

10A/5.5.4

Formerly D-10196, Rev B

**INSTALLATION, OPERATING,
AND MAINTENANCE INSTRUCTIONS**

LESLIE CLASS GTW

THREE WAY CONTROL VALVES

1/2" - 10"

ANSI CLASS 150 - 300

DIN 16-25



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I. INTRODUCTION

Description

The Leslie/K&M Three-Way Control Valves are used for mixing or diverting service. The mixing valve is available in sizes from 1/2" to 12". The diverting valve is available in sizes from 1/2" to 10". The valve ends are flanged or threaded. The body is available in carbon steel and stainless steel in ANSI classes up to 300.

Operating Principles

The Leslie/K&M Three-Way Control Valves operate on a reciprocating principle. The plugs move in a straight line into and out of a seat ring. The flow is controlled by distance of the plug from the seat ring. Illustrated below are the configurations for the mixing and the diverting valves.

- a. 3-Way Mixing Valve, 1/2" to 12"
- b. 3-Way Diverting Valve, 1/2" to 1-1/2"
- c. 3-Way Diverting Valve, 2"

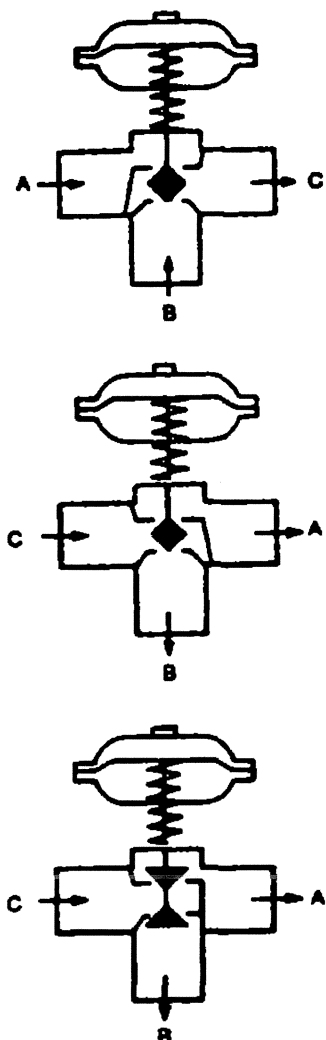


Figure 1

Inspection

This equipment has been properly packaged and protected for shipping, however, if improperly handled during shipment, damage could occur. Carefully inspect equipment for damage and malfunction.

Storage

Store in a clean, cool, dry location and protect from dirt, dust and other debris. If stored outdoors, wrap the equipment in plastic and store high enough off the ground to keep it from being immersed in water or buried by snow. Replace the plastic plugs in the positioner ports with pipe plugs.

Replacement Parts

It is advised that one set of recommended spare parts be kept on hand for each valve size and type. Recommended spare parts are identified on the Assembly Drawings. Replacement parts can be ordered from your local Leslie/K&M representative or from the sales and service centers listed on the back of this manual. When ordering parts, include the valve size and the Valve No. from the second line of the data plate attached to the actuator. Also include the drawing number, part name, item number and quantity as shown on the Assembly Drawing (not the exploded view).

Leslie Service

Leslie service personnel are available to start up or repair Leslie products. Leslie can also train your own personnel to do this work. Contact your nearest Leslie representative for information on this service.

WARNINGS AND CAUTIONS

Warnings and Cautions must be strictly adhered to in order to avoid possible personal injury or damage to the valve, piping system or to property.

I. INSTALLATION OF VALVE

WARNING

Unless otherwise specified, the stem of this valve has been assembly lubricated with a silicone base lubricant that may not be compatible with your pipeline medium. Ensure lubricant compatibility with your pipeline medium prior to startup. Failure to do so can result in personal injury and/or equipment damage. Stem will need no further lubrication unless a lubricated packing is used along with a lubricator bonnet.

WARNING

Do not apply rotating torque to a bellows bonnet valve stem as it will rupture the bellows and break the seal. The pressure rating of the bellows unit may be lower than the pressure rating of the valve. See the Bellows Unit Data Plate on the actuator for the pressure rating of the bellows unit. If the rating of the bellows unit is lower than the rating of the valve, do not operate the valve at a pressure greater than the rating of the bellows unit.

WARNING

Wear proper protective clothing, gloves and goggles to prevent contact with pipeline medium when installing the valve on a pipeline that has previously been in service.

A. Bypass

In order to insure continuous operation of the pipeline during inspection or repair of the valve/actuator, it is recommended that a bypass system with a second control valve be installed.

B. Cleaning

WARNING

When using pressurized air for cleaning, use proper protective goggles to prevent flying debris from entering the eyes. All persons in close proximity to the cleaning operation must be so equipped. Air pressure used for cleaning must be less than 30 psig (2 bar) (OSHA 1926.302(b)(4)).

Clean the piping interior of all foreign matter such as scale, dirt, oil and grease before installing the valve on the pipeline. Clean all valve/pipe mating surfaces such as threads and flange faces and clean gaskets to assure a leak-tight fit. Make sure that no foreign matter has fallen into the valve.

C. Installation Position and Clearances

1. Make sure that the centerline of the valve body coincides with the centerline of the pipeline.
2. Install the valve/actuator assembly in a vertical position with the actuator above the valve. For installation in any other position, contact your Leslie/K&M representative for instructions.

3. Install the valve according to the arrow on the valve body. The arrow indicates the correct direction of flow through the valve.
4. Allow sufficient clearance above the actuator to permit its removal from the valve. Clearance requirements are determined by the actuator yoke size. Clearances are as follows:

Yoke Size	Clearance Requirements Above Top of Diaphragm Case
C	7" (178 mm)
E	7" (178 mm)
F	8.5" (216 mm)
H	9" (229 mm)

D. Threaded End Installation

1. Thread Specifications: Threads are NPT and conform to ANSI B1.20.1, Pipe Threads, General Purpose (inch).
2. Thread Sealant: Use a thread sealant that is compatible with the pipeline medium. Apply sealant to male pipe threads only. Do not apply sealant to the first few threads on a pipe.

E. Flanged End Installation

1. Flanged Specifications

CAUTION

Deviation from any of the following requirements could result in flange breakage and/or valve leakage.

2. Gaskets

Gasket dimensions for steel and alloy flanges are in ANSI B16.5 with the exception of ring-joint gaskets. Dimensions for this type of gasket are in accordance with ANSI B16.20, Ring-Joint Gaskets and Grooves for Steel Pipe Flanges.

3. Bolts

Joints (of any material) using low strength carbon steel bolts shall not be used above 400°F (200°C) or below -20°F (-29°C) (ANSI B16.5). Bolt and nut data for steel and alloy flanges are in accordance with ANSI B16.5.

4 Installation

When installing a flanged valve in a pipeline, do not use the flange bolts to draw the pipe flanges into contact with the valve flanges. Make sure that one end of the piping is free to move easily toward the valve. Properly support the piping so the valve flanges are not stressed. When installing the flange bolts, use a criss-cross pattern and tighten each bolt gradually.

F. Air Supply

- 1 Make sure that the air supply to the pneumatic system does not exceed the pressure limit of the actuator or the instruments. The supply air to the system must be clean, dry, (See ISA-S7-3) and properly regulated. Therefore, it is recommended that a combination regulator/air filter be installed in the supply air line. Air pressure to the instruments should be at least 5 psig (0.4 bar) above the maximum pressure required to operate the valve under the most severe service conditions.

G. Actuator

- 1 If the actuator is not equipped with a positioner, connect the air line from the controller to the actuator.
- 2 Reverse Action Actuator
 - a Remove the shipping plug from the diaphragm case vent and replace it with the breather cap that comes with the actuator.
 - b Do not turn this type of actuator on a valve before taking the following steps. Connect an air supply to the actuator. Supply enough air to lift the plug off the seat ring, then turn the actuator on the valve. If this procedure is not followed, the actuator will be difficult to turn because of friction between the plug and the seat ring. Also, turning the actuator when the plug is seated could damage the plug and seat ring contact surfaces.
- 3 The actuator can be turned on the valve to make the positioner more accessible for servicing. To turn the actuator, loosen the lock nut on C, E and F Yokes or remove the four bolts on an H Yoke. On a reverse action actuator, raise the plug off the seat ring before turning the actuator.

H Insulation

When insulating a piping system, do not insulate an extended bonnet on a valve. An extended bonnet is to be used for high and low temperature extremes (above

340°F or below 32°F). Insulation will interfere with the heat transfer capabilities of the bonnet and defeat its purpose.

II. OPERATION

Perform Steps A through D before putting anything into the pipeline. Refer to the valve drawings and actuator drawings for parts identification.

A. Actuator Check

- 1 Reverse Action Actuator - Make sure that the shipping plug in the diaphragm case vent has been replaced by the breather cap.
- 2 Make sure that the supply air pressure to the controller (and positioner if included) is correct and that the air is properly filtered and regulated.

B. Valve Operation Check

Connect a regulated air line to the actuator and operate the valve through its entire stroke range. It should operate smoothly. If it does not, check the packing nuts to see if they have been tightened excessively and are causing stem binding. Check the actuator scale to make sure that the valve is operating at full stroke. Full stroke length is indicated on the actuator data plate in the "STROKE DESCR" box.

C. Fail-safe Check

Observe the fail-safe position of the actuator to make sure that it is correct when there is no air pressure. With no air pressure to the actuator, a direct action (air-to-close) actuator stem should be retracted (in the "up" position) and a reverse action (air-to-open) actuator stem should be extended (in the "down" position). The action of the actuator will be indicated on the actuator data plate in the "DIAPHRAGM PRESS (OPENS) OR (CLOSES) PLUG" box.

D. Packing Nuts

Tighten the packing nuts alternately, one complete turn past finger-tight, one half turn at a time before putting the valve in service. It is not necessary to tighten Spring-Loaded V-Ring packing as it has already been tightened at the factory. Inspect for leakage when the valve is first put into service and periodically thereafter.

E. System Flush

- 1 It is recommended that a new piping system be flushed prior to putting it in service. Debris in the pipeline could damage a valve or render it inoperable. Piping systems that have butt welded piping must be flushed to remove welding debris.
- 2 Make sure that all valves in the system are fully opened during the flushing process.

F. Actuator Lines

Connect all lines in the actuator system

III. MAINTENANCE

Refer to the valve drawings and actuator drawings for parts identification

A. Leslie Service

Leslie service personnel are available to repair and maintain our products. Leslie can also train your own personnel to do this work. Contact your nearest Leslie/K&M representative for information on this service.

B. Periodic Maintenance

1 Packing Box Adjustment

- a **Spring-Loaded PTFE V-Ring Packing** - This type does not need adjusting as constant spring pressure on the packing continually compensates for wear. The packing nuts are completely tightened down when this packing is installed. Replace it as soon as it begins to leak.

CAUTION

Tighten the packing nuts only enough to stop a leak. Over-tightening the nuts will cause excessive packing wear and can cause stem binding.

- b **All Packing Other Than Spring-Loaded** - Tighten the packing nuts periodically to compensate for wear. Alternate between nuts, tightening them one half turn at a time with the same total number of turns on each nut. If a packing leak develops, tighten the packing nuts only enough to stop the leak. When tightening the packing nuts no longer stops a leak, replace the packing.

2 Valve Stem Cleaning

Clean the valve stem and polish it with crocus cloth. Dirt on a valve stem causes excessive packing wear.

3 Valve Stem Lubrication

WARNING

Unless otherwise specified, the stem of this valve has been assembly lubricated with a silicone base lubricant that may not be compatible with your pipeline medium. Ensure lubricant compatibility with your pipeline medium. Failure to do so can result in personal injury and/or equipment damage. Stem will need no further lubrication unless a lubricated packing is used along with a lubricator bonnet.

WARNING

Unless otherwise specified, valves with a lubricator bonnet have been factory supplied with a silicone base lubricant that may not be compatible with your pipeline medium. Ensure lubricant compatibility with your pipeline medium. Failure to do so can result in personal injury and/or equipment damage.

- a Use the correct lubricant in the lubricator bonnet for your particular valve application. It must be compatible with your pipeline medium.
- b If the valve has a lubricator on the bonnet, turn the lubricator screw a few revolutions at regular intervals to inject a small amount of lubricant into the packing box. If the valve bonnet is equipped with an isolation valve, open it every time the valve is lubricated and close it when done. Do not tighten the lubricator screw excessively as compressed lubricant can cause stem binding. When the lubricator screw can no longer be turned down, back it all the way out and remove it from the lubricator reservoir. Refill the reservoir with the correct lubricant leaving space in the lubricator reservoir to insert the screw.

C. Removal of Valve From Pipeline

It is not necessary to remove the valve body from the pipeline to inspect or repair it or to change the trim or packing. You can remove the valve from the pipeline and follow Valve Maintenance Procedures with the valve on the pipeline.

Figure 2

NO.	PART NAME
A1	BODY
A2	BONNET
A3	NUT
A4	STUD
A5	SPRING (V-RING PACKING)
A6	PACKING
A7	GLAND
A8	GLAND PLATE
A9	NUT
A10	STUD
A11	STEM
A12	PIN
A13	FLANGE LOWER
A14	PLUG
A15	SEAT
A16	GASKET

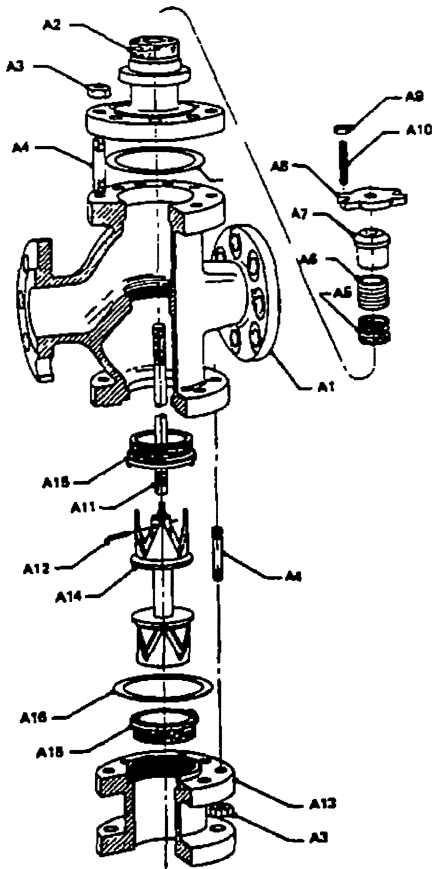
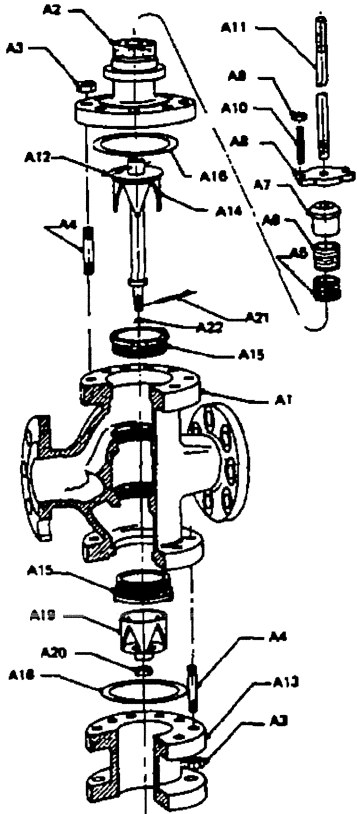


Figure 3



NO.	PART NAME
A1	BODY
A2	BONNET
A3	NUT
A4	STUD
A5	SPRING (V-RING PACKING)
A6	PACKING
A7	GLAND
A8	GLAND PLATE
A8	NUT
A10	STUD
A11	STEM
A12	PIN
A13	FLANGE, LOWER
A14	PLUG, UPPER
A15	SEAT
A16	GASKET
A19	PLUG, LOWER
A20	NUT
A21	COTTER PIN
A22	O-RING

WARNING

Wear proper protective clothing, gloves and goggles to prevent contact with pipeline medium. Tag all valves in the system stating the repairs being made. Wash the exterior of the valve/actuator assembly and the valve interior. Isolate the valve, depressurize and drain the piping system, depressurize the pneumatic system and turn off the electricity to the controller (if applicable) before removing the valve from the pipeline.

- 1 Remove all control and supply lines to the actuator and positioner
- 2 Remove all flange nuts and bolts or unscrew the valve from the pipeline
3. Remove the valve/actuator assembly from the pipeline
- 4 Remove the gaskets from the pipeline/valve flanges (if applicable)
- 5 Scrape the flange surfaces to remove all gasket particles or remove the sealant from the threads with a wire brush to assure a leak-tight fit when the valve is reinstalled on the pipeline

D. Removal of Actuator from Valve

See actuator section

E. Valve Maintenance Procedures

WARNING

Wear proper protective clothing, gloves and goggles to prevent contact with pipeline medium. Tag all valves in the system stating the repairs being made. Isolate the valve and depressurize and drain the piping system. Wash the exterior of the valve and flush the interior thoroughly before beginning work on it.

- 1 Disassembly - Three-Way Mixing Valves, 1/2" to 12" and Three-Way Diverting Valves, 1/2" to 1-1/2"
 - a Remove the lubricator bonnet attachments (if applicable) so they do not get broken off when handling the valve

- b Loosen the packing nuts
 - c Remove the bonnet to body nuts
 - d Slide the bonnet straight up off the valve body. Be careful not to bend the valve stem
 - e Remove the bonnet to body gasket
 - f Remove the lower flange (A13) nuts
 - g Remove the lower flange, seat ring and gasket
 - h Remove the plug/stem assembly through the bottom of the valve
- 2 Disassembly - Three-Way Diverting valve, 2" to 10"
 - a Remove the lubricator bonnet connections (if applicable) so they do not get broken off when handling the valve.
 - b Loosen the packing nuts
 - c Remove the bonnet to body nuts
 - d Slide the bonnet straight up off the valve body. Be careful not to bend the valve stem
 - e Remove the bonnet to body gasket
 - f Remove the lower flange (A13) nuts
 - g. Remove the lower flange and gasket
 - h Remove the cotter pin (A21) from the nut (A20) on the lower plug (A19)
 - i Insert a wrench into the valve inlet port. Hold it on the square plug stem and remove the nut (A20) from the lower plug. Remove the lower plug from the valve
 - j While holding the lower plug (A19) against the seat ring, pull on the valve stem to remove it from the lower plug. Remove the lower plug from the valve
 - k Remove the upper plug/stem assembly through the top of the valve

NOTE Do not replace the stem packing at this time. It may be needed later for plug and seat ring lapping.

- 3 Inspection and Replacement of PartsDo not replace the stem packing until the final valve reassembly
 - a Clean the valve stem and polish it with crocus cloth
 - b Clean all gasketed surfaces

- c Inspect the interior of the valve, the seat rings, the plugs and the valve stem. Check for scratches, wear and damage. Check the upper threads on the stem for sharp protrusions that could damage the packing when being installed. Repair or replace parts as needed. Use a medium compatible thread lubricant when replacing seat rings.

NOTE When replacing either a plug or a valve stem, it is recommended that the plug/stem assembly be replaced together as a unit. The new plug/stem assembly will come drilled and pinned together from the factory. If the plug or stem are purchased separately, they are not drilled.

- d Replaced the O-ring (A22) in the lower plug (A19) on a 2" to 10" diverting valve.
- e When installing a new stem on an old plug, screw the stem into the plug as far as it will go. Then drill the stem through the existing hole in the plug and pin the assembly.

NOTE When ordering replacement parts from your local Leslie/K&M, see Section IE for instructions.

4 Plug and Seat Ring Lapping (Optional)

For critical shutoff application, to improve the shutoff performance of a valve, the seat ring and plug may be lapped.

To check for proper seating of the plug and seat ring, apply a light coating of Permatex non-drying Prussian Blue on the seating surface of the plugs. Install the plugs in the valve and place the bonnet on the valve body, securing it finger-tight with two diagonally opposed nuts. Be careful not to allow the plugs to touch the seat rings. Lower (or raise) the plug onto the seat ring and rotate the valve stem 5 to 10°. Lift the plug off the seat ring and repeat this step on the upper seat ring. Hold the plugs off the seat rings and remove the bonnet and plugs from the valve body following the correct disassembly procedure for the valve. Inspect the seat rings. For proper seating, there should be a continuous ring of blue on the seat ring.

Use the following lapping compounds:

- Steel Plug/Seat - #400 grit compound for rough lapping
#600 grit compound for finishing
- Stellite Plug/Seat - #300 grit compound for rough lapping
#600 grit compound for finishing

Reassemble with new gaskets. They may also be used for the final valve reassembly provided they have not been damaged during this procedure.

- a Apply rough lapping compound around the perimeter of the plug on the seating surface.

NOTE Make sure that the old packing is in the bonnet and the packing nuts are loose.

- b Assemble the valve according to Procedure IIIF7 or 4F8 with the exception that only two diagonally opposed nuts are used on the bonnet. On all Three-Way Mixing Valves and the 1/2" to 1-1/2" Diverting Valves, use all of the nuts on the lower flange to hold the lower seat ring firmly in place. Finger-tighten the nuts on the bonnet and wrench-tighten the lower flange nuts (if lapping the lower plug/seat ring).

NOTE To prevent scratching or galling of the plug and seat ring contact surfaces, do not allow the full weight of heavier plugs to rest on the seat ring when lapping. Do not force the plug against the seat ring. You will either raise or lower the plug to bring it into contact with the upper or lower seat ring depending on the valve action (mixing or diverting). See Figure 1 for plug/seat ring arrangements.

- c Screw two jam nuts on the valve stem and tighten them together. Lower the plug onto the seat ring and rotate the stem back and forth several times using a wrench on the valve stem jam nuts. Do not force the plug against the seat ring. Lift the plug off the seat ring and rotate it a quarter turn. Lower the plug on to the seat ring and rotate it back and forth several times. Continue to repeat this procedure until the plug has been rotated against the seat ring at a total of four different positions (0°, 90°, 180° and 270°).
- d Disassemble the valve according to Procedure IIIF1 or IIIF2.
- e Clean the lapping compound off the plug and seat ring and examine them for defects. If defects still exist, repeat the lapping procedure. If defects have been eliminated, go to Step f.
- f Repeat the lapping procedure with the following exceptions:

- 1) In Step a, substitute #600 grit compound in place of the rough lapping compound.
- 2) After Step d, clean the interior of the valve body, the gaskets, the plug, seat ring, and all other parts of the valve assembly to remove the lapping compound. Remove the jam nuts from the valve stem.

5 Plug and Seat Ring Remachining (optional)

- a The seating surface angle as measured from the

valve stem axis is 30° on the plug and 32° on the seat ring

- b If lapping the seat ring on a metal to metal plug/seat assembly does not eliminate the defects, it is then recommended that the seat ring be replaced. Shutoff can only be obtained if the correct angles are carefully machined on the plug and seat ring.

6 Packing Removal

Keep the work area clean so as not to introduce foreign matter into the packing box. The bonnet must be removed from the valve for this procedure.

WARNING

Wear proper protective clothing, gloves and goggles to prevent contact with the pipeline medium that will be in the packing box and on the packing. Tag all valves in the system stating the work being done. Isolate the valve and depressurize and drain the pipeline. Wash the exterior and interior of the valve.

- a Remove the packing nuts (A9) and the gland plate (A8) from the bonnet.
- b Remove the packing gland (A7) from the packing box.
- c Remove the valve stem from the bonnet. Clean it, then polish it with crocus cloth.
- d Inspect the valve stem for damage, wear and scratches. Inspect the valve stem upper threads for any sharp edges that could damage packing when being installed. Repair or replace the valve stem as needed.
- e Remove the packing from the packing box using a hook tool. Be careful not to scratch the packing box wall.
- f Flush out the packing box thoroughly.
- g Clean the packing box wall.
- h Inspect the packing box wall for damage that could interfere with an effective packing seal and inspect for edges that could damage packing when being installed. Repair or replace the bonnet as needed.

NOTE Do not repack the bonnet at this point. If repacking is done before reassembly, the packing could be damaged when the stem is put into the bonnet. The packing must be installed.

7 Reassembly - Three-Way Mixing Valve 1/2" to 12"

and Three-Way Diverting Valve, 1/2" to 1-1/2"

- a Insert the plug/stem assembly into the valve body through the bottom.
- b Place a gasket on the lower flange (A13).
- c Place the lower flange/seat ring/gasket assembly on the lower valve body, being careful to guide the lower plug inside the seat ring so that bottom of the plug does not scratch the seat ring.
- d Hold the lower flange in place on the valve body and screw the nuts on the flange studs finger-tight.
- e Tighten the flange nuts evenly with a wrench, one half turn at a time, using a crisscross pattern.
- f Insert a gasket in the recess on top of the valve body.
- g Slide the bonnet over the valve stem onto the valve body.
- h Screw the nuts on the bonnet studs finger-tight.
- i Tighten the bonnet nuts evenly with a wrench, one half turn at a time, using a crisscross pattern.

8. Reassembly - Three-Way Diverting Valve, 2" to 10"

- a Insert the plug/stem assembly into the valve body through the top opening. Be careful not to turn the plug on the seat ring or it could damage the plug/seat ring contact surfaces.
- b Put a light coating of lubricant that is compatible with the pipeline medium on the lower plug O-ring.
- c Slide the lower plug onto the plug stem being careful not to damage the O-ring.
- d Insert a wrench into the valve inlet. Hold it on the square plug stem and screw the nut (A20) on the lower plug stem.
- e Install a cotter pin through the nut/plug stem.
- f Place a gasket on the lower flange (A13).
- g Place the lower flange/gasket assembly on the lower valve body and hold it in place.
- h Screw the nuts on the flange studs finger-tight.
- i Tighten the flange nuts evenly with a wrench, one half turn at a time, using a crisscross pattern.
- j Insert a gasket in the recess on top of the valve body.

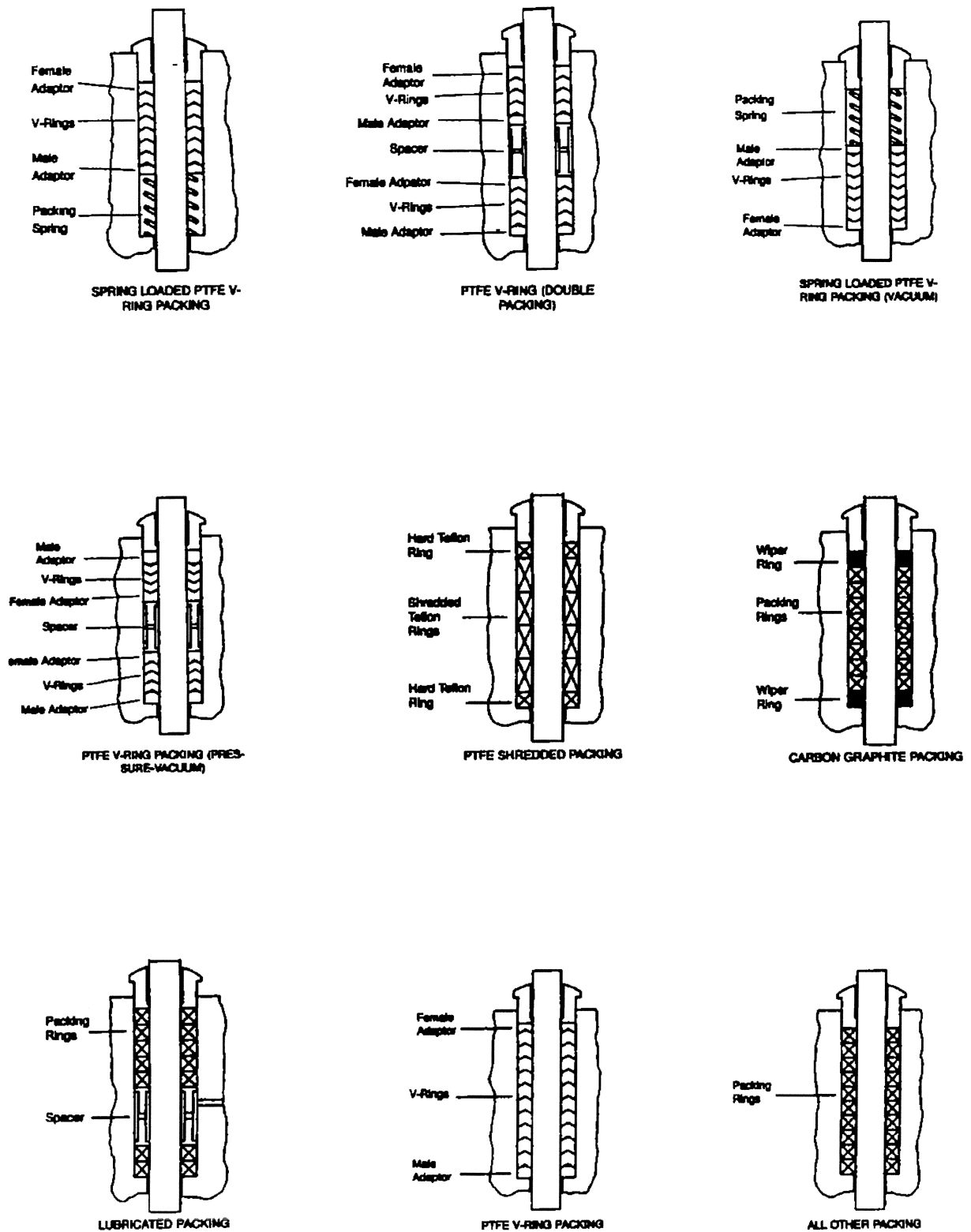


Figure 4

- k Slide the bonnet over the valve stem onto the valve body and hold it in place
- l Screw the nuts on the bonnet studs finger-tight
- m Tighten the bonnet nuts evenly with a wrench, one half turn at a time, using a crisscross pattern

9 Packing Installation (Figure 4, page 12)

- a The various packing types (except for the bellows bonnet) are illustrated in Figure 4, page 12. Slide the packing components one at a time carefully over the stem and into the packing box. Push the packing components to the bottom of the packing box one at a time with a piece of plastic pipe slightly smaller than the OD of the packing. Be careful when installing PTFE V-Ring packing so as not to damage the inner or outer edges. If the edges are damaged, the packing may not seal.
- b Place the packing gland (A7) in the packing box

when repacking has been completed

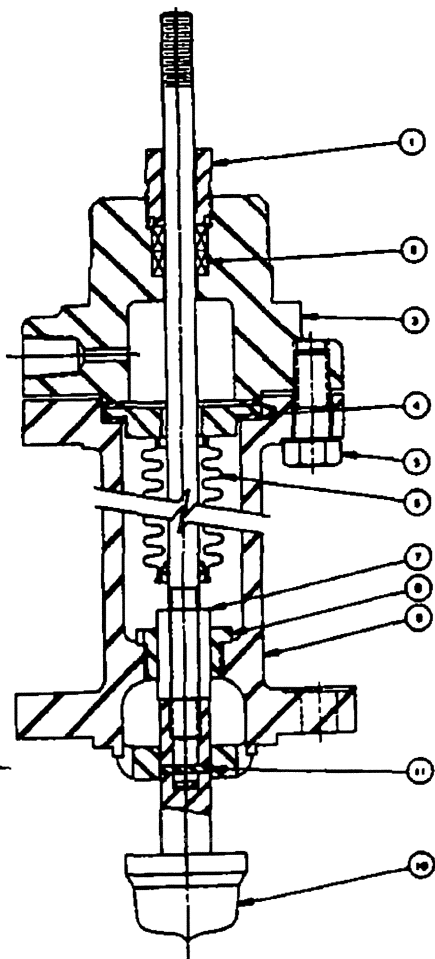
- c Place the gland plate (A8) on the bonnet
- d Place the packing nuts (A9) on the studs (A10) and finger-tighten them

CAUTION

Tighten the packing nuts enough to prevent a leak. Over-tightening the packing nuts will cause excessive packing wear and can cause stem binding.

- e All Packing Other Than Spring-Loaded - Alternate between nuts, tightening them one half turn at a time with the same number of turns on each nut. Tighten the nuts only enough to prevent leakage.
- f Spring-Loaded PTFE V-Ring Packing Only - Tighten the packing nuts (A9) completely down until they bottom out. The spring in the packing will apply constant pressure on the rings to compensate for

Figure 5



BELLOWS UNIT DRAWING

NO	PART NAME	QTY
1	PACKING NUT	1
*2	PACKING	—
3	BONNET	1
*4	GASKET	2
5	SCREW	4
*6	STEM & BELLOWS ASSEMBLY	1
*7	TORQUE ADAPTER	1
*8	TORQUE BUSHING	1
9	BELLOWS HOUSING	1
*10	PLUG	1
*11	PIN	1

* RECOMMENDED SPARE PARTS

Order by part name and by valve type and size. Include the valve no. from the second line of the Actuator Data Plate and the title of this drawing. Do not include the part number from this drawing.

wear Replace this packing as soon as it begins to leak

- g Lube Bonnet - Screw the lubricator or the isolation valve/lubricator onto the bonnet See Section III,B,3 for the lubrication procedure

F. Bellows Unit Maintenance Procedure

CAUTION

Do not apply rotating torque to the valve stem as it will rupture the bellows and break the seal

WARNING

If the pipeline medium is hazardous, a bellows bonnet must be equipped with a warning device that is capable of detecting a bellows rupture

WARNING

Wear proper protective clothing, gloves and goggles to prevent contact with pipeline medium Wash the interior of the valve and all parts of the bellows unit that come in contact with pipeline medium This includes the outer surface of the bellows and the interior of the bellows housing *There may also be pipeline medium inside the bellows, in the bonnet above the bellows flange and in the packing box if the bellows has been leaking*

See the Bellows Unit Drawing (page 13, Figure 5) at the end of this section for parts identification

1 Disassembly

- a Remove the Tell-Tale Gauge or other attachments from the bonnet tap.
- b. Remove the actuator (see actuator section) if not already done
- c Remove the packing nut (1) from the bonnet
- d Remove the screws (5) that hold the bonnet (3) on the bellows housing (9)
- e Pull straight up on the bonnet to remove it from the bellows housing
- f Screw two jam nuts on the stem (6) and tighten them together

NOTE Follow Steps h through q if the bellows is not leaking and the bellows unit is being disassembled for purposes other than to replace a damaged bellows

- g If the bellows is damaged, pull up hard on the stem (6) to free the bellows flange from the recess in the bellows housing and unscrew the stem from the torque adapter (7) If the bellows flange is stuck to the housing, place a wrench on the stem jam nuts and turn the stem counterclockwise to tear the bellows from the stuck flange Unscrew the stem from the torque adapter, stick a screw driver into the flange hole and pry the stuck flange out of the housing recess Go to Step l.

- h On a non-leaking bellows unit, make a continuous mark with a marking pen from the stem (6) to the top surface of the bellows flange

- i Lift up on the stem to free the bellows flange from the bellows housing recess. If the bellows flange can not be easily freed from the housing, go to Step k

- j Place a wrench on the stem jam nuts and slowly unscrew the stem clockwise from the torque adapter (7) while observing the marks on the stem and top of the flange If the marks on the stem and flange begin to move apart, stop unscrewing the stem immediately or the bellows will be torn from the flange Find out why the bellows is hanging up and not turning with the stem, correct the problem and continue to unscrew the stem from the torque adapter Go to Step l

- k When the bellows flange is stuck to the housing on a non-leaking bellows, air pressure must be used to free the flange If too much force is used in trying to pull a stuck bellows assembly out of a housing, the bellows could be damaged Use the following procedure to free a stuck flange

- 1) Remove the stem jam nuts

- 2) Replace the bonnet (3) on the bellows housing (9) and secure it with the bonnet to housing screws (5) Do not completely tighten the screws Leave the screws loose enough to allow about .08" or 2mm of clearance between the bonnet and the gasket on top of the bellows flange when the bonnet is lifted up This clearance is necessary to allow the flange to pop up when it is freed by air pressure

- 3) Secure gasketed blind flanges to the valve One of the blind flanges must have an air line connector If the valve has threaded ends, apply thread sealant to the pipe threads and screw a pipe plug into two ends of the valve and a reducing bushing with an air line connector into the other end

CAUTION

Do not exceed the pressure rating of the bellows unit or the valve body. Excessive pressure on the bellows will cause a rupture and break the seal.

- 4) Connect an air line to the valve and slowly apply pressure until the bellows flange is freed from the housing.
- 5) Remove the airline and the end connections from the valve.
- 6) Remove the bonnet (3) from the bellows housing (9).
- 7) Screw the jam nuts on the stem and tighten them together.
- 8) Place a wrench on the stem jam nuts and slowly unscrew the stem counterclockwise from the torque adapter (7) while observing the marks on the stem and top of the flange. If the marks on the stem and flange begin to move apart, stop unscrewing the stem immediately or the bellows will be torn from the flange. Find out why the bellows is hanging up and not turning with the stem, correct the problem and continue to unscrew the stem from the torque adapter.
- l Remove the bellows assembly (6) from the housing (9).
- m Remove the bellows flange gaskets (4).
- n Remove the bellows housing to valve body nuts.
- o Slide the bellows housing (9) off the valve body and the plug/torque adapter assembly (10/7).
- p Remove the packing from the bonnet. Save for plug and seat ring lapping and the bellows leak test.
- q Remove the plug assembly (with torque adapter attached) from the valve body following procedure in Section III,F,1 or III,F,2.

NOTE Do not repack the bonnet at this point. If repacking is done before reassembly, the packing could be damaged when the stem is put into the bonnet. The packing must be installed carefully over the stem after the bonnet, bellows assembly and bellows housing have been reassembled.

2 Inspection and Replacement of Parts

- a Clean the stem (6) and polish it with crocus cloth.

- b Clean all gasketed surfaces.

- c Inspect the stem, the stem threads and the packing box wall for sharp protrusions that could damage the packing. Check the seat rings, the interior of the bonnet (3) and the bellows housing (9), the bellows assembly (6), the torque adapter (7) and torque bushing (8), the plug (10) and the packing nut (1) for wear or damage. Repair or replace the damaged parts as needed. Use a medium compatible thread lubricant when replacing seat rings.

- d To replace a torque adapter (7) or a plug (10), drive the pin (11) from the assembly and unscrew the adapter from the plug.

- e Replace the damaged parts and screw the torque adapter into the plug as far as it will go.

- f Drill the adapter/plug assembly and pin it.

3 Plug and Seat Ring Lapping (optional)

In order to lap a plug and seat ring in a bellows bonnet valve, use the following procedure:

- a Make a valve stem from bar stock, threading it on both ends to accept the plug on one end and the jam nuts on the other end. The stem must be as long as the combined lengths of the bellows assembly stem (6) and the torque adapter (7).

- b Screw the fabricated valve stem firmly into the plug.

- c Follow the plug and seat ring lapping procedure in Section III,F,4.

4 Plug and Seat Ring Remachining (optional)

- a Use the valve stem from the above procedure.
- b Follow the plug and seat ring remachining procedure in Section III,F,5.

5 Reassembly

CAUTION

Do not allow the plug to turn when in contact with the seat ring. It could damage the plug/seat ring contact surfaces.

Install new valve and bellows unit gaskets during reassembly. Steps in this procedure apply to both mixing and diverting valves of all sizes unless otherwise stated at the beginning of a step.

The torque adapter and the torque bushing prevent any

twisting motion that might be caused by the pipeline flow from being transmitted to the bellows attachment point on the bellows flange. Any rotating torque applied to the bellows could tear it from the bellows flange.

- a Place a gasket in the flange recess on top of the bellows housing (9)
- b Insert the bellows assembly (6) into the housing
- c Three-Way Diverting Valves, 2" to 10"
 - 1) Insert the upper plug/torque adapter assembly into the top of the valve body
 - 2) Install a new O-ring in the lower plug (A19) and apply medium compatible lubricant
 - 3) Insert the lower plug into the bottom of the valve and slide it over the plug stem
 - 4) Screw the nut (A20) on the plug stem to retain the lower plug
 - 5) Install the cotter pin (A21) in the nut/plug stem
- d Three-Way Diverting Valves, 1/2" to 1-1/2" and Three-Way Mixing Valves, 1/2" to 12" Insert the plug/torque adapter assembly into the valve body
- e Place a gasket on top of the valve body.
- f Lower the bellows unit onto the valve body. Slide the torque bushing (8) over the torque adapter (7) and insert the bellows stem into the torque adapter
- g Screw the bellows stem into the torque adapter until it bottoms out
- h Secure the bellows housing to the valve body. Tighten the nuts evenly using a crisscross pattern
- i Unscrew the bellows assembly (6) from the torque adapter (7) one complete turn. Free play is required in this connection to permit a slight rotating movement of the torque adapter within the torque bushing (8) without transmitting this torque up the bellows assembly to the bellows attachment point on the flange
- j Place a gasket on top of the bellows flange
- k Remove the stem jam nuts
- l Slide the bonnet (3) over the stem (6), lower it onto the bellows housing and finger-tighten the packing nut
- m Replace the housing to bonnet screws. Tighten them evenly with a wrench, using a crisscross pat-

tern

6 Bellows Leak Test

- a Secure gasketed blind flanges to the valve. One of the blind flanges must have an air line connector. If the valve has threaded ends, apply a medium compatible thread sealant to the pipe threads and screw a pipe plug into two ends of the valve and a reducing bushing with an air line connector into the other end
- b Remove any attachment to the bonnet (3) tap
- c Attach an air line to the air connector on the valve
- d Apply a sufficient amount of soap solution to the bonnet tap to maintain a film across the opening

CAUTION

Do not exceed the pressure rating of the bellows unit or the valve body, whichever is lower

- e. Pressurize the valve to pipeline operating pressure and observe the soap film across the bonnet tap for signs of a bellows leak. Move the valve stem up and down to flex the bellows while continuing to hold operating pressure. If a leak is detected, change the bellows assembly and repeat the test procedure
- f Remove the air line and the end connections from the valve

7 Repacking

- a Remove the packing nut and the old packing and install the correct type and number of new packing components. If V-Ring packing is used, make sure that it is installed in the correct position for the type of service in your pipeline (pressure or vacuum). See Section 4F9, Figure 2 for the proper installation position of V-Ring packing
- b Slide the packing components one at a time carefully over the valve stem and into the packing box. Push the packing components to the bottom of the packing box one at a time with a piece of plastic pipe slightly smaller than the OD of the packing. Be careful when installing PTFE V-Ring packing so as not to damage the inner or outer edges. If the edges are damaged, the packing may not seal
- c Screw the packing nut (1) into the packing box finger-tight

G. Remounting Actuator on Valve

See actuator section

H. Reinstalling Valve/Actuator Assembly

WARNING

Wear proper protective clothing, gloves and goggles to prevent contact with pipeline medium

Clean all valve/pipe mating surfaces before reinstalling valve in pipeline

1 Installation Position

- Make sure that the centerline of the valve body coincides with the centerline of the pipeline
- Install the valve/actuator assembly in a vertical position with the actuator above the valve
- Install the valve in the pipeline with the arrow on the valve body pointing in the same direction as flow direction of the pipeline medium.

2 Threaded End Installation

Use a thread sealant that is compatible with the pipeline medium. Apply sealant to male pipe threads only. Do not apply sealant to the first few threads on a pipe.

Flanged End Installation

CAUTION

Deviation from any of the following requirements could result in flange breakage and/or valve leakage

- Gasket dimensions for steel and alloy flanges are in accordance with ANSI B16.5 with the exception of ring-joint gaskets. Dimensions for this type of gasket are in accordance with ANSI B16.20, Ring-Joint Gaskets and Grooves for Steel Pipe Flanges
- Joints (of any material) using low strength carbon steel bolts shall not be used above 400°F (200°C) or below -20°F (-29°C) (ANSI B16.5). Bolt and nut data for cast iron flanges is in ANSI B16.1. Bolt and nut data for steel and alloy flanges is in ANSI B16.5
- When installing a flanged valve in a pipeline, do not use the flange bolts to draw the pipeline flanges into contact with the valve flanges. Make sure that one end of the piping is free to move easily toward the valve. Properly support the piping so the valve flanges are not stressed. When installing the flange bolts, use a crisscross pattern and tighten each bolt gradually.

4 Actuator Lines

- Connect all lines to the actuator and its control system
- Check for air leaks at all connections

I. Deciphering the Data Plate

- Exploded View of Three-Way Mixing Valve, 1/2" to 12" and Three-Way Diverting Valve, 1/2" to 1-1/2"
- Exploded View of Three-Way Diverting Valve, 2" to 10"

5 SPECIFICATIONS

The valve specifications are noted on the actuator Data Plate (illustrated below) that is mounted on the actuator. The information included on the Data Plate is explained below. Information that is not included on the Data Plate can be obtained by writing or calling your local Leslie/K&M representative and giving us the Valve No. (C) from the second line on the Data Plate.

A Code

Example GTW DL - 40 - D - C - B4

1 2 3 4 5 6

CODE	A	
NO	B	VALVE NO C
TAG NO	D	
CUST P O NO	E	
ACTUATOR RATING	F	PSI
SIGNAL	H	BENCH SET
<input type="radio"/> DIAPHRAGM PRESS	G	<input type="radio"/> PLUG
RATING	J	MAX TEMP. Q
BODY DESCR	M	PLUG N
TRIM MAT'L	P	GUIDE L
TRIM SIZE O	STROKE K	C _v R

1 GTW = Globe Three-Way Valve

Note: Items 2 to 6 are actuator specifications. See actuator section.

- B W/O - Factory originated work order number
- C Valve No. - Leslie identification number that gives access to the computer parts list for each valve/actuator assembly
- D Tag No. - Customer originated identification number
- E Cust. P.O. No. - Customer's purchase order number
- Note: Items F to L are actuator specifications. See

actuator section

- J Rating - ANSI class designation of the valve
- K Stroke - Maximum plug travel in a properly adjusted valve
- L Guide - None
- M Body Descr - Indicates valve size and body material

Valve Size indicated in inches by a full number or fraction or combination thereof

Body Material - CARB STL = Carbon Steel, 316 SST = 316 Stainless Steel
- N Plug - Indicates the valve function

MX = Mixing valve, DV = Diverting valve
- O Trim Size - Size of the trim indicated in inches by a full number or fraction or combination thereof Trim is always full size
- P Trim Matl - Plug and Seat ring material 316 SST = 316 Stainless Steel, /Stell = Stellite Overlay
- Q Max Temp - Maximum operating temperature of the valve
- R Cv - Flow Coefficient.

TROUBLESHOOTING

Listed below are some of the problems encountered in operating precision control valves along with their possible causes. See the valve and actuator maintenance sections (III F, beginning on page 14) for instructions on repairing or replacing parts. Refer to your positioner maintenance manual for positioner problems.

If...	Then...
There is excessive flow through the valve when it is closed	<p>Check the reverse action actuator for a broken, weak or improperly adjusted spring</p> <p>Air pressure is too low on the direct action actuator</p> <p>Check the diaphragm, control line or instrument for an air leak on the direct action actuator</p> <p>Check for improper adjustment of the positioner</p> <p>Check the plug and seat ring for wear</p> <p>Check for a bent valve stem</p> <p>Look for any foreign matter in the valve interrupting the plug seating</p> <p>Check the adjustment of the actuator/valve stem gap</p>
There is insufficient downstream flow of the valve when open	<p>Check for a weak, broken or improperly adjusted spring in a direct action actuator</p> <p>Check for air leaks in the diaphragm, O-ring, control line or instrument on the reverse action actuator</p> <p>Check for improper adjustment of the positioner</p> <p>Check for foreign matter caught in the valve</p> <p>Check for insufficient air pressure on a reverse action actuator.</p> <p>Check the vent cap on a reverse action actuator to see if its plugged</p> <p>Check the actuator/valve stem gap for improper adjustment</p>
Travel through the stem is jerky	<p>Check the stem packing. It may be too tight</p> <p>Check for low air pressure in the actuator</p> <p>Check the valve stem, it may be bent</p> <p>Check to confirm that the positioner and/or controller are properly calibrated</p>

If...	Then...
Travel through the stem is jerky (cont'd)	<p>The breather cap. in the reverse action actuator, may be plugged</p> <p>Check for too much grease in the lantern ring (used with lubricated packing)</p>
The actuator does not move to the Fail-Safe position upon loss of air pressure	<p>Verify that the air in the actuator is venting to the atmosphere in a reverse action actuator</p> <p>Check that the positioner is not faulty</p> <p>Check for spring failure</p> <p>Check the valve stem for damage</p> <p>Inspect the valve for any foreign matter</p> <p>Check that the stem packing is not too tight</p>
There exists high air consumption or leakage	<p>Check the O-rings or gaskets in a reverse action actuator for leakage</p> <p>Inspect the diaphragm case for leakage</p> <p>Confirm that the diaphragm is not ruptured</p> <p>Check for a leak in the air supply or instruments</p>
The actuator does not respond to signal change	<p>Check for spring failure</p> <p>Check for a ruptured diaphragm</p> <p>Check for loss of air pressure</p> <p>Verify that the positioner is not faulty</p> <p>Verify that the controller is not faulty</p> <p>Check for foreign matter caught in valve</p> <p>Confirm that the valve stem is not locked up from over-tightening of the packing</p> <p>Check that the breather cap is not plugged on a reverse action actuator</p> <p>Check for leakage of the O-rings in the reverse action actuator</p>
The valve is not controlling flow properly	<p>Check for changes in the flow and pressure conditions in the pipeline</p> <p>Check adjustment of the positioner</p>

If...	Then...
The valve is not controlling flow properly (cont'd)	<p>Check for positioner malfunction and/or incorrect cam selection</p> <p>Check for Improper sizing of valve or trim</p> <p>Confirm that the packing is not too tight</p>
The packing box is leaking	<p>Check the packing for signs of wear</p> <p>Verify that there is grease in the lantern ring (used with lubricated packing)</p> <p>Check that the packing nuts are not too loose</p> <p>Verify that the packing box wall or valve stem is not dirty</p> <p>Check for pits or scratches in the packing box wall</p> <p>Check for pits, scratches or wear in the valve stem</p>