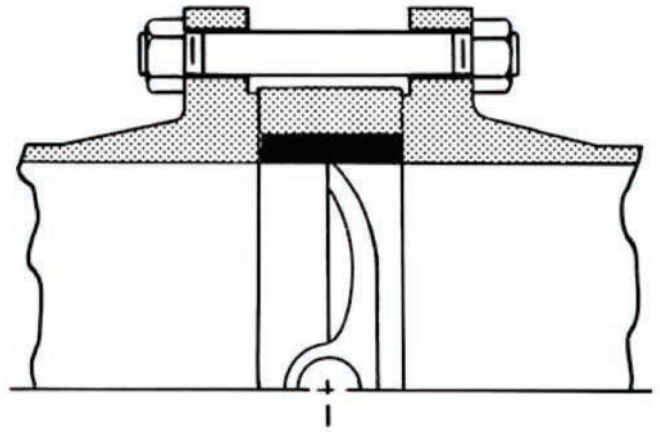
Flange bore should be Schedule 40.

Gaskets are required for unlined valves only.

Gasket Inside Diameter (I.D.) should be equal to pipe Outside Diameter (O.D.).



Unlined Valve



Lined Valve

Figure 3

Installation - Alignment (cont.)

Slip on Flanges

Flange bore matches pipe O.D.

Gaskets are required for unlined valves.

Gasket I.D. should be equal to pipe O.D.

CAUTION

Slip on flanges are not recommended for use with lined valves.

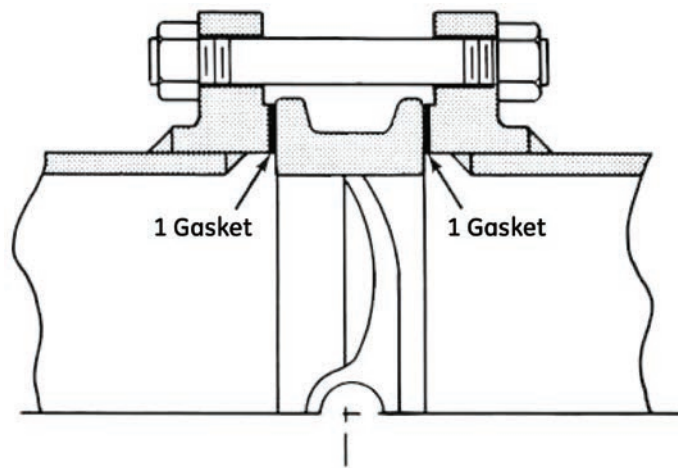
Screwed Flanges

Gaskets are required for unlined valves.

Gasket I.D. should be equal to pipe O.D.

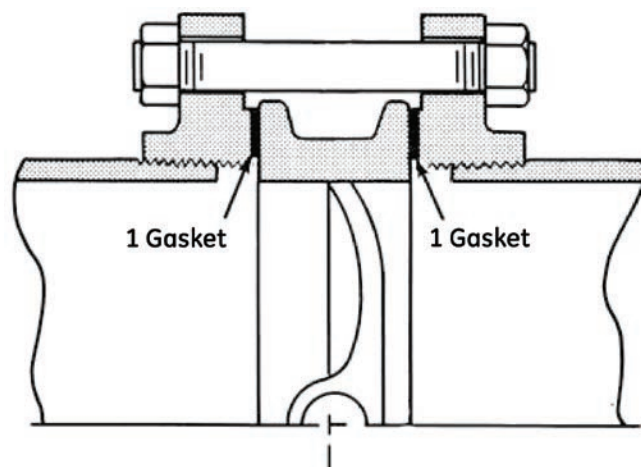
CAUTION

Screwed flanges are not recommended for use with lined valves.



Unlined Valve

Figure 4



Unlined Valve

Figure 5

37002 Series MiniTork Butterfly Valve				Commercial Steel Pipe		
Pressure Class	Size (in.)	Body Width	Body I.D.	Schedule	Nominal Wall Thickness	Nominal I.D.
ANSI 125 lb Iron 150 lb Steel 250 lb Iron 300 lb Steel	2	1750	2	40	.154	2067
	3	1875	3	40	.216	3068
	4	2000	4	40	.237	4026
	6	2250	6	40	.280	6065
	8	2500	8	40	.322	7961
	10	2500	10	40	.365	10020
	12	3000	12	40	.406	11938

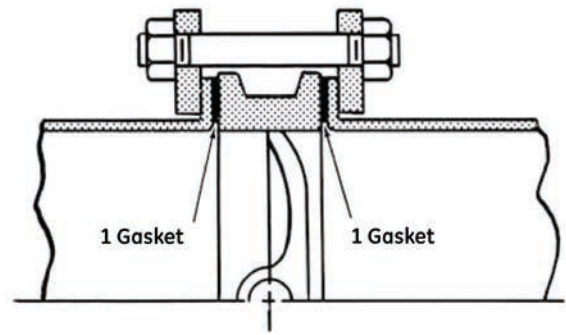
Table 1

Installation - Alignment (cont.)

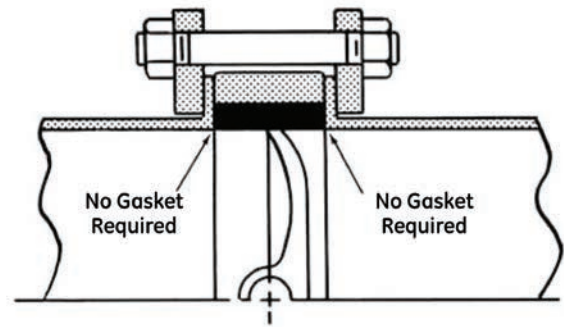
Thin Wall Stainless Steel Pipe and Tubing

Thin wall stainless steel pipe has a larger I.D. than schedule 40 pipe. Check your pipe dimensions and install as shown. Use gaskets with unlined valves.

Maximum allowable line pressure for the lined valve installation shown is 60 psi. For higher line pressures use socket weld flanges or use spacer rings identical to the ones used with O.D. Tubing. (See Table 3)



Unlined Valve



Lined Valve

Figure 6

Lightweight Stainless Pipe		
Size (in.)	Schedule 10S I.D. (in.)	Schedule 5S I.D. (in.)
2	2.157	2.245
3	3.260	3.334
4	4.260	4.334
6	6.357	6.407
8	8.329	8.407
10	10.420	10.482
12	12.390	12.438

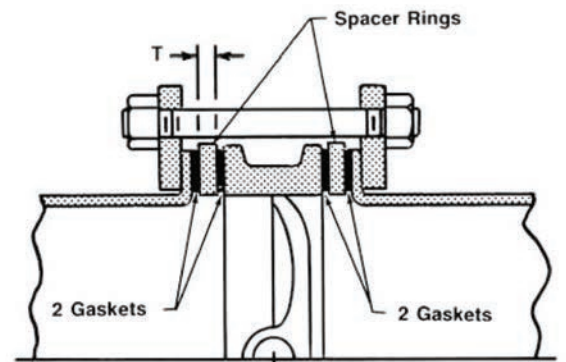
Table 2

O.D. Tubing 3" and Larger (recommended by TAPPI)

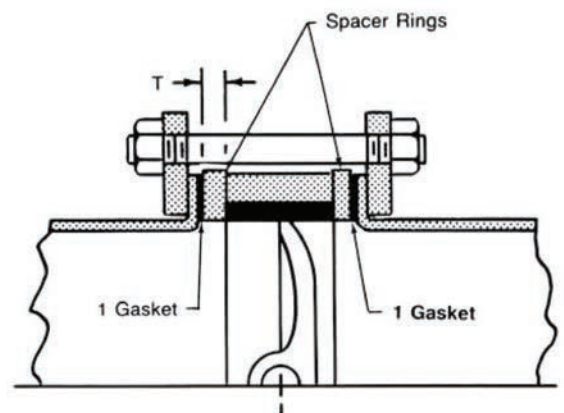
This thin wall tubing O.D. is nominal size. Example: 6" tubing is 6" O.D. Gasket I.D. should be valve body bore + 1/4". (See Table 1) 3" tubing as shown in Table 3 does not require spacers.

O.D. Tube System - Thin Wall					
Working Pressure	Pipe		Spacer Ring		
	Size (in.)	I.D. (in.)	O.D. (in.)	I.D. (in.)	T (in.)
125 lb WP	3	2.870	-	-	-
	4	3.870	6 3/4	4 1/32	1/4
	6	5.870	8 5/8	16 1/16	3/8
	8	7.870	10 7/8	8	1/2
	10	9.870	13 3/4	10	3/4
	12	11.844	16	12	5/8
250 lb WP	3	2.870	-	-	-
	4	3.870	7	14 1/32	1/4
	6	5.844	9 3/4	6 1/16	3/8
	8	7.782	12	8	5/8
	10	9.750	14 1/8	10	7/8
	12	11.720	16 1/2	12	3/4

Table 3



Unlined Valve



Lined Valve

Figure 7

Installation - Alignment (cont.)

I.D. Tubing (Canadian Standard)

This tubing I.D. is nominal. Example: 6" tubing is 6" I.D. (See Table 4). Install lined valve without gaskets. Use gaskets with unlined valves. Cut gasket I.D. to equal tubing I.D. + 1/4" to prevent possible extrusion from interfering with the disc.

I.D. Tube Canadian Std	
Size (in.)	I.D. (in.)
2	2
3	3
4	4
6	6
8	8
10	10
12	12

Table 4

Heavy Wall Pipe 2", 3" and 4" Valves

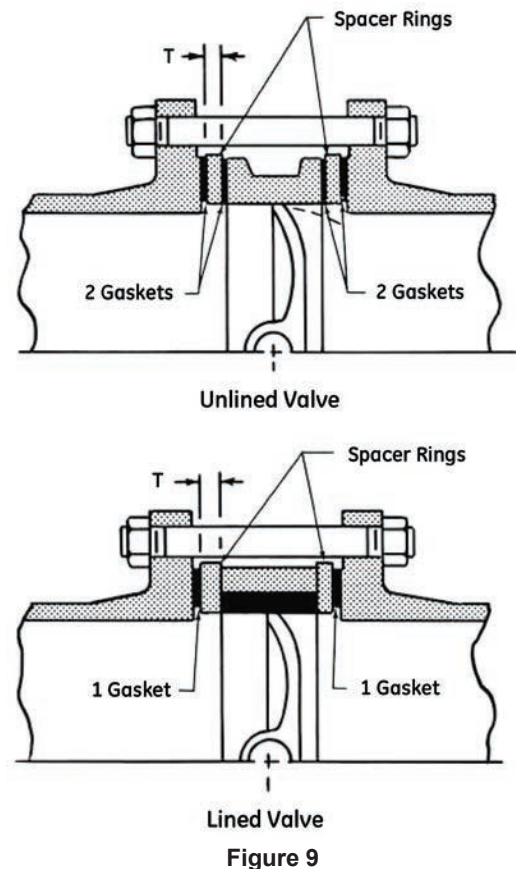
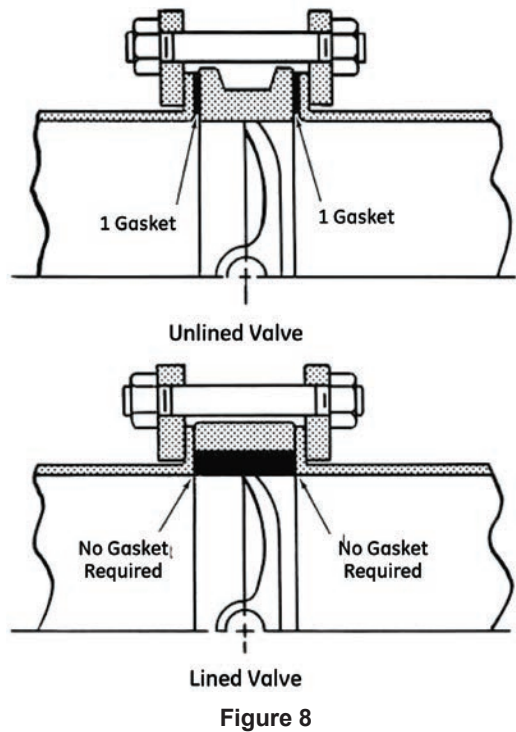
The 2", 3" and 4" MiniTork Butterfly valves, both lined and unlined, may be mounted in Schedule 80 pipe lines in the standard manner without disc-pipe interference. See section on mounting the valve in "STANDARD COMMERCIAL WROUGHT STEEL PIPE".

6", 8", 10" and 12" Valves

For pipe I.D. less than standard Schedule 40 (either Schedule 60 or 80), either the flanges must be bored out to a given recess depth or spacer rings must be used on either side of the valve to assure free movement of the disc.

Valve Size (in.)	Pipe Recess		I.D. (in.)	Spacer Rings		Thick-ness T (in.)
	A (in.)	B (in.)		O.D. 150 lb. (in.)	O.D. 300 lb. (in.)	
6	1/4	61/16	61/16	8 5/8	9 3/4	1/4
8	1/2	8	8	10 7/8	12	1/2
10	7/8	10	10	13 1/4	14 1/8	7/8
12	1	12	12	16	16 1/2	1

Table 5



Weld Neck Flanges

150 lb and 300 lb ANSI weld neck flanges have standard bore which matches 37000 Series MiniTork Butterfly valve bore.

CAUTION

Slip on and screwed flanges not recommended for lined valves.

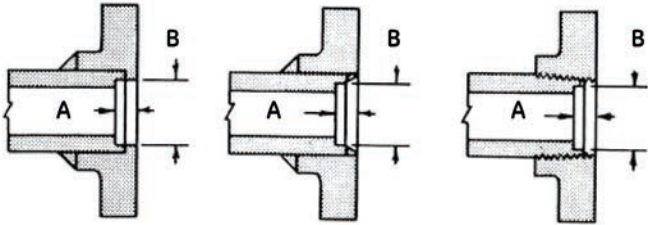


Figure 10

Actuator Air Piping

The MiniTork II actuator is designed to accept 1/4" NPT air supply piping. Use 1/4" O.D. tubing, or equivalent for all air lines. If the air line exceeds 25' in length or if the valve is equipped with volume boosters, 3/8" tubing is preferred. All connections must be free of leaks.

CAUTION

Do not exceed loading pressure indicated on the warning tag located on the diaphragm cover.

Changing Actuator Position

For each valve action, air to open or air to close, the actuator and bracket may be mounted in any one of three recommended positions (See Figure 1). Actuator position is usually determined by adjacent piping, obstacles of various types or air piping arrangements. If for example, the valve orientation is Position 6, but the valve must be installed in Position 2, simply rotate the entire unit 180° around the axis of the shaft and install in the line. In such a case, no disassembly is required other than repositioning gauges so that they are not upside down. However, if the valve orientation must be changed from Position 2 to Position 4, partial disassembly is required. Depending on whether the valve is or is not equipped with the handwheel and whether the valve is lined or unlined, select the appropriate section in this instruction and proceed.

Changing Actuator Action

For the positions shown in Figure 1, the valve action is air to open or air to close. In both cases the actuator stem extends with admission of air to the actuator. Changing valve action requires partial disassembly in repositioning the actuator to the other hole in the bracket. If the valve is equipped with a handwheel, it must be repositioned to the opposite side of the bracket.

Note: The handwheel is always installed so it operates against the actuator spring force. The handwheel is always located on the same side of the bracket as the actuator (See Figures 12 and 13). Depending on whether the valve is or is not equipped with the handwheel and whether the valve is lined or unlined, select the appropriate section on disassembly and proceed.

Maintenance

CAUTION

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

This section is primarily addressed to recommended routine maintenance required on the valve which does not require complete disassembly. Routine maintenance is limited to the packing box and diaphragm replacement.

Packing Box

Packing box maintenance is one of the principal chores of routine servicing. Tightness of the packing is obtained through compression which is achieved by evenly tightening packing stud nuts (23A) against a packing flange (22). Care must be taken not to over tighten as this could prevent smooth operation of the valve. If all compression is used up and the valve leaks around the stem, new packing is required.

Note: If replacement of all packing is required, the valve must be disassembled. Refer to appropriate section.

The following procedure should be used for temporary repairs only.

- Loosen and remove packing flange stud nuts (23A).
- Slide packing flange (22) and packing follower (8) down the shaft.

Note: As a temporary repair, it may be desirable to simply add more packing, since removal of any packing while the valve is assembled to the actuator is difficult. In addition, only one or two pieces of packing can be removed without disassembly. String packing, compatible with the service, can be used as a temporary repair, however it must be replaced with the correct packing as soon as possible.

- Add or replace packing as desired.

CAUTION

Do not over-tighten. Nuts should be tightened only enough to stop leakage.

- Slide packing follower (8) and packing flange (22) back into position.
- Replace and evenly tighten packing flange stud nuts (23A).
- Place valve back in service and check for leaking.

Actuator Diaphragm Replacement

CAUTION

This section pertains to actuator Model 33 Old Version and Model 33 New Version indicated where applicable.

CAUTION

The upper diaphragm case (84) is under spring tension. A warning tag (97) is attached to each of the three (3) long capscrews (95). The tension nuts (96) attached to cap screws (95) must be evenly removed last. The following procedure must be followed to avoid injury.

Type 33 OLD Version Actuator (produced up to year 1993) - refer to Figures 15 & 17

- A. Isolate the valve, vent process pressure and shut off all electrical signal air and supply lines to the valve.
- B. If equipped with a handwheel, it must be rotated to the disengaged position.
- C. Remove air supply piping to upper diaphragm case (84).
- D. Remove side covers (56).
- E. Remove retaining rings (11) and remove pivot pin (12) and spacers (10) (handwheel only) to free rod end bearing (94).
- F. Loosen and remove all short cap screws (86) and hex nuts (87).
- G. Loosen each tension nut (96) approximately three full turns.

CAUTION

The upper diaphragm case (84) should separate as the tension nuts are loosened the three turns. If it does not, before proceeding, separate the upper diaphragm case (84) by tapping it around the circumference or inserting a screw driver between the upper and lower case (84-91).

- H. Continue loosening the tension nuts (96) evenly approximately three turns each time insuring that the upper diaphragm case (84) and diaphragm (85) continue to separate.
Note: Continue Step H until the tension nuts (96) can be easily removed by hand indicating the upper diaphragm case (84) is not under spring tension.
- I. Remove tension bolts (95) and upper diaphragm case (84)
- J. Holding the trunion block with a suitable wrench or vice, loosen and remove capscrew (83) and Dyna seal washer (82).
- K. Remove diaphragm/diaphragm plate subassembly from the actuator .

Note: Trunion block should be held so as not to damage trunion block plug (79) or capscrews (81).

- L. With capscrew (83) removed, stop (80), diaphragm (85), diaphragm plate (88), and spring guide (89) may now be separated from trunion block and stem subassembly .
- M. Clean all mating/sealing surfaces which will come in contact with the Dyna-seal washer (82), diaphragm (85), stop (80) and diaphragm plate (88).

Note: Diaphragms used in the MiniTork II Series actuators are the same as those used on HPBV Ball Valve II and Sigma-F Series actuators, therefore they are supplied without a punched hole for the capscrew (82). Prior to proceeding with reassembly, a hole must be punched in the center of the diaphragm. The hole must be just sufficient for the capscrew (83) to enter which will allow the Dyna-seal washer (82) to seal around the capscrew (83) when it is tightened.

- N. Place new Dyna-seal washer (82) on capscrew (83) and insert into stop (80) with cupped edge of stop towards the capscrew head.

Note: On 30 sq. in. and 70 sq. in. actuators the stop (80) and spring guide (89) are identical and interchangeable. However, on the 140 sq. in. actuator the stop (80) has a much smaller diameter than the spring guide making it easily identifiable.

- O. Insert capscrew (83) through diaphragm (85), diaphragm plate (88). spring guide (89).

Note: The diaphragm plate (88) and spring guide (89) are assembled with the cupped edge away from the diaphragm (85).

- P. Screw capscrew (83) into trunion block (78) and tighten firmly.

Note: When holding trunion block (78), care must be taken not to damage trunion block plug (79) or capscrews (81).

- Q. Ensure spring (90) and spring guide (98) are properly aligned in lower case (91) and install the diaphragm/diaphragm plate and trunion block subassembly.

- R. Determine correct orientation for air inlet and replace upper diaphragm case (84) and install long capscrews (95), warning plate (97) and tension nuts (96).

Note: These bolts are installed spaced as shown in Figure 14.

- S. Take up tension nuts (96) evenly and sufficiently to allow installation of short capscrews (83), and hex nuts (87.)

- T. Tighten tension nuts (96) and then tighten all hex nuts (87) using a criss-cross tightening pattern.

Note: Nuts should be tightened only enough to seal the diaphragm between the upper and lower case. Do not over tighten.

- U. Connect rod end bearing (94) to lever (33) by installing pivot pin (12), spacers (10) (handwheel only), and retaining rings (11).

- V. Replace side covers (56) and connect air supply piping to upper diaphragm case (84).

W. Place back in service and if so equipped, rotate handwheel to desired position.

Type 33 NEW Version Actuator (produced after year 1993) - refer to Figure 25

- A. Isolate the valve, vent process pressure and shut off all electrical signal air and supply lines to the valve.
- B. If equipped with a handwheel, it must be rotated to the disengaged position.
- C. Remove air supply piping to upper diaphragm case (84).
- D. Remove retaining rings (11) and remove pivot pin (12) and spacers (10) (handwheel only) to free rod end bearing (94).
- E. Loosen and remove all short cap screws (86) and hex nuts (87).
- F. Loosen each tension nut (96) approximately three full turns.

 CAUTION

The upper diaphragm case (84) should separate as the tension nuts are loosened the three turns. If it does not, before proceeding, separate the upper diaphragm case (84) by tapping it around the circumference or inserting a screwdriver between the upper and lower case (84-91).

G. Continue loosening the tension nuts (96) evenly approximately three turns each time insuring that the upper diaphragm case (84) and diaphragm (85) continue to separate.

Note: Continue Step G until the tension nuts (96) can be easily removed by hand indicating the upper diaphragm case (84) is not under spring tension.

- H. Remove tension bolts (95) and upper diaphragm case (84).
- I. Remove diaphragm from the actuator.
- J. Clean all mating/sealing surfaces which will come in contact with the diaphragm (85).
- K. Determine correct orientation for air inlet and replace upper diaphragm case (84) and install long capscrews (95), warning plate (97) and tension nuts (96).

Note: These bolts are installed spaced as shown in Figure 14.

- L. Take up tension nuts (96) evenly and sufficiently to allow installation of short capscrews (83), and hex nuts (87.)
- M. Tighten tension nuts (96) and then tighten all hex nuts (87) using a criss-cross tightening pattern.

Note: Nuts should be tightened only enough to seal the diaphragm between the upper and lower case. Do not over tighten.

N. Place back in service and if so equipped, rotate handwheel to desired position.

Disassembly Procedures

This section addresses the complete disassembly of the MiniTork II valve and actuator in order to gain access to repair or replacement of components. If only partial disassembly is required, such as when changing valve action, refer only to the appropriate section. It is highly recommended that the unit be removed from the line for disassembly.

Actuator Removal

CAUTION

When working on air to close units, be certain that the vane is not jammed in the closed position with the actuator spring exerting force to open the valve. In such a case, while disassembling, the valve could suddenly snap open, possibly causing injury. When the actuator stem is fully extended, the spring is exerting force in the opposite direction. If the valve is jammed closed, on an air to close unit, use external air supply pressure to hold the actuator in a closed position and complete the necessary steps in this section to disconnect pivot pin (12) then release air pressure from the actuator ensuring rod and bearing (94) separates from lever (33) and actuator stem (77) fully retracts.

- A. If equipped with a handwheel it must be rotated to the disengaged position.
- B. Remove positioner and air piping to upper diaphragm case (84).
- C. Remove side covers (56), front cover (13) and bottom cover (19).
- D. Ensure actuator stem is fully retracted (see Caution above).
- E. Remove retaining rings (11), pivot pin (12) and spacers (10).

Note: The spacers (10) are only used on units equipped with handwheel.

- F. Remove hex nuts (75) and lockwashers (76) and lift actuator from bracket.

Actuator Disassembly

- A. Loosen and remove all short capscrews (86) and hex nuts (87).
- B. Loosen each tension nut (96) approximately three full turns.

CAUTION

The upper diaphragm case (84) should separate as the tension nuts are loosened the three turns. If it does not, before proceeding, separate the upper diaphragm case (84) by tapping around the circumference or inserting the screwdriver between the upper and lower case (84) and (91).

- C. Continue loosening the tension nuts (96) evenly (approximately three turns each time) insuring that the upper diaphragm case (84) and diaphragm (85) continue to separate.

Note: Continue Step C until the tension nuts (96) can be easily removed by hand indicating the upper diaphragm case (84) is not under spring tension.

- D. Remove tension bolts (95) and upper diaphragm case (84).
- E. Remove diaphragm/diaphragm plate sub assembly from the actuator.

For Actuator Model 33 OLD Version (refer to Figures 15 & 17)

- F-1. Holding the trunion block with a suitable wrench, loosen and remove capscrew (84) and Dyna-seal washer (82).

Note: Hold trunion block so as to not damage trunion block plug (79) or capscrews (81).

- G-1. With capscrews (83) removed, stop (80), diaphragm (85), diaphragm plate (88) and spring guide (89) may be separated from trunion block and stem subassembly.
- H-1. Loosen capscrew (81) and remove trunion block plug (79).
- I-1. Actuator stem (77) may now be removed from trunion block (78).
- J-1. Loosen locknut (93) and unscrew rod end bearing (94).
- K-1. Remove spring (90), spring button (98) and stop (92) from lower diaphragm case (91).
- L-1. Refer to Actuator Reassembly section.

For Actuator Model 33 New version (refer to Figure 25)

- F-2. Remove retaining rings (81), holding the stem/rod subassembly (77), remove pin clevis (79).

Note: Stem/rod subassembly (77) may now be removed.

- G-2. Disassemble stop (98) and diaphragm (85), loosen and remove capscrew (83), diaphragm plate (88) and spring guide (89), while holding diaphragm clevis plate (78).
- H-2. Remove diaphragm clevis plate (78)
- I-2. Disassemble Stem/rod subassembly (77).
- J-2. Remove spring (90), stop subassembly (92) from lower diaphragm case (91).
- K-2. Refer to Actuator Reassembly section.

Handwheel Removal

- A. Rotate handwheel to disengage position.
- B. Remove bottom cover (19).
- C. Remove retaining clips (40) and clevis pin (39).
- D. Loosen and remove capscrews (43), lockwashers (44) and remove handwheel and bracket subassembly.

Handwheel Disassembly

- A. Remove pivot pins (45) and remove bracket (42).
- B. Loosen and remove capscrews (72), spacer (73), stop (74) and stop collar (75).
Note: If the handwheel will be reassembled to the valve in the same orientation, note the assembly sequence of spacers (73) and stop (74) when disassembling, since they should be reassembled in the same sequence.
- C. Remove handwheel subassembly from handwheel shaft (41).
- D. Remove retaining ring (47), then loosen and remove locknut (71).
- E. Remove bearing race (49B) and bearing (49A).
- F. Remove handwheel pivot (46), O-ring (50) and thrust washer (48).
- G. Refer to Handwheel Reassembly Section for reassembly.

Body Removal

- A. Refer to Actuator Removal Section and complete Steps A through E.
- B. If the unit is equipped with a handwheel, refer to Handwheel Removal Section and complete Steps A through D.
- C. Loosen indicator arm (9) by loosening clamp screw (32) and nut (70).

Note: At this time using ink or a small dab of paint, mark the relative position of one spline on the shaft (4) to the lever (33). During reassembly these marks will be used to correctly align lever on shaft.

- D. Loosen lever capscrew (34).
- E. Remove packing flange nuts (23A).
- F. Remove body stud nuts (23) and lockwashers (24).
- G. Separate body subassembly (1) from bracket (17).

Note: Two tapered pieces of steel long enough to apply leverage are placed between the body bonnet flange and the bracket 180 ° apart and pressure applied evenly to separate the body from the bracket. In some instances, the bearing (16) may also come out of the bracket during this procedure, simply continue separating body and bracket and remove bearing (16) indicator arm (9), lever (33) and packing flange (22).

Body Disassembly

- A. Remove packing follower (8) then using a packing hook, remove all packing (7).
- B. Using a small grinding wheel, grind off the peened ends of the shaft pins (21), then drive out the pins.
Note: Since the pins are tapered, they can only be driven out one way. They can only be driven out towards the peened end.
- C. Remove shaft (4).

CAUTION

When using heating devices, ensure that proper safety precautions are observed. Such items as the flammability and toxicity of the control substance must be considered and proper precautions taken.

Note: Difficulty is sometimes encountered when removing the shaft from the valve. Application of heat to the valve while using one of the following methods may facilitate removal. IF THE VALVE IS LINED, HOWEVER, USE OF HEAT IS NOT RECOMMENDED.

- D. Replace lever (33) on splined end of shaft and tighten capscrew (34). On units equipped with handwheel use both levers.
- E. With lever tightened firmly and using a soft faced mallet, tap the lever (33) as close to the shaft as possible and remove the shaft (4).

Note: If the shaft cannot be removed by tapping tightened lever, Figure 18 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 jacked 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 lever is flush with the end of the spline.

- F. The components which should come out with the shaft (4) are the bushing (3), spacer tube (5) and packing adapter (6).
- G. Remove the vane from the body.

Note: If the valve is equipped with a liner, remove O-rings (27).

- H. Remove lower bushing (3) and spring (2).

Note: If the valve is lined, the liner must be pressed out of the body to gain access to the lower bushing (3). The spring (2) IS NOT USED in a lined valve. To remove the liner, place a heavy steel plate (which is no larger than the O.D. of the liner) over the liner and support the body on V blocks to allow clearance for the liner and press out the liner. Lower bushing (3) may now be removed.

- I. Refer to Valve Body Reassembly Sections - Lined and Unlined Valves for reassembly.

Reassembly Procedures

This Section addresses the complete reassembly of the unit. If only partial reassembly is required, such as when changing valve action, refer only to the appropriate reassembly section.

CAUTION

Lubricants are required during the reassembly. Ensure that any lubricant used is compatible with service conditions.

Valve Body Reassembly (Lined Valves)

- A. Ensure that the inside bore of the body is clean and free of nicks and deep scratches which could tear the liner during assembly .
- B. Insert lower bushing (3) into the valve body.
- C. Lubricate O-rings (27) and insert into the liner (29).
- D. Apply lubricant to a lower bushing (3) and install.
- E. Insert the liner (27) into the body being sure to line up the shaft holes in the liner with the shaft holes in the valve body.

Note: To simplify assembly and proper alignment of the liner in the body, the following is recommended: Lubricate the shaft and insert into the liner. With the valve body laying on a flat surface, place the liner over the body bore and using the shaft, visually align shaft and liner with body shaft hole. Using a soft faced mallet, lightly tap the liner to start it into the valve bore. Remove the shaft and using a heavy steel plate, no larger than the O.D. of the liner, place it over the liner, support the valve on V-blocks and press the liner into the body. THE LINER MUST PROTRUDE EVENLY ON BOTH SIDES OF THE VALVE BODY.

- F. Assemble upper bushing (3), spacer tube (5) and packing adapter (6) on the shaft.

Note: The counterbored end of the spacer tube (5) and the beveled end of the packing adapter (6) must face the splined end of the shaft.

- G. Insert plain end of shaft (4) through the body stuffing box and partially into the liner (29).
- H. Insert the vane (26) into the body, referring to Figure 1 and insuring vane is installed in proper operating quadrant.
- I. Push shaft (4) through vane (26) and into lower bushing (3).
- J. Ensure upper bushing (3), spacer tube (5) and packing adapter (6) are seated in position.
- K. Move vane (26) to the closed position.

Note: On lined valves, the closed position is achieved when the circumference of the vane makes full contact with the liner. DO NOT JAM THE VANE INTO THE LINER.

- L. Install packing (7) insuring skives are staggered approximately 120° from preceding packing ring.

- M. Install packing follower (8) and proceed to valve and shaft pinning. (Refer to corresponding Section next page).

Note: The vane is not pinned to the shaft until the body subassembly is assembled to the bracket.

Valve Body Reassembly (Unlined Valves)

- A. Install spring (2) into the lower bushing hole of the body.
- B. Apply lubricant to the lower bushing (3) and install.
- C. Assemble upper bushing (3), spacer tube (5) and packing adapter (6) on the shaft.

Note: The counterbored end of the spacer tube (5) and the beveled end of the packing adapter (6) must face the splined end of the shaft.

- D. Insert the plain end of the shaft (4) through the body stuffing box but not into the body bore.
- E. Insert the vane (26) into the body as shown in Figure 11 to ensure it is installed in proper operating quadrant.
- F. Push the shaft (4) through the vane (26) and into the lower bushing (3).
- G. Ensure upper bushing (3), spacer tube (5) and packing adapter (6) are seated in position.
- H. Move the vane (26) to the closed position.

Note: On unlined valves the closed position is achieved when the vane is centered in the body.

- I. Install the packing (7) ensuring skives are staggered approximately 120° from preceding packing ring.
- J. Install the packing follower.
- K. Refer to next Section for vane and shaft pinning.

Note: The vane is not pinned to the shaft until the body subassembly is assembled to the bracket.

Vane and Shaft Pinning

If the valve was disassembled to replace only the shaft (4), the old vane (26) may be used to drill and ream the shaft pin holes. However, if a new vane (26) was installed a new shaft (4) is required. Proceed as follows:

- A. Determine the desired orientation of the valve body to the bracket and ensure that the bonnet studs (25), (short studs) and packing flange studs (20) (long studs) will be as shown in Figure 21.
Note: Regardless of body orientation, studs are always positioned as shown for ease of access.
- B. Install bearing (16) in bracket (17).
- C. Slide the valve shaft partly into the bracket opening.
- D. Ensure packing follower (8) is in place and place packing flange (22) inside the yoke and onto the shaft.

CAUTION

Before proceeding, determine valve action (air to open/air to close) and refer to the appropriate Figure (Figure 12 air to open, Figure 13 air to close) and study it carefully. Note that to obtain proper alignment, the lever must be positioned on the shaft so that with the vane in the closed position and the slot in the end of the shaft aligned with the vane, the distance between the top of the bracket and the top of the pivot pin must be as shown.

- E. Hold lever (33) inside the yoke and in line with the shaft and slide the shaft completely into the bracket through the lever and into the bearing (16).

Note: If the valve is equipped with a handwheel, the lever consists of two separate arms which are a MATCHED PAIR and are not interchangeable. The sequence of assembly is to place one lever over the shaft, then the lever arm (37) and next the second lever arm onto the shaft then slide the shaft into the bracket and bearing.

- F. Temporarily install pivot pin (12) into the lever and check measurement shown in Figure 12 or 13 for valve action desired.
- G. Install a capscrew and washer on the slotted end of the shaft with a washer large enough to bear against the bracket. These are used to pull the shaft snugly against the bearing.
- H. Clamp the vane in the dead center closed position and slide shims near the shaft on each side of the vane to center it precisely in the body bore. The purpose of this step is to assure that in operation, the ball bearing will absorb axial thrust from fluid pressure while keeping the vane centered.
- I. Refer to Figure 23 to determine correct size, drill and reamer for size valve being repaired and drill and ream the holes in the vane and shaft at the position shown in Figure 23.
- J. Drive in new taper pin (21) firmly and peen the ends.
- K. Proceed to next Section for actuator to bracket assembly which will include final adjustments required.

Reassembly of Valve Body to Bracket

If the valve body was removed from the bracket and the vane or shaft did not require pinning, reassemble as follows:

- A. Determine the desired orientation of the valve body to the bracket and ensure that the bonnet studs (25) (short studs) and packing flange studs (20) (long studs) will be as shown in Figure 21.

Note: Regardless of body orientation, studs are always positioned as shown for ease of access.

- B. Install bearing (16) in bracket (17).
- C. Slide the valve shaft partly into the bracket opening.
- D. Ensure packing follower (8) is in place and place packing flange (22) inside yoke and onto the shaft (4).

CAUTION

If the valve is being assembled in the same orientation and action, ensure that the mark on the lever and mark on the shaft spline made during disassembly are aligned. If the valve action or orientation is changed, refer to Figure 12 for air to open or Figure 13 for air to close and study the Figure carefully. Note that to obtain proper alignment, the lever must be positioned on the shaft so that with the vane in the closed position, the distance between the top of the bracket and the top of the pivot pin is as shown.

- E. Hold the lever (33) inside the yoke and in line with the shaft and slide the shaft completely into the bracket through the lever and into the bearing (16).

Note: If the valve is equipped with a handwheel, the lever consists of two separate arms which are a MATCHED PAIR and are not interchangeable. The sequence of assembly is to place one lever over the shaft then the lever arm (37) and then the second lever arm onto the shaft then slide the shaft into the bracket and bearing.

- F. Temporarily install pivot pin (12) into lever and check measurement shown in Figure 12 or 13 for valve action desired.
- G. Install washer (24) and body stud nut (23) and tighten firmly.
- H. Install packing flange stud nut (20) and finger tighten only at this time.
- I. If the valve is equipped with a handwheel, separate levers and install lever arm pin (36) insuring lever arm (37) notch is located in correct location. See Figure 12 or 13.
- J. Install indicator arm (9) and loosely install clamp screw (32) and nut (70).
- K. Proceed to the actuator to bracket assembly section below.

Actuator Reassembly

For Actuator Model 33 OLD Version (Figures 15 & 17)

- A. Replace spring button (98) (A size only) and spring (90) into lower diaphragm case (91).
- B. Replace locknut (93) on rod end bearing and screw rod end bearing into actuator stem (77).
- C. Replace actuator stem (77) into trunion block (78).
- D. Replace trunion block plug (79) and secure with capscrews (81).

Note: With capscrews securing trunion block plug in place, the actuator stem should move freely in the trunion block.

- E. Refer to Actuator Diaphragm Replacement Section and complete Steps M through T.
- F. Proceed to next Section for actuator to bracket assembly which will include final adjustments required.

For Actuator Model 33 NEW Version (Figure 25)

- A. Replace spring (90) into lower diaphragm case (91).
- B. Replace locknut (93) on rod end bearing (94) and screw rod end bearing into stem/rod subassembly (77).
- C. Install stem/rod subassembly (77) and clevis diaphragm plate (78) using pin clevis (79).
- D. Secure with retaining rings (81).
- E. Refer to Actuator Diaphragm Replacement Section and complete Steps J through M.

Reassembly of Actuator to Bracket

With the valve body assembled to the bracket, determine action desired and proceed as follows:

- A. Ensure stop (92) is in place in the actuator.
- B. Replace the actuator on the bracket in the appropriate hole for desired action and ensure that the rod end bearing (94) is straddled by the lever (33) (or levers if handwheel is supplied).
- C. Replace lock washers (76) hex nuts (75) and tighten securely.
- D. Rotate the vane to the closed position, insuring that it is operating in the quadrant shown in Figure 11.

CAUTION

In order for the valve to operate properly and ensure tight shutoff for lined valves, the vane must operate in quadrant shown in Figure 11.

- E. Depending on the valve action (air to close or air to open), proceed to the appropriate following section.

Air to Open

- A. With the vane in the closed position, align the hole in the rod end bearing (94) with the hole in the lever (33) by rotating the rod end bearing in the proper direction.

- B. Install pivot pin (12) and retaining rings (11).

Note: On units equipped with a handwheel, spacers (10) must also be installed on either side of the rod end bearing.

- C. Ensure that lever (33), rod end bearing and actuator shaft are vertically aligned and tighten capscrew (34).

Note: On units equipped with a handwheel, ensure that both levers are as close together as possible and in vertical alignment with the rod end bearing and actuator stem, then tighten capscrews (34).

- D. Tighten hex nut (93) against the actuator stem (77).
- E. Replace front cover (13).
- F. Rotate indicator arm (9) to indicate closed position on the valve and secure in place by tightening clamp screw (32) and nut (70).
- G. If the unit is equipped with a handwheel, proceed to Handwheel to Bracket Assembly Section.

- H. Replace bottom cover (19), side covers (56) and base cover (28).

Air to Close

- A. Ensure that the vane will operate in the quadrant shown in Figure 11 and place the vane in the closed position.
- B. Attach a temporary air supply line to the actuator and apply 20 psi of air pressure, insuring that when the rod end bearing (94) extends it is straddled by the lever (33) (or levers if handwheel is supplied).
- C. Align the hole in rod end bearing (94) with the hole in the lever (33) by rotating the rod end bearing in the proper direction.
- D. Install pivot pin (12) and retaining rings (11).

Note: If the unit is equipped with a handwheel, spacers (10) must be installed on each side of the rod end bearing (94).

- E. Tighten hex nut (93) against the actuator stem (77).
- F. Ensure lever (33) is vertically aligned with the rod end bearing and stem assembly and tighten lever capscrew (34).

Note: On units equipped with a handwheel, ensure both levers are as close together as possible and in vertical alignment with the rod end bearing and actuator stem then tighten capscrews (34).

- G. Relieve air pressure and remove temporary air line.
- H. Replace front cover (13).
- I. Rotate the indicator arm (9) to indicate open position and secure in place by tightening clamp screw (32) and nut (70).
- J. If the unit is equipped with a handwheel, proceed to the Handwheel to Bracket Assembly.
- K. Replace bottom cover (19) side cover (56) and base cover (28).

Handwheel Reassembly

To reassemble the handwheel, proceed as follows:

- A. Replace thrust washer (48) and handwheel pivot (46).

Note: The handwheel pivot is installed so that the recessed end is away from the thrust washer as shown in Figure 16.

- B. Install O-ring (50) in the groove.

Note: Do not lubricate O-ring.

- C. Apply a liberal amount of lubricant to the bearing race (49) and bearing (49A) and install, insuring there is one race on either side of the bearing.
- D. Install lock nut (71) and finger tighten only.
- E. Install retaining ring (47).

Handwheel to Bracket Assembly

The handwheel is always installed on the same side of the bracket as the actuator . To install the handwheel assembly, proceed as follows:

- A. Insert handwheel shaft (41) through appropriate bracket hole and onto lever arm (37) and install clevis pin (39) and retaining clips (40).
- B. Install handwheel bracket (42), lock washers (44) and capscrews (43) and tighten firmly.
- C. Rotate the handwheel subassembly onto the shaft (41) far enough to allow alignment of the holes in the handwheel pivot (46) to align with the hole in the hand wheel bracket (42) and install pivot pins (45) and tighten firmly.
- D. Rotate the handwheel to the disengaged position.

Note: The disengaged position is achieved when the handwheel shaft is fully visible in the slot on the end of the handwheel.

- E. Connect an air supply to the actuator and apply 20 psi of air pressure to fully extend the actuator shaft.
- F. Rotate the handwheel until the groove in the lever arm (37) just makes contact with the lever arm pin (36).
- G. Measure the distance as shown in Figure 24 and install handwheel stop subassembly as shown in the Reference Table of Figure 25.

Note: Install stop collar (75), spacer (73) and stop (74) in the correct orientation and secure cap screw (72).

- H. Install end cap (51).
- I. Replace bottom cover (19), side covers (56) and base cover (28).

Minor Adjustments

In some instances it may be required to shorten or lengthen the rod end bearing (94) to obtain the shut off desired, especially with lined valves. Simply loosen lock nut (93) and holding the actuator stem on the flats provided, rotate the shaft to extend the shorten rod end bearing (94) then re-tighten lock nut against the actuator shaft.

CAUTION

Extension of the rod end bearing is limited to approximately 3/8" using this method for adjustment. Further extension could prevent sufficient thread engagement for satisfactory performance. Should more than 3/8" be required, lever (33) is not on the correct shaft spline. Refer to the appropriate Section of this Instruction and change as required.

Parts Reference and Figures

Ref. No.	Part Name
1	Body
■ • 2	Spring
3	Bushing
4	Shaft
5	Spacer Tube
6	Packing Adapter
• 7	Packing
8	Packing Follower
9	Indicator Arm
10	Spacer
11	Retaining Ring
12	Pivot Pin
13	Front Cover
14	Shaft Cover
15	Shaft Cover Screw
16	Bearing
17	Bracket
18	Guide
19	Bottom Cover
20	Packing Flange Stud
• 21	Taper Pin
22	Packing Flange
23	Body Stud Nut
23A	Packing Flange Nut
24	Lock Washer
25	Bonnet Stud
26	Vane
• 27	O-Ring
28	Boss Cover
• 29	Liner
30	Warning Plate

Ref. No.	Part Name
31	Cover
32	Clamp Screw
33	Lever
34	Cap Screw
35	Lock Washer
36	Lever Arm Pin
37	Lever Arm
38	Lever Arm Bearing
39	Clevis Pin
40	Retaining Clips
41	Handwheel Shaft S/A
42	Handwheel Bracket
43	Cap Screw
44	Lock Washer
45	Pivot Pin
46	Handwheel Pivot
47	Retaining Ring
48	Thrust Washer
49 A	Needle Bearing
49 B	Bearing Race
50	O-Ring
51	End Cap
52	Handwheel Plate
53	Handwheel Plate Screw
54	Handwheel
55	Indicator Dot
56	Side Cover
57	Serial Plate
58	Drive Screw
70	Nut
71	Locknut

Ref. No.	Part Name
72	Cap Screw
73	Spacer
74	Stop
75	Stop Collar
76	Lock Washer
77	Stem
78	Trunion Block
79	Trunion Block Plug
80	Stop
81	Cap Screw
82	Dyna-Seal Washer
83	Cap Screw
84	Upper Diaphragm Case
• 85	Diaphragm
86	Cap Screw
87	Hex Nut
88	Diaphragm Plate
89	Spring Guide
90	Spring
91	Lower Case
92	Stop
93	Hex Nut
94	Rod End Bearing
95	Cap Screw
96	Tension Nut
97	Warning Plate
98	Spring Button
• 99	Information Plate
100	Hex Nut
• Recommended spare part. ■ Unlined construction only.	

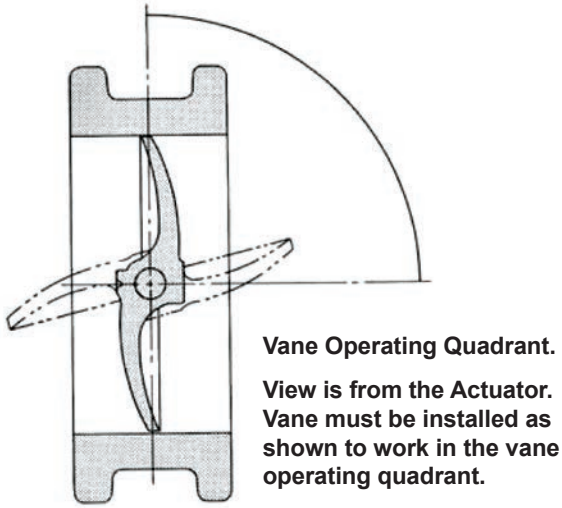


Figure 11

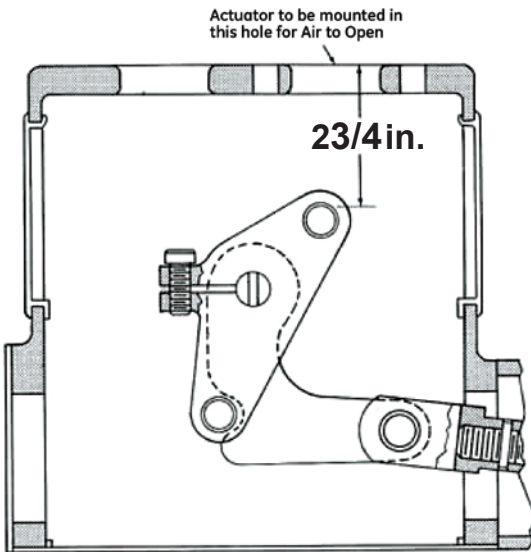
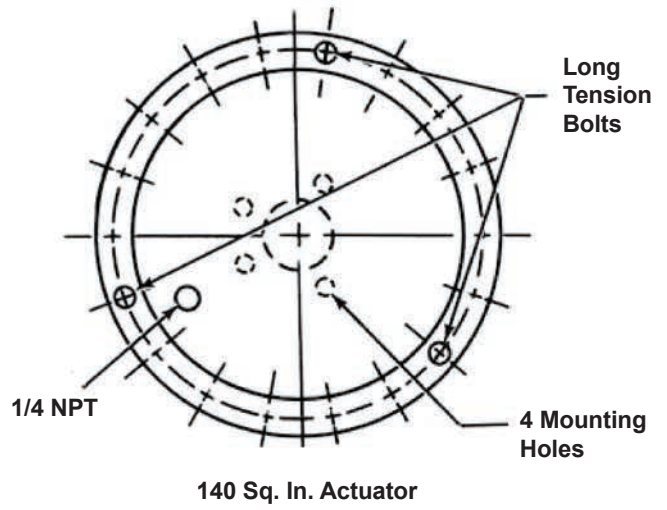


Figure 12

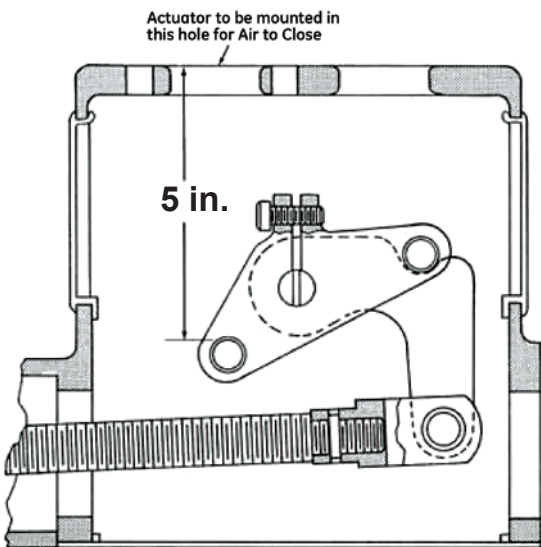
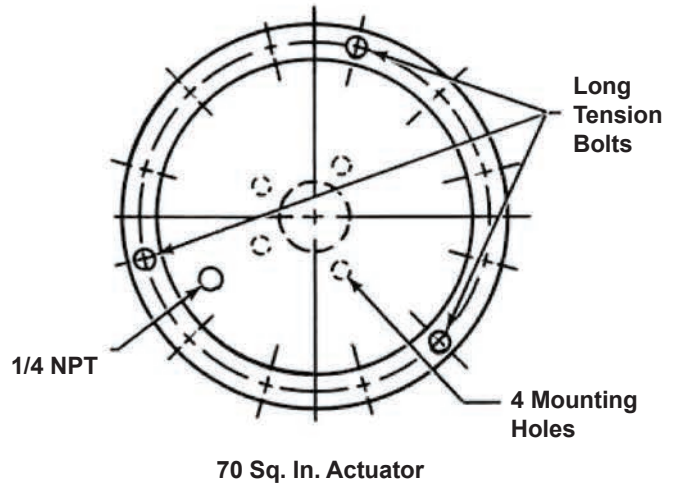


Figure 13

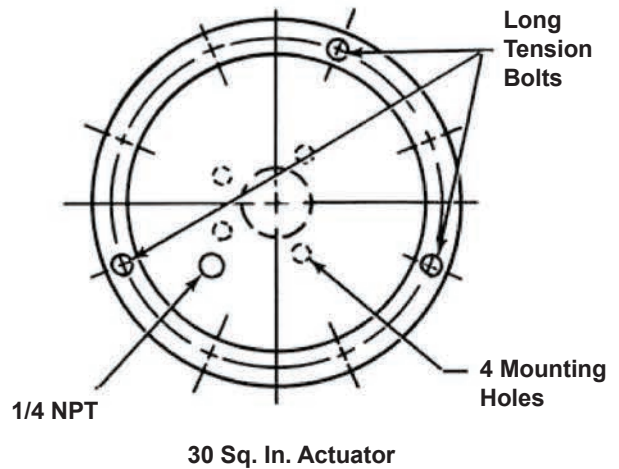


Figure 14 - Relationship of Holes

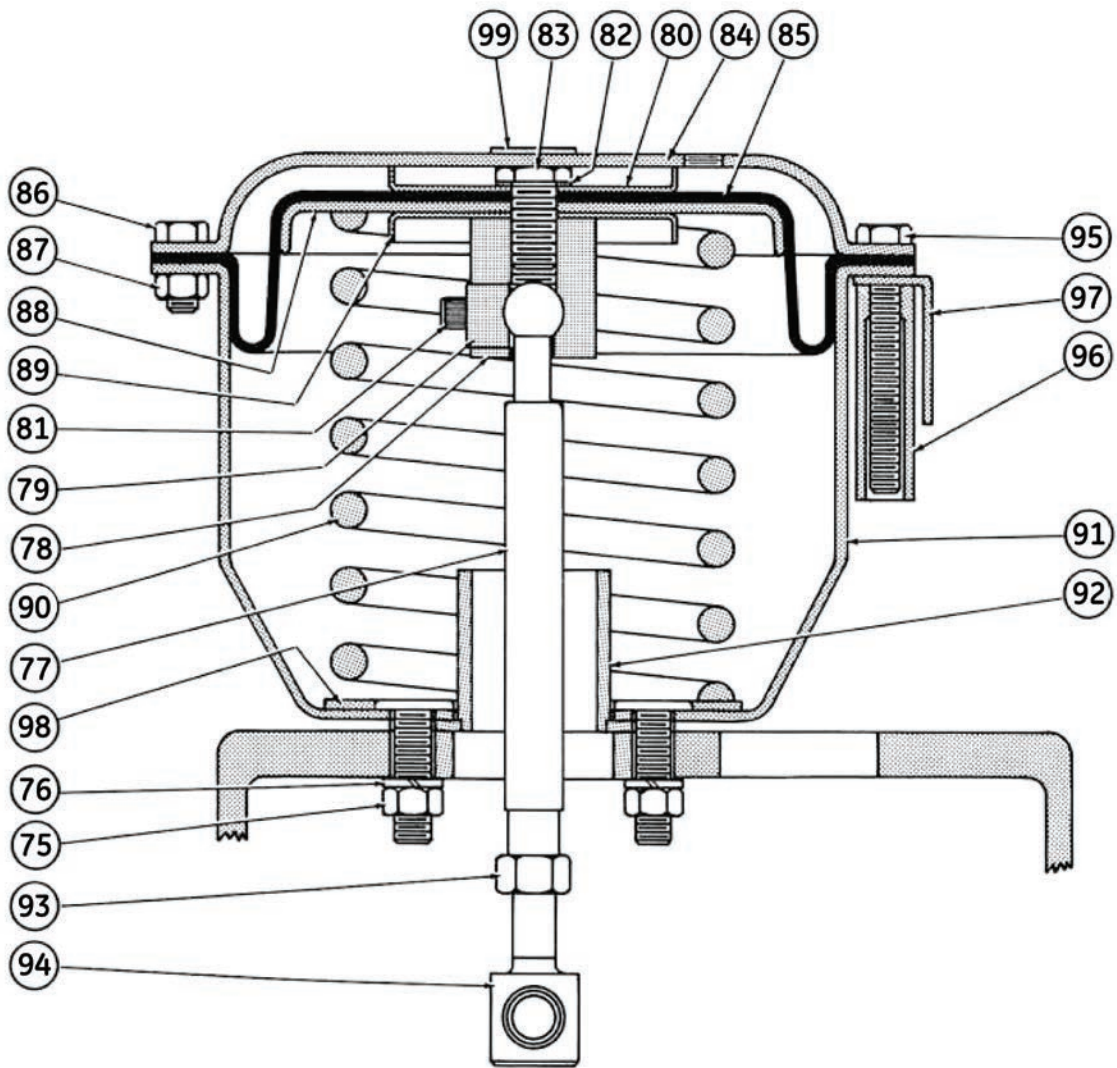


Figure 15 - Actuator Type 33 Old version

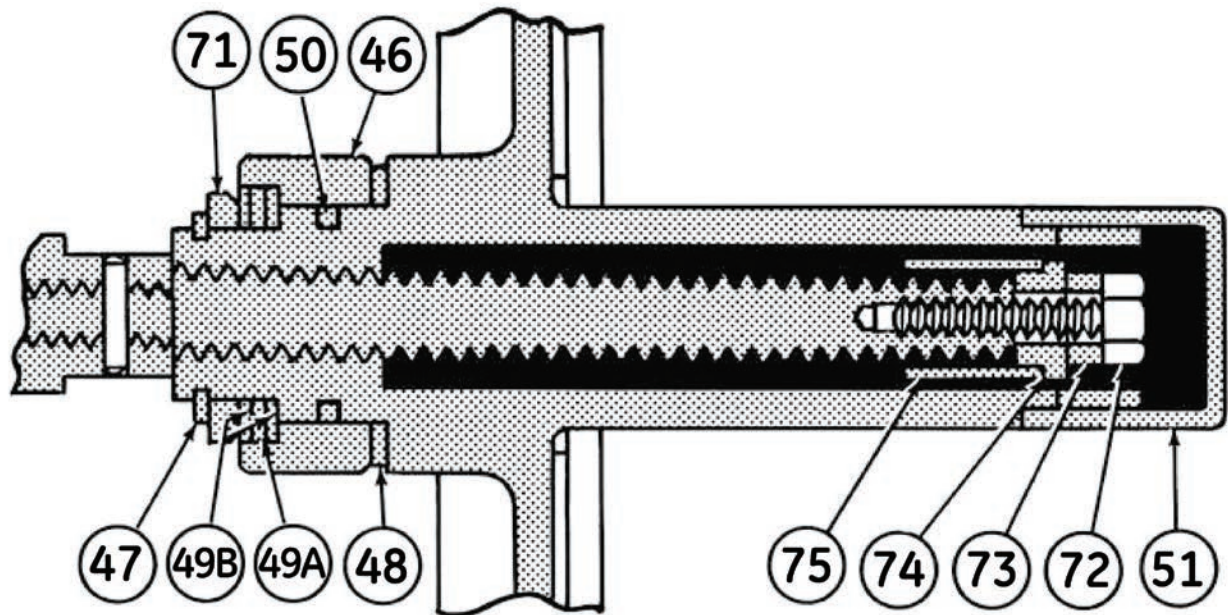


Figure 16

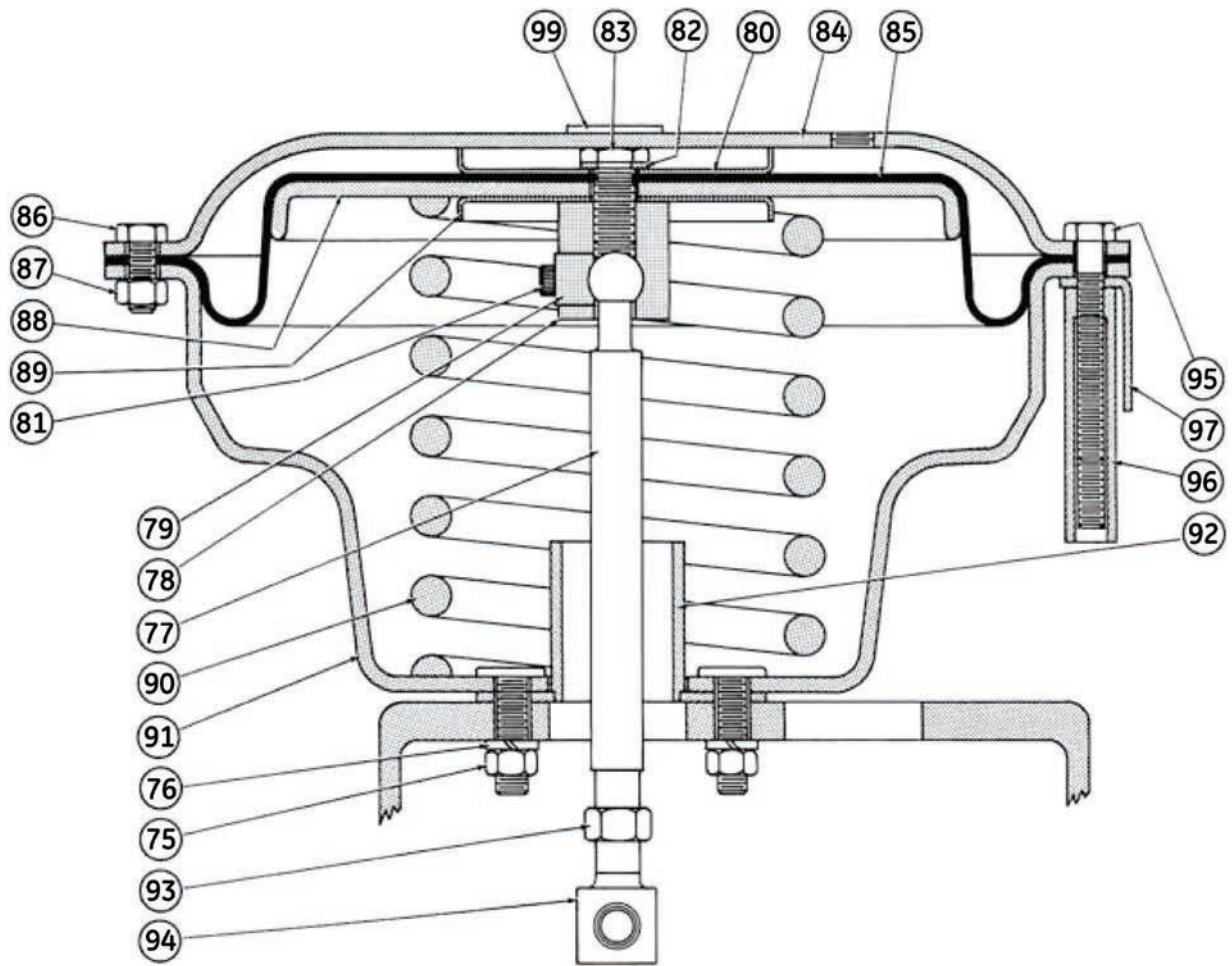


Figure 17 - Actuator Type 33 Old version

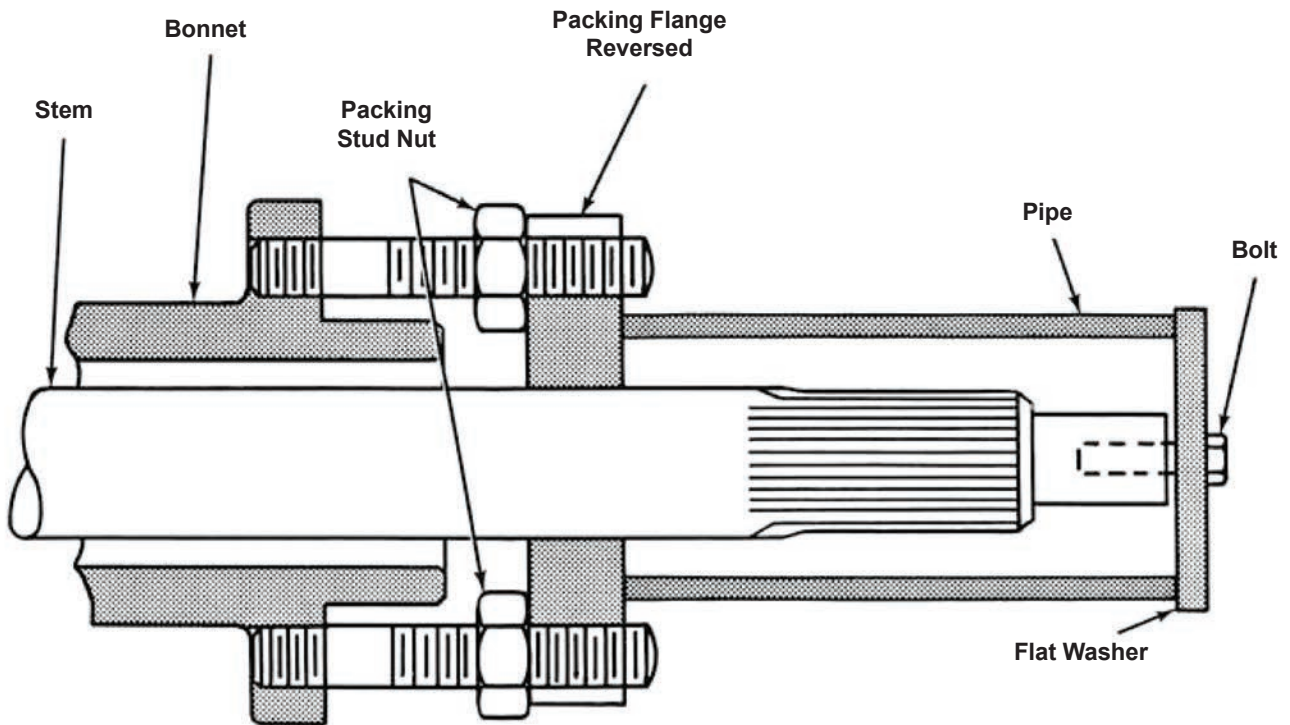


Figure 18

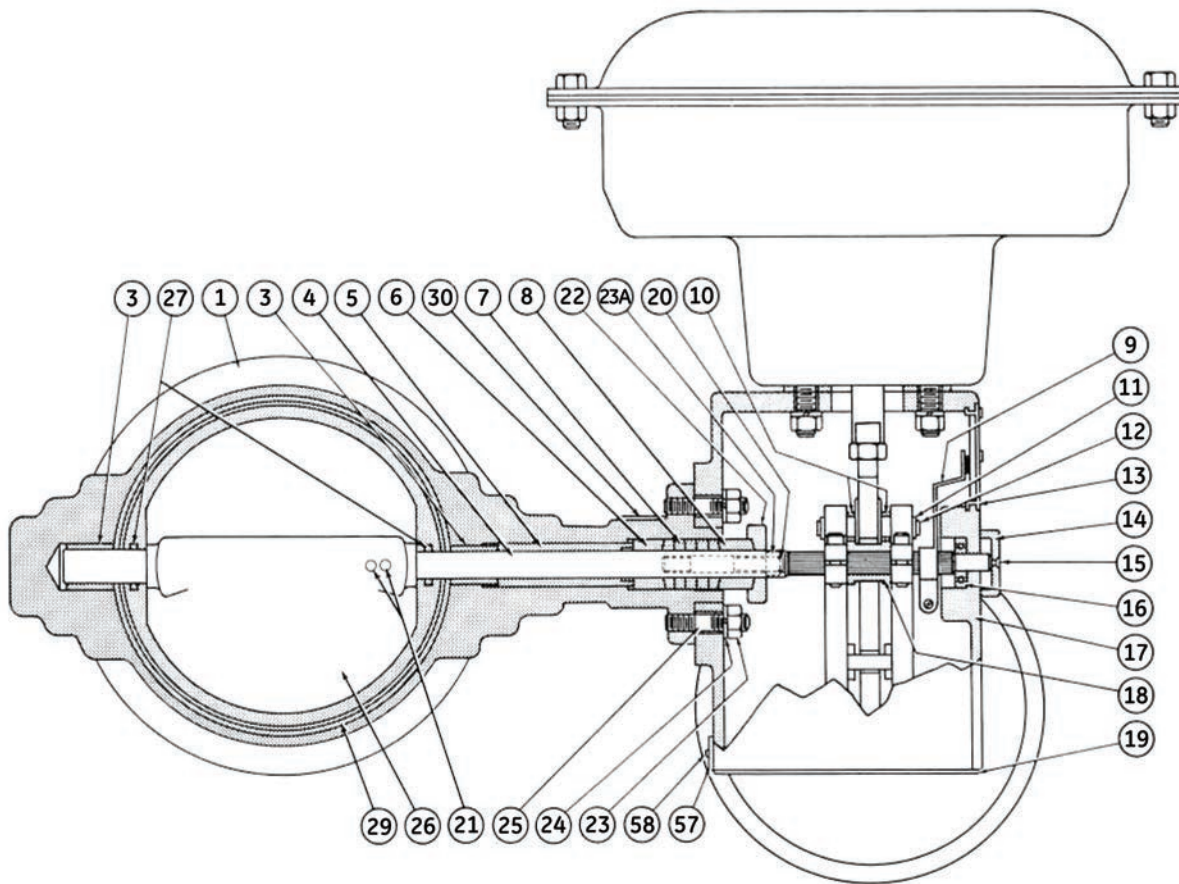


Figure 19

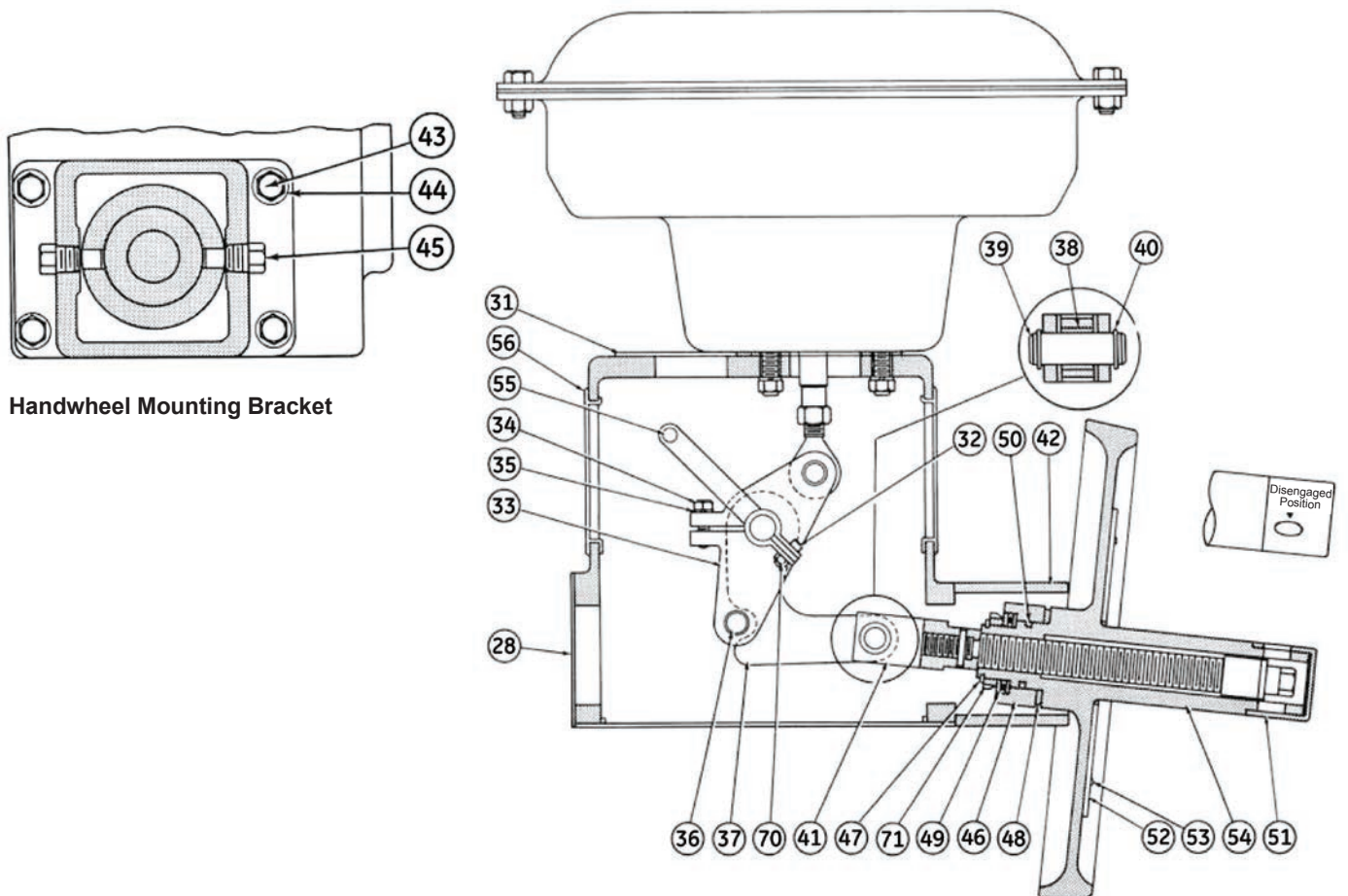


Figure 20

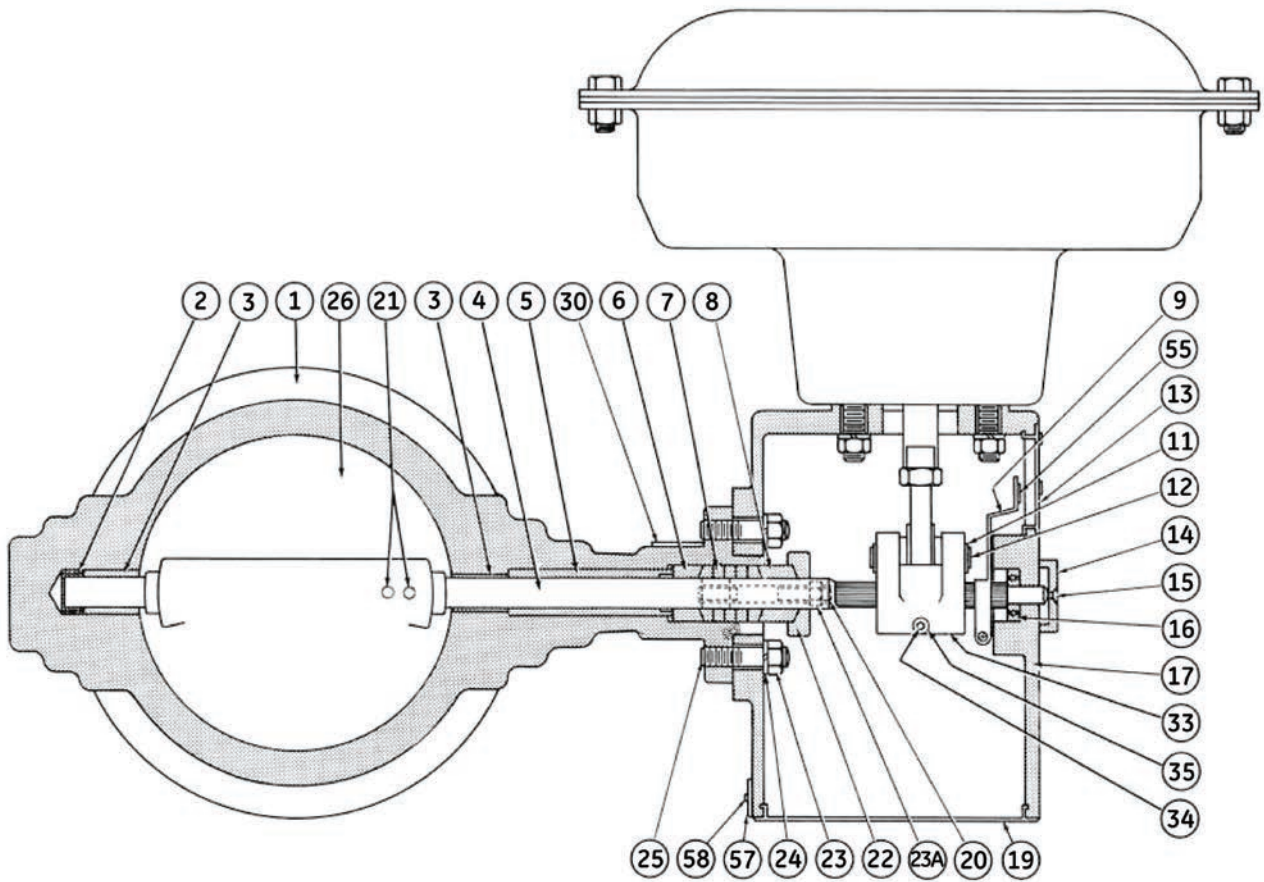


Figure 21

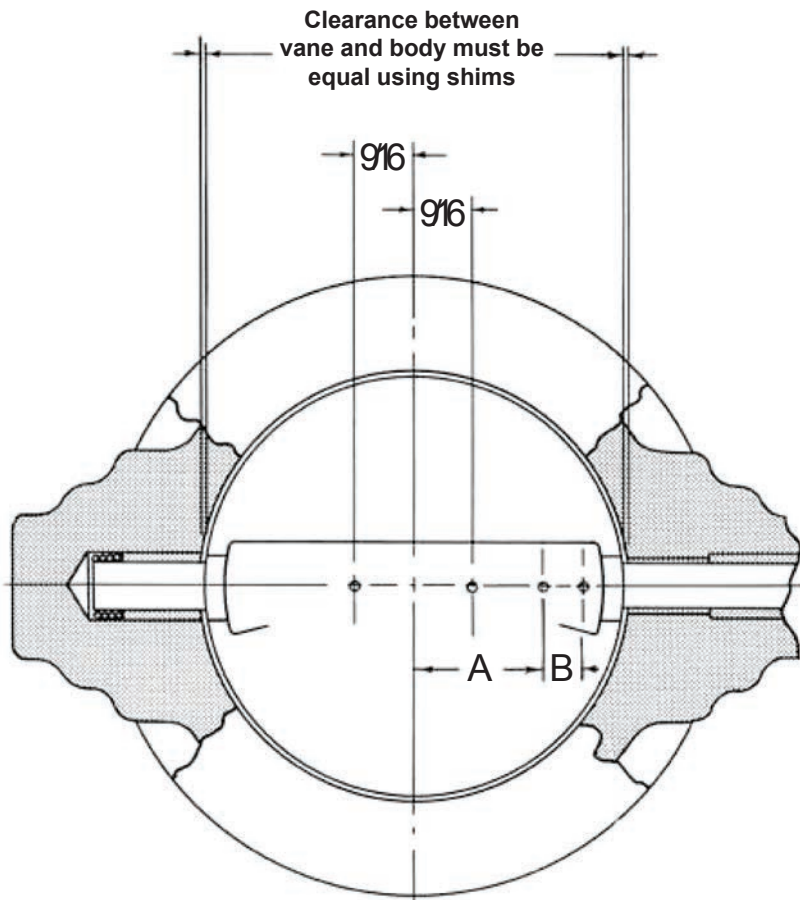


Figure 22

Size (in.)	A (in.)	B (in.)	Drill Size (in.)	Taper Reamer Size
2	Note 1	Note 1	No. 19 (.166 Dia)	No. 2
3	9/16	3/8	No. 19 (.166 Dia)	No. 2
4	3/4	1/2	No. 19 (.166 Dia)	No. 2
6	1 3/4	1/2	No. 19 (.166 Dia)	No. 2
8	2 1/4	1/2	1/4	No. 5
10	3	1	1/4	No. 5
12	3 3/4	1	1/4	No. 5

1. On 2" valves, drill holes 9/16" each side of centerline.

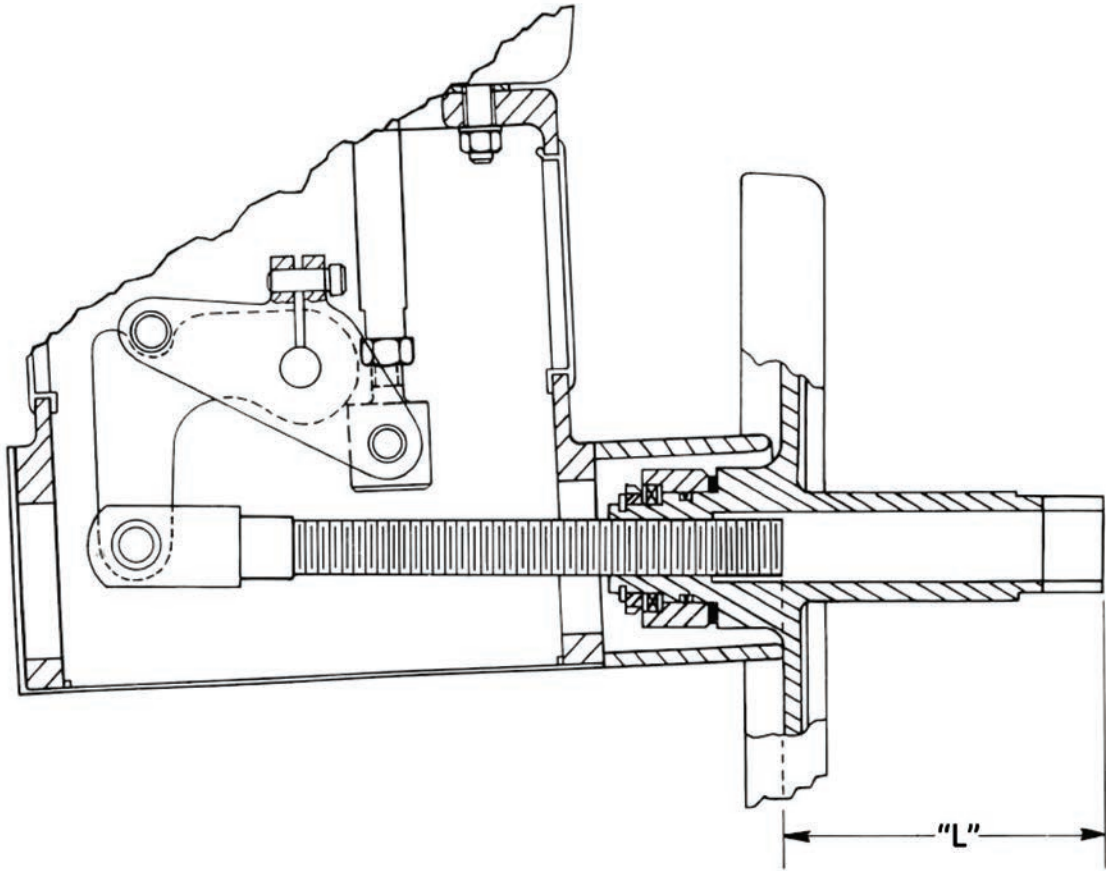
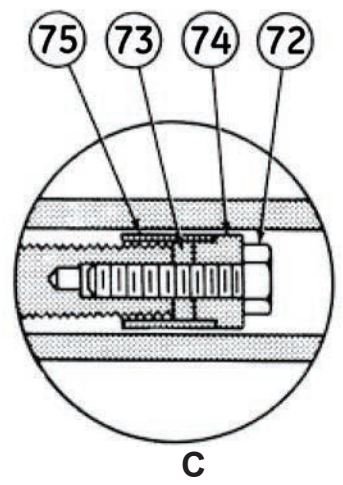
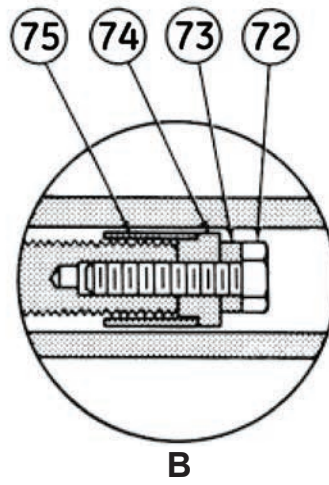
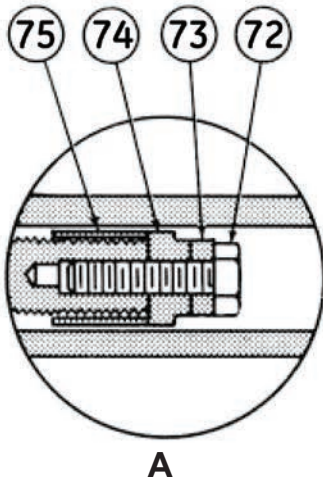


Figure 23



If "L" Dimension is		Use Handwheel Orientation
More Than (in)	But Less Than (in)	
-	5.543	A
5.543	5.777	B
5.778	-	C

Figure 24

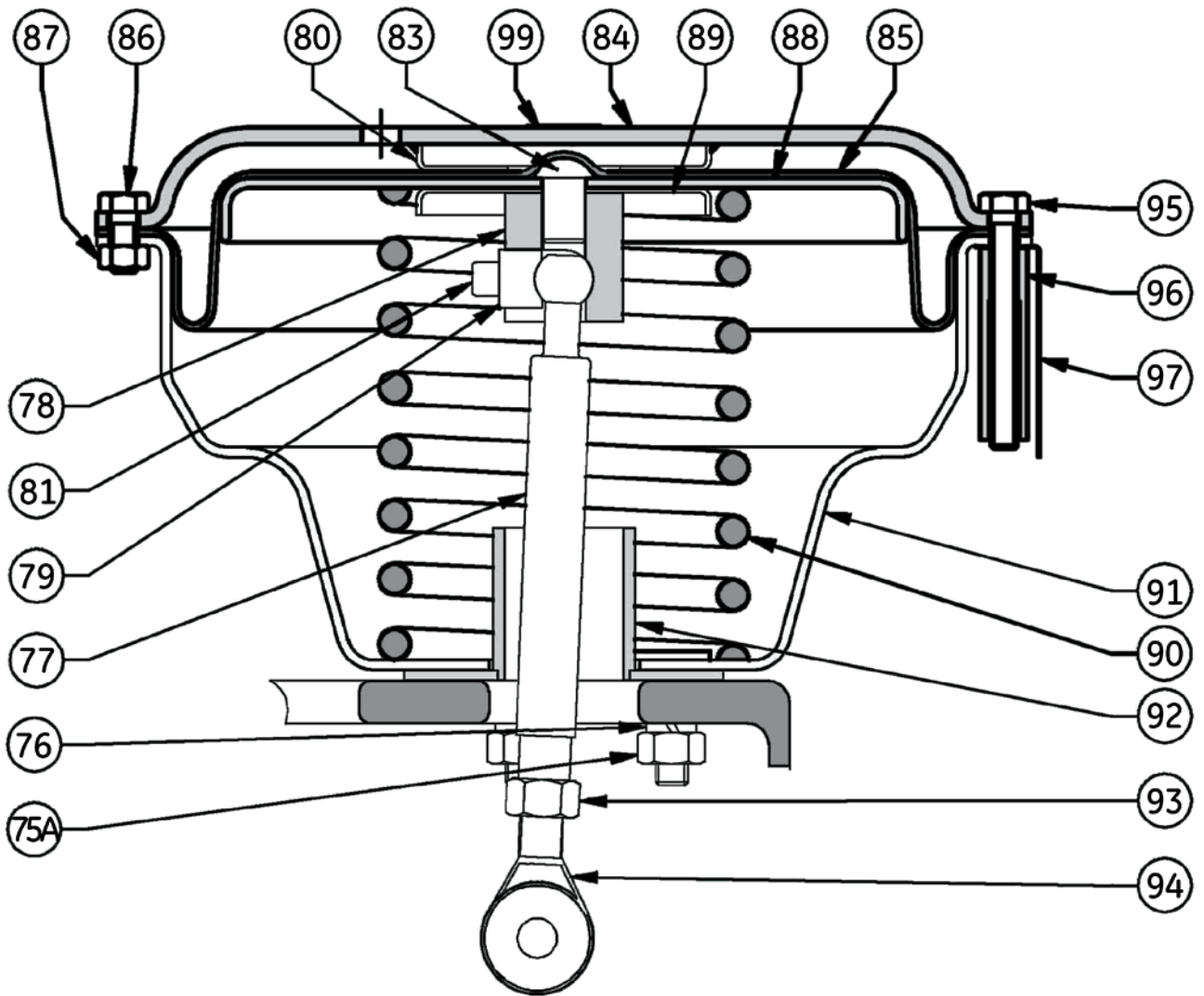
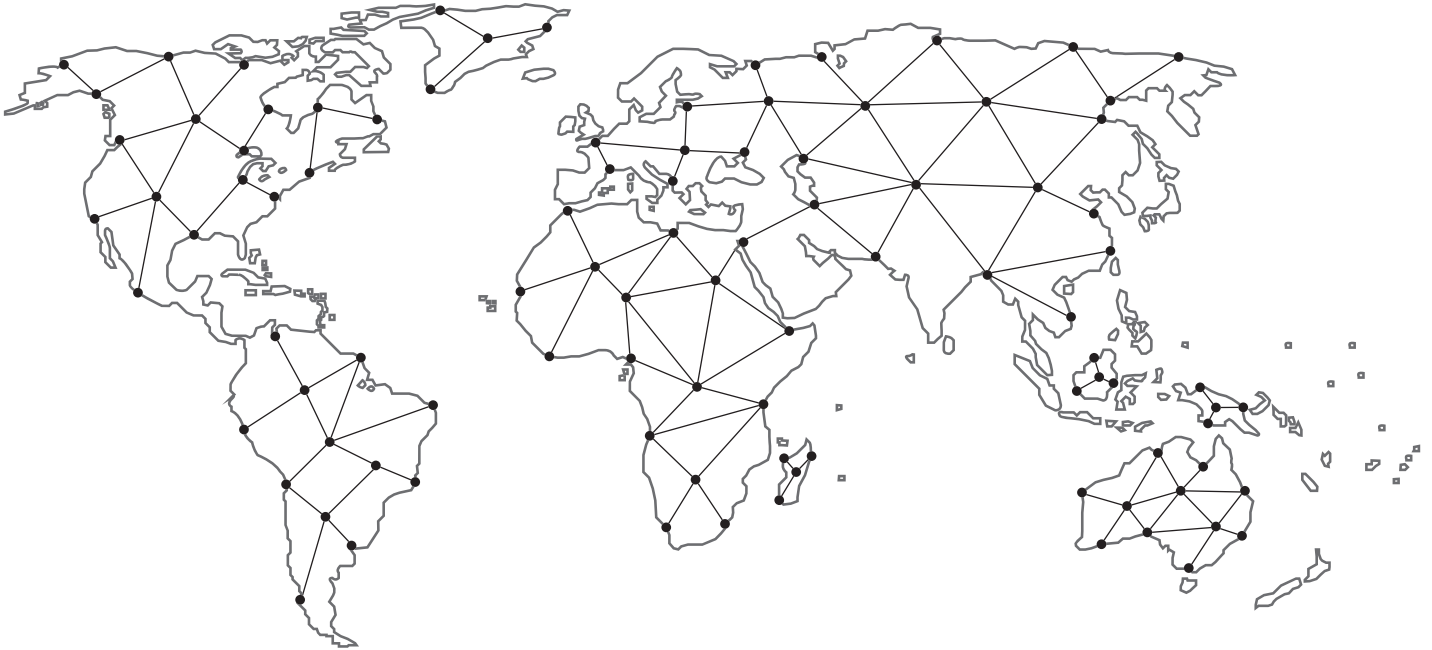


Figure 25 - Actuator Type 33 New version, case Type B (70 sq. in) and Type C (140 sq. in.)

Ref. No.	Part Name		Standard Material
75A	Nut Hex 3/8" 16-UNC		A 194 Gr 2H
76	Lock Washer		A 307
77	Spring stem		A 564 Gr 630 (H 1075)
78	Trunnion block		Sintereed nickel, iron, copper alloy WAKEFIELD 39C type
79	Trunnion block plug		
80	Stop		A 283 Gr D
81	Screw 1/4" 28-UNF		A 4140 + NYLON type polyamide insert
83	Screw 1/2" 20-UNF		A 307
84	Upper cover		A 283 Gr D
85	Diaphragm		Linen-faced polydien RAYON-faced NEOPREN type
86	Cover screw		A 307
87	Nut		A 307
88	Diaphragm plate		A 283 Gr D
89	Spring guide	70 sq. in. actuator	A 283 Gr D
		140 sq. in. actuator	A 1010-1025
90	Spring		A 229
91	Lower cover	Cover	A283 Gr D
		Screw 3/8" 16-UNC	A 1010-1025
92	Bearing stop		
93	Nut 1/2: 20-UNF		Stainless steel
94	Lower rod end bearing		-
95	Screw		Stainless steel
96	Tension nut		A 307
97	Warning plate		Stainless steel
99	Information plate		-

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