

## Bottom-Outlet Plug Valve A-547PL Series

Installation, Operation & Maintenance (IOM) Manual

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# 1 Regulations and Safety Requirements

## 1.1 Regulations

Midland bottom-outlet plug valves are used in contact with a variety of products, many of which are hazardous materials and could cause serious injury or damage if mishandled. The acceptance and transportation of products are regulated by the DOT and AAR in the U.S.A., and in Canada by CTC and Transport Canada. Regulations of other governmental bodies must be complied with for stationary and mobile applications. All personnel should be familiar with and follow these regulations. Nothing in these instructions is intended to conflict with or supersede these regulations. The information in this document was gathered from knowledgeable sources. However, Midland Manufacturing Corporation makes no representations or guarantees about its accuracy or completeness, and assumes no liability for this information.

Specifications are subject to change without notice.

This valve should only be installed, operated and maintained by qualified personnel. Read all of these instructions carefully before proceeding.

Operation of the valve must conform to all applicable specifications from TC, AAR, DOT, CFR (Parts 173.31, 174.67, etc.) and other governmental bodies, along with the operating instructions of your company.

## 1.2 Safety Warnings and Precautions

Please carefully read each of the following warnings and cautions prior to performing any work.

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**WARNING: Toxic Hazard.** Always use extreme caution and proper equipment when involved with hazardous materials. To avoid exposure to toxic or hazardous materials, make sure the tank car is empty and clean, and that the work area is free of hazardous chemicals before removing or installing any valve.



- **Wear protective clothing and equipment suitable for withstanding the materials to which you may be exposed**
- **Position yourself on the upwind side of the valve when possible**
- **Work in a well-ventilated area**
- **Work with a partner who can help you in the event of an emergency**
- **Follow approved safety precautions for hazardous or toxic materials**
- **Obtain MSDS sheets for all the commodities used with the associated valve**



**NOTICE:** Consult gasket manufacturer and Midland Manufacturing for torque requirements as max torque may vary by valve model. Do not exceed 200 ft-lb.



**CAUTION:** Be sure the car is empty and clean, and that the work area is free of hazardous chemicals that may have been in the car, before removing a valve or installing a new one.

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**NOTICE:** Repair work is limited to cleaning and polishing. See Paragraph A3.11.1 of the Tank-Car Specifications.



**WARNING: Machining Not Allowed.** Machining, grinding, welding or other alterations to the valve seat or stem seat is not allowed per AAR M1002, Paragraph A3.11 of the Tank-Car Specifications.



**NOTICE:** To ensure best practice and consistency of your qualification procedure, O-rings, gaskets and wire seals should always be replaced.

Nuts, washers and studs must be closely inspected before re-use or replaced regularly.

Valve components such as the top guide, stem, retainer, body and spring must be thoroughly inspected.



**NOTICE:** Procedures may not cover all conditions encountered in the field. Therefore, it is the responsibility of the repair agency to obtain approval from Midland for inspection, evaluation, repair and maintenance procedures not covered herein.

Evaluation of critical component metal surfaces of the valves after cleaning, inspection and specialized testing performed by agencies other than the repair facility are the responsibility of the repair facility.

Where numerical tolerances cannot be provided, the disposition of the internal integrity and surface quality of parts is under the jurisdiction of the repair facility and dependent on its experience and judgment.



**NOTICE: Without consent from the valve manufacturer or car owner,** repair work is limited to cleaning and polishing. See AAR M1002, Paragraph A3.11.1 of the Tank-Car Specifications.



**WARNING: Machining Not Allowed. Without consent from the valve manufacturer or car owner,** machining, grinding, welding or other alterations to the valve seat or stem seat is not allowed per AAR M1002, Paragraph A3.11.1 of the Tank-Car Specifications.



**CAUTION: Safety Protection.** Wear appropriate safety glasses or face shield and protective clothing when conducting this procedure. Valve testing involves high-velocity air and water flow that can cause injury.



**CAUTION:** Do not use an extension or cheater on the valve handle. If it does not move freely, report this to the tank car supervisor. The tank may be pressurized, contain solidified product, or the valve may be jammed.



NOTICE

**NOTICE:** Routine Maintenance involves valve inspection and component replacement for valves in-service on tank cars in accordance to the car owner's standard maintenance program to ensure the valve performs the intended function without failure until the next qualification, or for the design life. Routine maintenance may be done with the valve installed on the rail car.

**NOTICE:** It is essential to establish a periodic retesting and preventive maintenance program for pressure relief valves. The DOT and AAR have set forth a retesting interval that should be considered the maximum length of time between tests. If your company's experience indicates that a shorter interval is advisable, a program with more frequent retesting should be implemented.

**NOTICE:** It is an AAR requirement (refer to D3.4) that new O-rings be installed when a valve is retested.



CAUTION

**CAUTION:** Do not permit the top guide to fly up. About 50 ft-lb of force is necessary to restrain the spring.



CAUTION

**CAUTION:** Do not scratch the O-ring groove, as a scratch could cause a leak path around the O-ring.



NOTICE

**NOTICE:** Emergency Response is the temporary remediation to a valve observed to be emitting product in an unintended manner. It is possible to replace O-rings on an internal style valve installed on a pressurized tank car. Since leak repair is a temporary measure, once the car is unloaded and pressure is relieved, the valve should be removed for complete inspection, repairs, and full qualification in accordance to the car owner's standard qualification and maintenance program. Leak repair is unscheduled maintenance and is not part of scheduled maintenance.

## 2 Introduction

The Midland A-547PL Series Modified Bottom Outlet Plug Valves are cavity free, corrosion-resistant devices designed for the containment of product in tank cars requiring superior product containment.

- High-quality steel construction with an optional integrated steam jacket
- Meets Level A protection per AAR
- Triple-seal design for exceptional sealing capabilities

### 2.1 Valve Features

Superior Construction & Features:

- 304 stainless steel wetted-parts
- Optional integrated steam jacket

Configuration Options:

- Integrated 304 stainless steel cap and chain
- Standard and specialty elastomers available

Safety & Performance:

- Spring-loaded plug ensures valve remains closed in the event of an accident
- Triple-seal design on plug provides exceptional redundant sealing
- Self-cleaning, cavity-free design prevents entrapment or isolation of media inside valve body

### 2.2 Valve Details

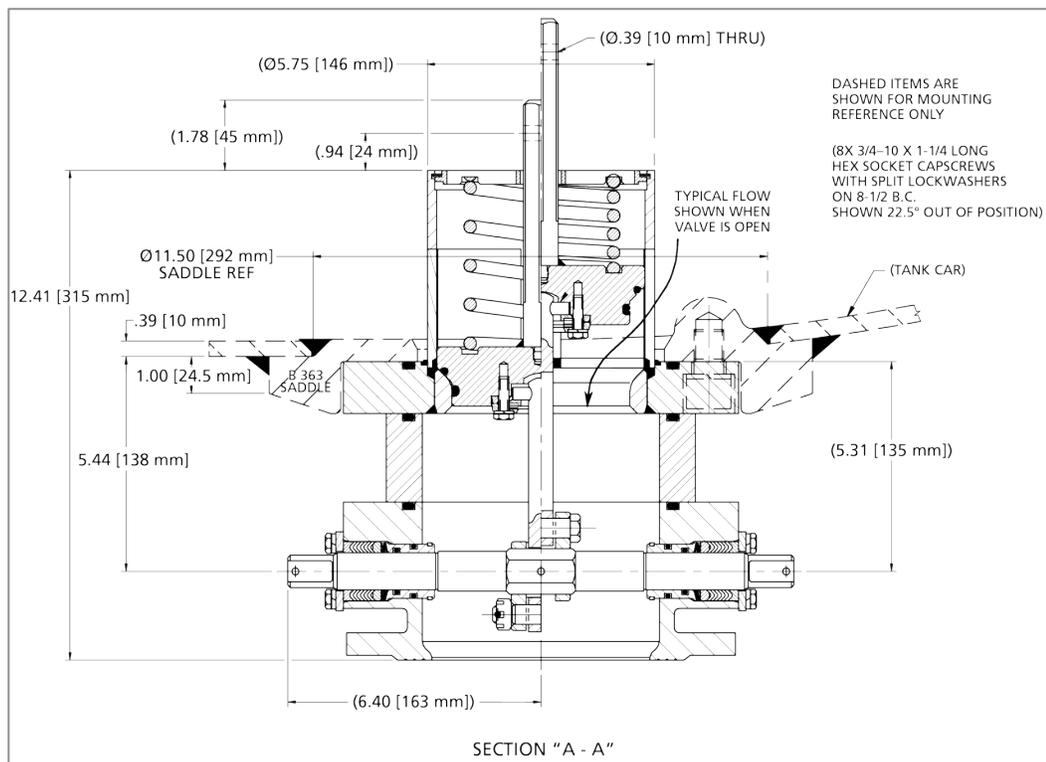


Figure 2-1 A-547PL Dimensions (Section A-A)

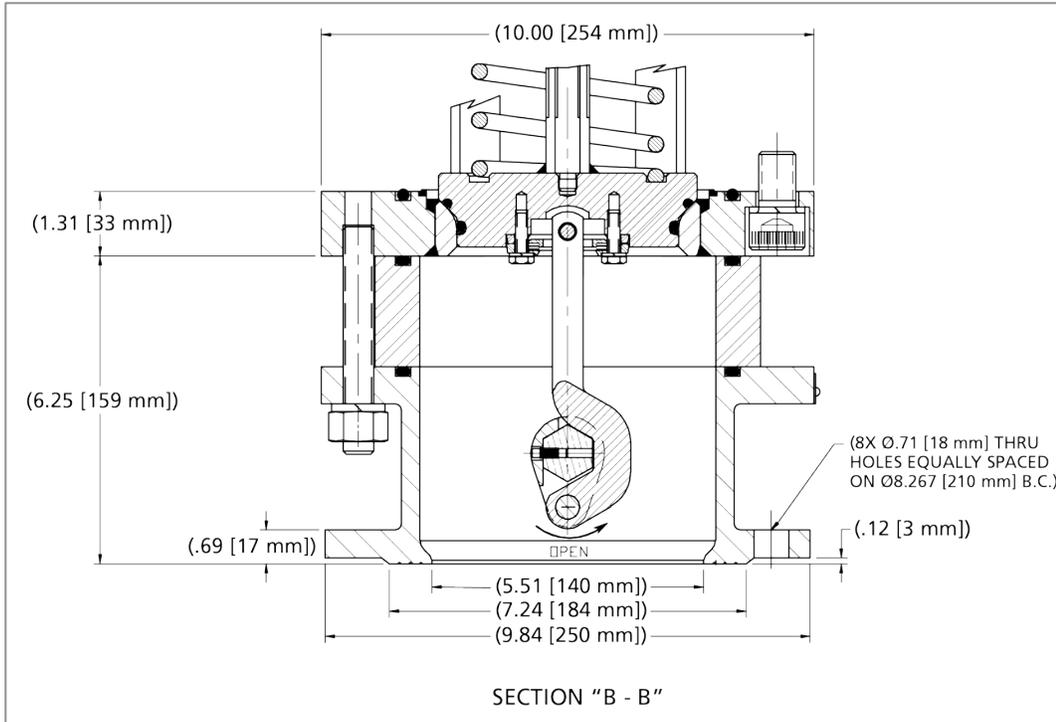


Figure 2-2 A-547PL Dimensions (Section B-B)

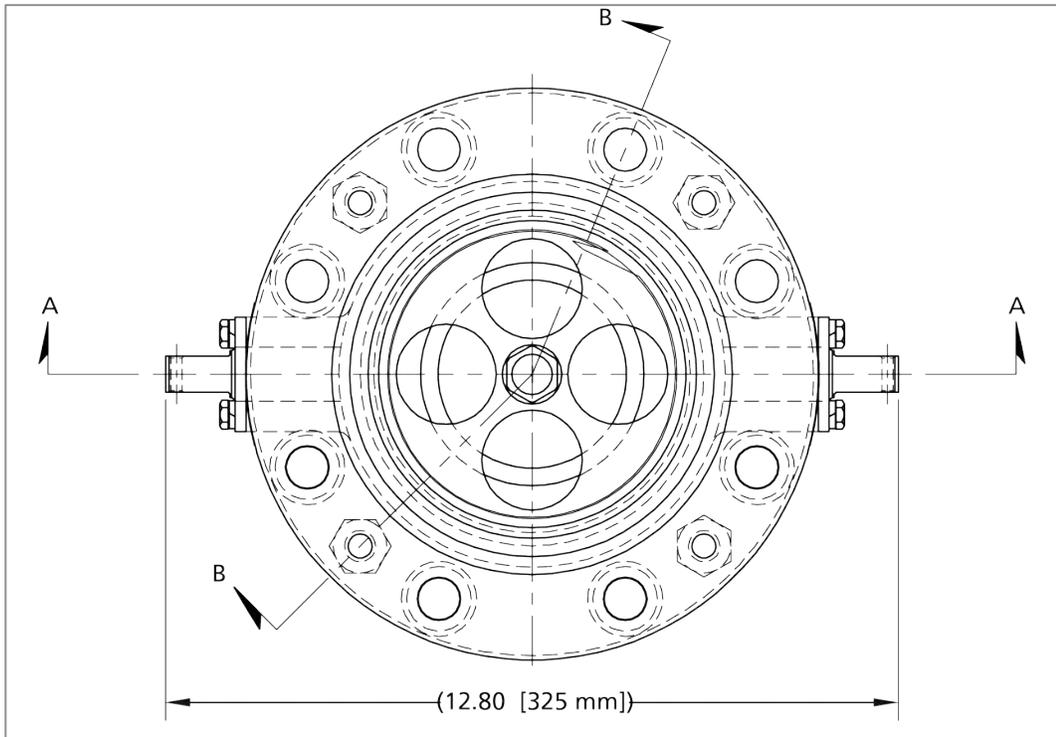


Figure 2-3 A-547PL Dimensions (Top View)

## 2.3 Component Identification and Parts Listings

ITEM	QTY.	PART NAME	A-547PL-02-MO-S01	
			MATERIAL	PART NO.
1	1	TOP GUIDE	STAINLESS STEEL	547PL-1-MO
2	1	SHAFT	STAINLESS STEEL	547PL-22-SS
3	1	PLUG ASSEMBLY	STAINLESS STEEL	547PL-3-MO
4	1	BODY	STAINLESS STEEL	549-4-SS <sup>2</sup>
5	1	SPRING	STAINLESS STEEL	545-5-MO
6	1	RETAINER COVER ASSEMBLY	STAINLESS STEEL	549-61-SS
7	-	-	-	-
8	2	PACKING FLANGE	STEEL, PLATED	549-8-CS
9	1	NAMEPLATE	STAINLESS STEEL	547PL-96-SS
10	1	SEAT O-RING	BUNA-N <sup>1</sup>	545-10-BN
11	1	BORE O-RING	BUNA-N <sup>1</sup>	545-11-BN
12	2	SAHFT O-RING	BUNA-N <sup>1</sup>	545-12-BN
13	2	BUSHING O-RING	BUNA-N <sup>1</sup>	545-13-BN
14	1	WIPER RING	PTFE	545-14-TF
15	1	CAM LEVER	STAINLESS STEEL	548-15-SS
16	1	CAM	STAINLESS STEEL	545-16-SS
17	1	CAM BOLT	NITRONIC 60	545-17-N60
18	2	RETAINER RING	STAINLESS STEEL	545-18-MO
19	-	-	-	-
20	2	PAKcing BUSHING	NITRONIC 60	545-20-N60
21	2	PACKING SET	PTFE	549-21-TF
22	2	PACKING SPRING	STAINLESS STEEL	549-22-SS
23	2	PACKING RING	PTFE	549-211-TF
24	1	RETAINER RING	STAINLESS STEEL	549-24-MO
25	8	PACKING BOLT/LOCKWASHER	STAINLESS STEEL	545-25-MO
26	4	RETAINER BOLT/LOCKWASHER	STAINLESS STEEL	545-26-MO
27	1	CAM STEM NUT	STAINLESS STEEL	724-20-SS
28	1	CAM STEM PIN	STAINLESS STEEL	545-28-MO
29	1	CAM PIN	STAINLESS STEEL	545-29-MO
30	-	-	-	-
31	1	BASE	STAINLESS STEEL	547PL-31-MO
32	4	STUD	STAINLESS STEEL	547PL-41-SS
33	3	BASE O-RING	BUNA-N <sup>1</sup>	547-33-BN
34	-	-	-	-
35	1	PIN	NITRONIC 60	549-35-N60
36	8	BODY BOLT	STEEL, PLATED	363-22-AS
37	8	LOCKWASHER	STEEL, PLATED	363-21-AS
38	4	LOCKWASHER	STAINLESS STEEL	566-322-SS
39	-	-	-	-
40	1	ADAPTER FLANGE	STAINLESS STEEL	547PL-40-SS
41	4	NUT	STAINLESS STEEL	566-321-SS

Table 2-1 Valve Components

### NOTES:

1. Alternative material available.
2. 549-4-MO bodies currently not available; 549-4-SS is a substitution.

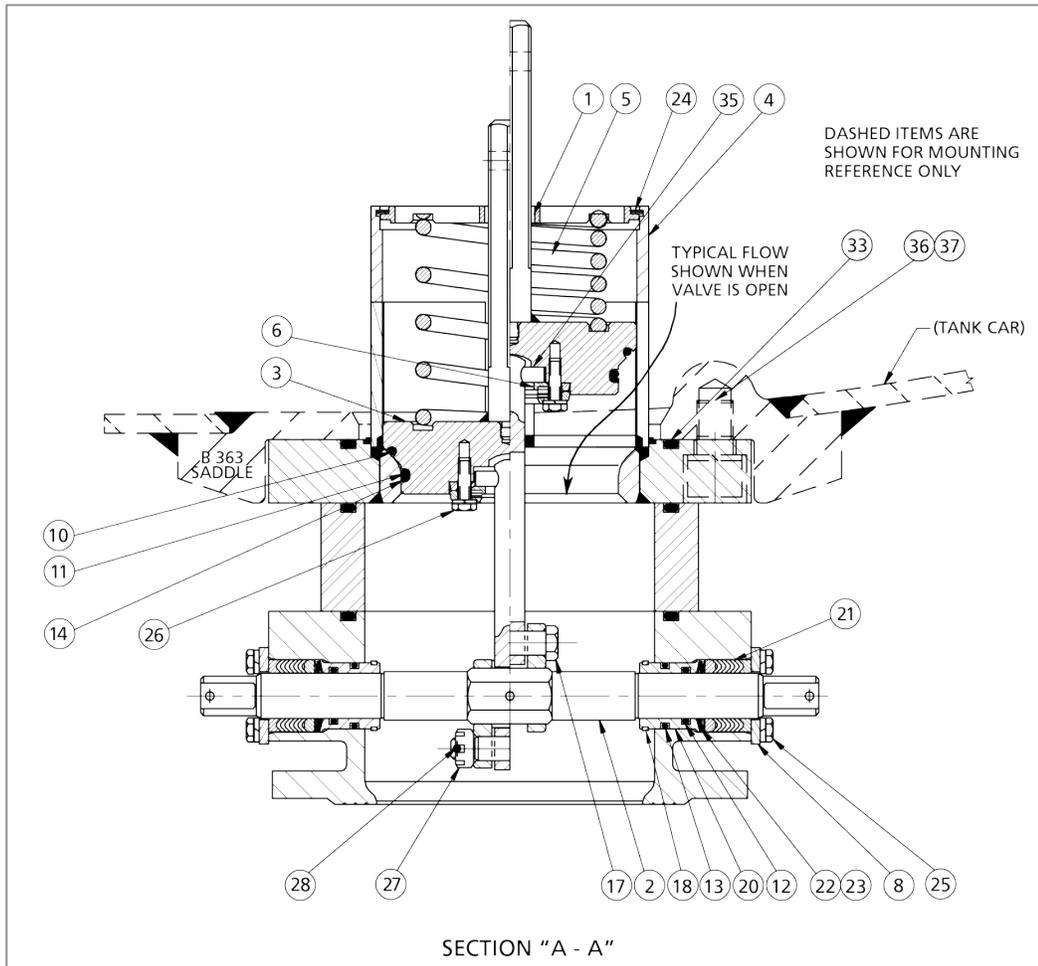


Figure 2-4 A-547PL Component Identification (Section A-A)

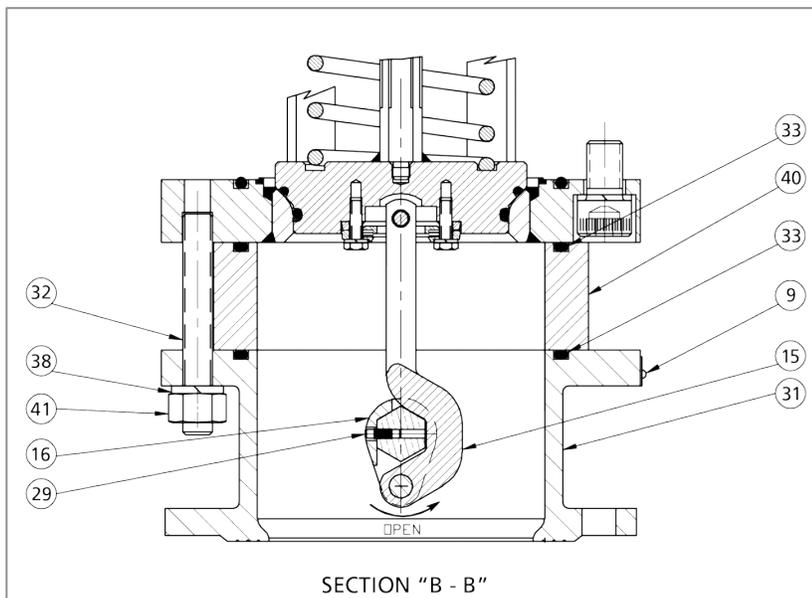


Figure 2-5 A-547PL Component Identification (Section B-B)

## 3 Operating Procedure

### 3.1 Opening the Valve

- 3.1.1 Conform with all applicable TC, AAR, and DOT regulations (Parts 173.31, 174.67, Pamphlet 34, etc.)



**CAUTION:** When loading or unloading, the vacuum relief valve's proper orientation must be verified, and the vent valve or manway cover opened to avoid either compressing air in loading, or drawing a vacuum when unloading.



**CAUTION:** Do not use an extension or cheater on the valve handle. If it does not move freely, report this to the tank car supervisor. The tank may be pressurized, contain solidified product, or the valve may be jammed.

- 3.1.2 For unloading, the valve handle must be secured in the open position. If it is not properly pinned open in the bracket, the handle will automatically swing toward the closed position.

### 3.2 Closing the Valve



**CAUTION:** Do not use an extension or cheater on the valve handle. If it does not move freely, report this to the tank car supervisor. The outlet may be filled with trapped incompressible liquid. Release liquid pressure prior to closing the valve.

- 3.2.1 Remove the pin from the bracket that keeps the handle in the open position. Rotate the handle to close. The handle must then be secured in the closed position with a pin and swivel that has a slot for a car seal, or by a lock, to prevent unauthorized opening later.

## 4 Valve Installation

Prior to installation, ensure that the valve remains clean and the gasket-sealing surfaces are not damaged.

### 4.1 Installation Procedure and Required Tools

SAE Wrench	Component(s)/Description
3/4" Wrench	Body Bolt (item 36)
Torque Wrenches (0 – 200 ft-lb)	
<b>Other Tools, Supplies, and Equipment:</b>	
Lint-free Cloth	Emery Paper (400 grit, cut in 1" strips)
Wire Brush	Lift or Jack

Table 4-1 Required Tools for Valve Assembly



NOTICE

**NOTICE:** Consult gasket manufacturer and Midland Manufacturing for torque requirements as max torque may vary by valve model. Do not exceed 200 ft-lb.



CAUTION

**CAUTION:** Be sure the car is empty and clean, and that the work area is free of hazardous chemicals that may have been in the car, before removing a valve or installing a new one.

- 4.1.1 Thoroughly clean the sealing surfaces on mounting saddle. Be sure there are no nicks, burrs, grit, paint, coatings, or any other residue on this surface. **Saddle sealing surfaces should be flat within 0.030 inches TIR.** This valve mounts to a Midland Saddle B-363 or equivalent.
- 4.1.2 Make sure base O-ring (item 33) is in the groove.
- 4.1.3 Align holes in base flange with 3/8" threaded holes in saddle. Make sure stem end is perpendicular to longitudinal axis of tank car.
- 4.1.4 Install bolts (item 36) and lock washers (item 37). Gradually apply torque in cross-pattern to 30 ft-lb.

## 4.2 Leak Inspection

4.2.1 Test all newly installed valves to conform to car-owner specifications. No leaks should be present.

### 4.2.2 Special Inspection Considerations

4.2.2.1 Previous procedures may not cover all conditions encountered in the field. Therefore, it is the responsibility of the repair agency to obtain approval from Midland for inspection, evaluation, repair and maintenance procedures not covered herein.

4.2.2.2 Facilities performing recommended dye-penetration and magnetic-particle testing must carry out such testing according to a qualified procedure conducted by certified trained personnel.

4.2.2.3 Evaluation of critical component metal surfaces of the valves after cleaning, inspection and specialized testing performed by agencies other than the repair facility are the responsibility of the repair facility.

4.2.2.4 Where numerical tolerances cannot be provided, the disposition of the internal integrity and surface quality of parts is under the jurisdiction of the repair facility and dependent on its experience and judgment.

## 5 Valve Qualification



**NOTICE:** To ensure best practice and consistency of your qualification procedure, O-rings, gaskets and wire seals should always be replaced.

Nuts, washers and studs must be closely inspected before re-use or replaced regularly.

Valve components such as the top guide, stem, retainer, body and spring must be thoroughly inspected.

### 5.1 Valve Disassembly and Required Tools

SAE Wrenches	Component(s)/Description	Item #
7/16" Socket Wrench	Retainer Bolts	26, 25
1" Wrench	Nuts	41
5/8" Wrench	Cam Bolt	17
<b>Other Tools, Supplies, and Equipment:</b>		
Hammer/Pin Pusher	Cam Assembly Pin	29
Flat-Head Screw Driver	Retainer Ring	18
Non-Scratching Tool to Remove O-Rings	O-Rings	12, 13

Table 5-1 Required Tools for Valve Disassembly



**NOTICE:** Valve disassembly should only be done by trained personnel with access to the proper machines, tools, procedures and personal-protective equipment (PPE).

### 5.2 Valve-Disassembly Procedure



**NOTICE:** Please note that following instructions are based on the A-547PL-02-XX valve model. Your specific valve model may vary from configuration shown; however, valve-disassembly procedure will be the similar.

5.2.1 Remove four retainer bolts (item 26) from retainer cover assembly with lockwashers (item 6).



**TIP:** Use a 7/16" wrench to remove retainer bolts (item 26).

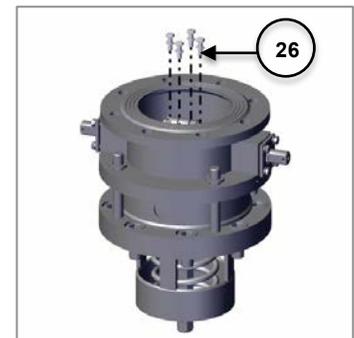


Figure 5-1 Remove Bolts

5.2.2 Remove four nuts (item 41) and lockwashers (item 38) from the body studs (item 32).



**TIP:** Use a 1" wrench to remove nuts (item 41).



Figure 5-2 Remove Nuts and Lockwashers

5.2.3 Remove base (item 31) and O-ring (item 33) and remove adapter flange (item 40) and O-ring (33). Remove O-rings.

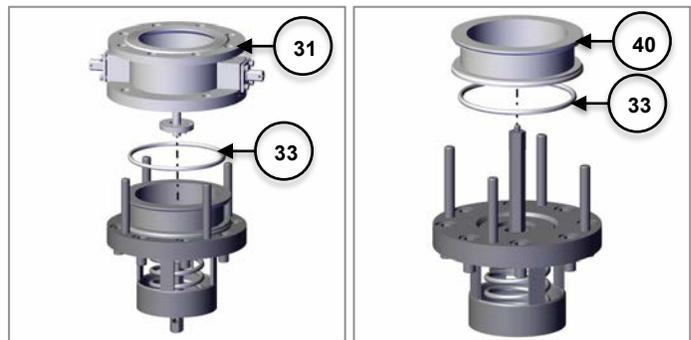


Figure 5-3 Remove Base, Adapter Flange and O-Rings

5.2.4 To start the top section of the valve disassembly, remove four studs (item 32) from the valve body (item 4).



Figure 5-4 Remove Studs

5.2.5 Place valve in fixture to compress the spring (item 5) and remove spring force from the top guide (item 1).

5.2.6 Remove top guide retainer ring (item 24) and top guide (item 1) from body (item 4).



**TIP:** Use a screw driver to pry retainer ring (item 24) loose.

5.2.7 Slowly release press until the spring (item 5) force is relaxed.

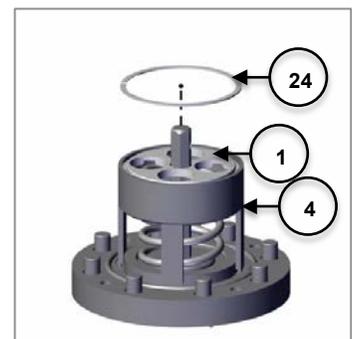


Figure 5-5 Remove Top Guide and Ring

5.2.8 Remove the top guide (item 1) and the spring (item 5) from the body (item 4).

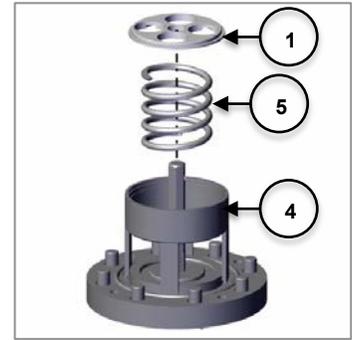


Figure 5-6 Remove Top Guide and Spring

5.2.9 To complete the top section of the valve disassembly, remove the plug assembly with O-rings and wiper (items 3, 10, 11 and 14) from the body (item 4) and remove the O-rings and wiper. (See Section 5.2.20 for disassembly of plug assembly.)

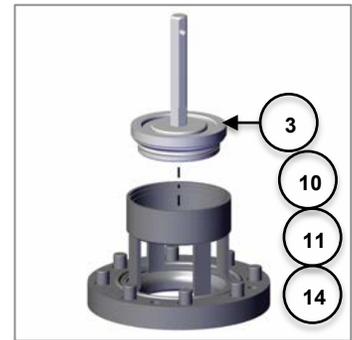


Figure 5-7 Remove Plug Assembly

5.2.10 To start bottom actuator disassembly, remove cam stem pin (item 28).

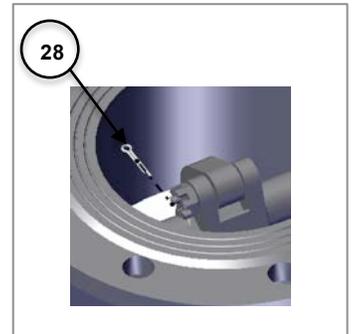


Figure 5-8 Remove Cam Bolt

5.2.11 Loosen the cam stem nut (item 27) and remove the nut and cam bolt (item 17).



**TIP:** Use two wrenches 7/16" and 5/8".

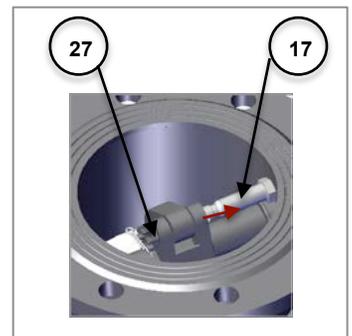


Figure 5-9 Remove Cam Stem Pin

5.2.12 Remove cam lever assembly (items 15 and 6) and remove the pin (item 35) to remove the retainer cover assembly (item 6) from the cam lever (item 15).

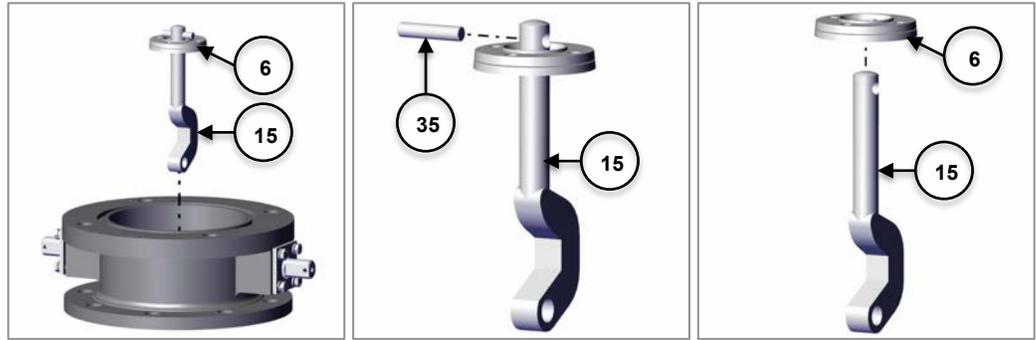


Figure 5-10 Remove Cam Lever, Pin and Retainer Cover Assembly

5.2.13 Rotate the shaft (item 2) to locate and remove the cam assembly pin (item 29).



**TIP:** Use a pin pusher and hammer to dislodge cam assembly pin (item 29).

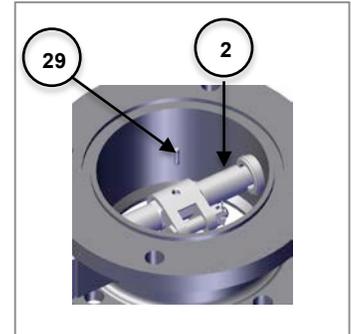


Figure 5-11 Remove Cam Assembly Pin

5.2.14 Remove the four packing bolts and lockwashers (item 25) from first side of the double-ended shaft assembly.



**TIP:** Use a 7/16" wrench to remove packing bolts (item 25).

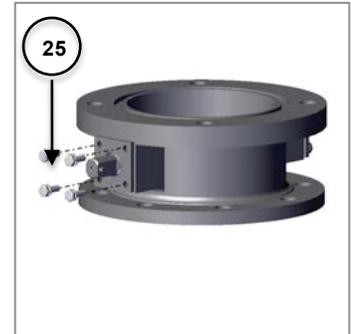


Figure 5-12 Remove Packing Bolts

5.2.15 Remove the packing flange (item 8) from the shaft (item 2).

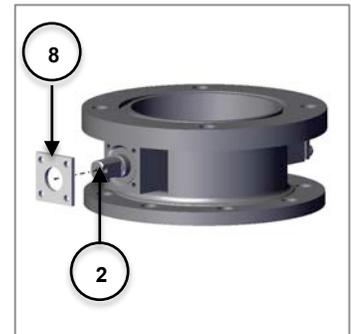


Figure 5-13 Remove Packing Flange

5.2.16 Remove the retainer ring (item 18) from the shaft (item 2).



**TIP:** Use a small flat-head screw driver to pry retainer ring (item 18) loose.

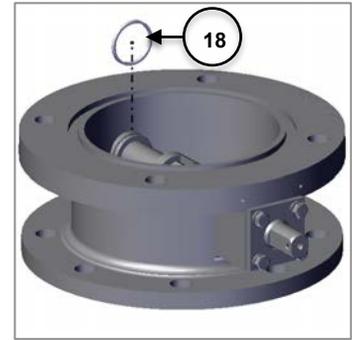


Figure 5-14 Remove Retainer Ring

5.2.17 Repeat steps 5.2.12 through 5.2.14 for the opposite end of the double-ended shaft assembly (item 2).

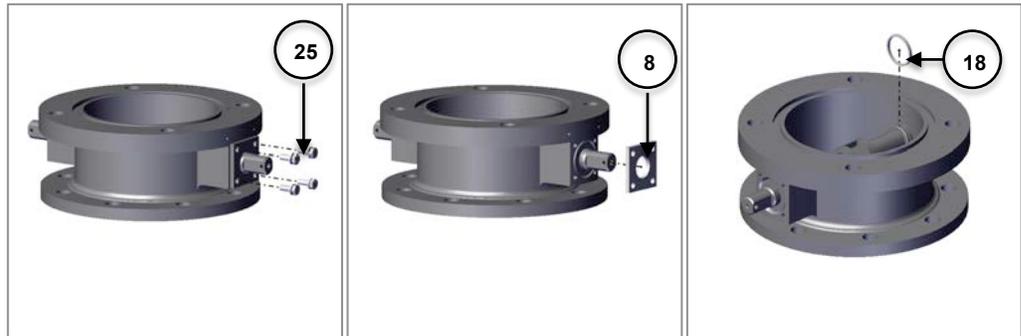


Figure 5-15 Remove Packing Bolts, Packing Flange and Retainer Ring

5.2.18 Pull the shaft assembly (item 2) from out of the base (item 31). In the same motion, remove the cam (item 16) from the back end of the shaft (item 2).



NOTICE

**NOTICE:** The opposite set of shaft packing components (items 22, 21, 20, 12 and 13) remain in the base for later disassembly.

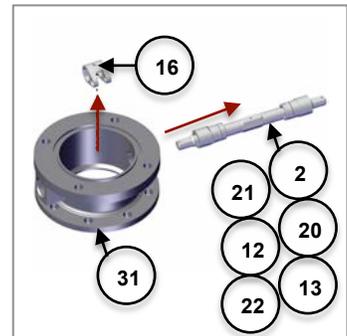


Figure 5-16 Remove Shaft Assembly

5.2.19 From the shaft (item 2), remove the packing set (item 21), packing ring (item 23) and packing spring (item 22).

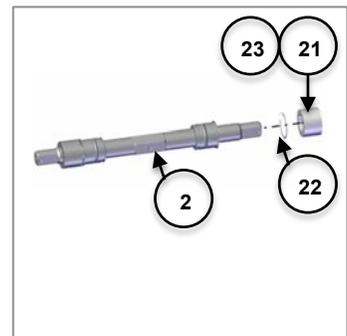


Figure 5-17 Remove Packing Set, Ring and Spring

5.2.20 From the shaft (item 2), remove the packing bushing (item 20) and O-rings (item 12 and 13).



**TIP:** Use non-scratching tool to remove O-rings.

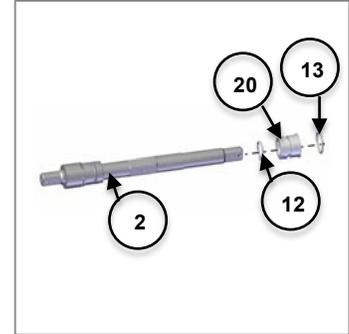


Figure 5-18 Remove Packing Bushing

5.2.21 From base, remove packing bushing and O-ring set (items 20, 12, and 13). Next, remove packing spring (item 21) and packing set (items 22 and 23).



Figure 5-19 Remove Packing Bushing and O-Rings, then Remove Packing Spring and Packing Set

5.2.22 From the plug assembly (item 3) with rings, remove the wiper ring (item 14), bore O-ring (item 11) and seat O-ring (item 10).



**TIP:** Use non-scratching tool to remove wiper ring and O-rings.

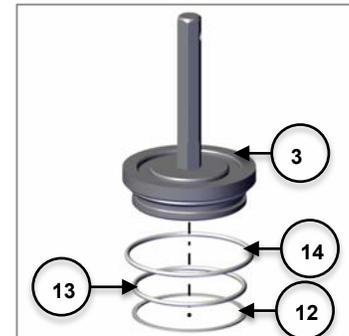


Figure 5-20 Remove Wiper Ring and O-Rings

### 5.3 Component Inspection

Key components must be thoroughly inspected during the qualification process. These components include the top guide, shaft, retainer, valve body, spring and plug assembly.

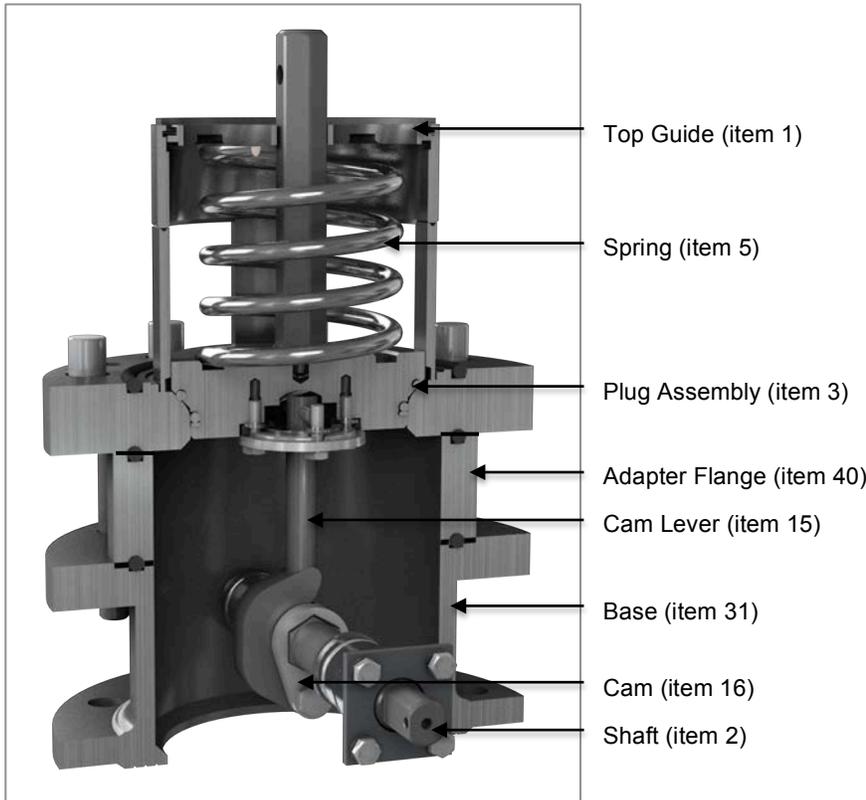


Figure 5-21 Component Inspection

Facilities performing recommended liquid dye-penetration and magnetic-particle testing must carry out such testing according to a qualified procedure conducted by certified trained personnel. In some instances, a component can be properly evaluated for damage or cracks only with the use of specialized techniques, such as liquid dye-penetration or magnetic-particle testing according to a qualified procedure by certified and trained personnel. Such testing is indicated within this document where mandatory.

O-Rings, gaskets and wire seals must always be replaced during this step.

**NOTICE:** Procedures may not cover all conditions encountered in the field. Therefore, it is the responsibility of the repair agency to obtain approval from Midland for inspection, evaluation, repair and maintenance procedures not covered herein.



Evaluation of critical component metal surfaces of the valves after cleaning, inspection and specialized testing performed by agencies other than the repair facility are the responsibility of the repair facility.

Where numerical tolerances cannot be provided, the disposition of the internal integrity and surface quality of parts is under the jurisdiction of the repair facility and dependent on its experience and judgment.



**NOTICE:** Without consent from the valve manufacturer or car owner, repair work is limited to cleaning and polishing. See AAR M1002, Paragraph A3.11.1 of the Tank-Car Specifications.



**WARNING: Machining Not Allowed.** Without consent from the valve manufacturer or car owner, machining, grinding, welding or other alterations to the valve seat or stem seat is not allowed per AAR M1002, Paragraph A3.11.1 of the Tank-Car Specifications.

### 5.3.1 Shaft Inspection

Visually inspect the shaft (item 2) paying close attention to two packing areas. The shaft should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

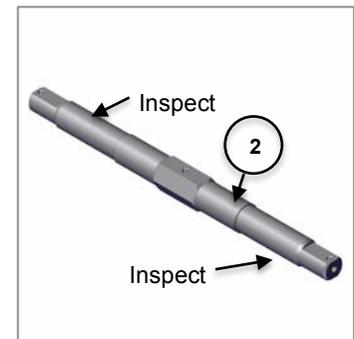


Figure 5-22 Inspect Shaft

### 5.3.2 Cam Lever Inspection

Visually inspect the cam lever (item 15). The cam lever should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

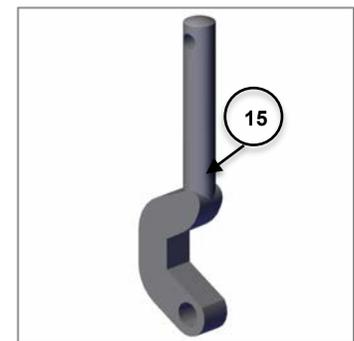


Figure 5-23 Inspect Cam Lever

### 5.3.3 Cam Inspection

Visually inspect the cam lever (item 16). The cam should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

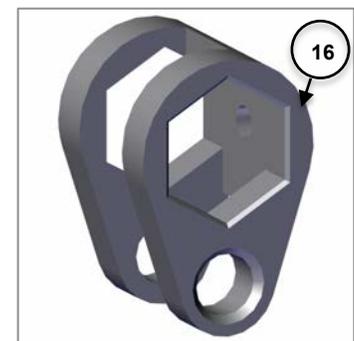


Figure 5-24 Inspect Cam

#### 5.3.4 Spring Inspection

Visually inspect the spring (item 5). The spring should be free of corrosion, nicks, dents, scratches and pits.

If any defects are found, the part is rejectable and should be replaced.

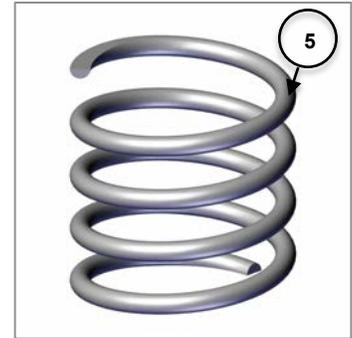


Figure 5-25 Inspect Spring

#### 5.3.5 Plug Assembly Inspection

Visually inspect the plug assembly (item 3) paying close attention to two O-ring grooves for bore and seat. The plug assembly should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

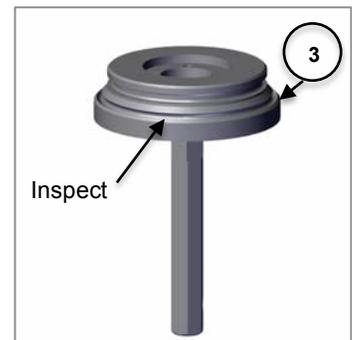


Figure 5-26 Inspect Plug Assembly

#### 5.3.6 Adapter Flange Inspection

Visually inspect the adapter flange (item 40) paying close attention to two O-ring grooves. The adapter flange should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

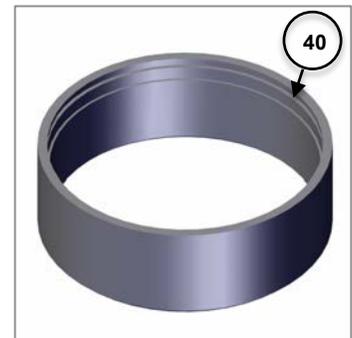


Figure 5-27 Inspect Adapter Flange

#### 5.3.7 Base Inspection

Visually inspect the base (item 31) paying close attention to two O-ring grooves. The base should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

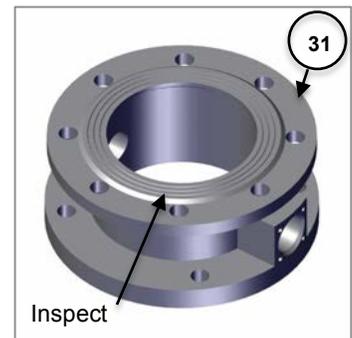


Figure 5-28 Inspect Base

### 5.3.8 Body Inspection

Visually inspect the body (item 4) paying close attention to two O-ring grooves and to the valve seating area. The body should be free of corrosion, nicks, dents, scratches and pits.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

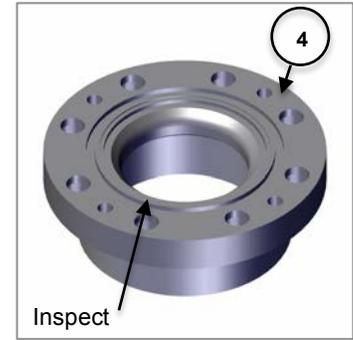


Figure 5-29 Inspect Body

### 5.3.9 Top Guide Inspection

Visually inspect the top guide (item 1). The top guide should be free of corrosion, nicks, dents, scratches and pits. Confirm that the interior area (where the plug assembly shaft passes) is unobstructed.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

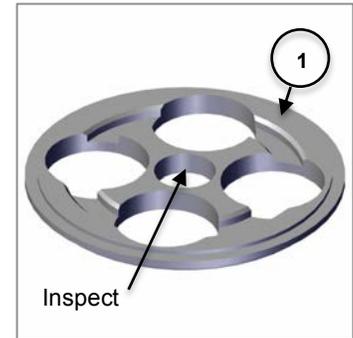


Figure 5-30 Inspect Top Guide

### 5.3.10 Packing Bushing Inspection

Visually inspect the packing bushing (item 20). The packing bushing should be free of corrosion, nicks, dents, scratches and pits. Ensure that there is no particulates or irregularities on interior surfaces.

Clean and inspect by sanding lightly with emery paper (400-grit). If this does not effectively clean the part, replace this part.

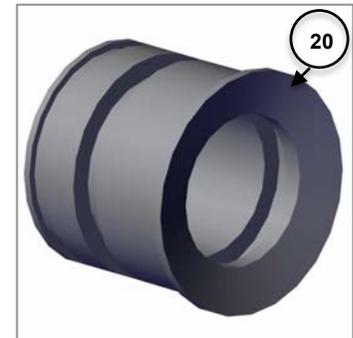


Figure 5-31 Inspect Packing Bushing

### 5.3.11 Threaded Components

All threaded components must be thoroughly inspected and cleaned, or replaced. Inspect threads for any sign of excessive wear, corrosion, pitting or other defects. If any are found, the part is rejected and should be replaced.

### 5.3.12 O-Ring and Gaskets Inspection

O-rings (items 10, 11, 12, 13, 33) and soft seals (items 21 and 23) must be replaced at the time of the periodic valve retest and when the valve is disassembled.



CAUTION

**CAUTION: O-ring Degradation.** O-rings develop micro-cracks, can swell or shrink, and become harder or softer with age and chemical exposure. An O-ring that fits loosely in the cap, or can only be pushed into the O-ring retainer with difficulty, is quite likely not the correct size. Many of Midland's O-rings are made on special molds to non-standard sizes and are obtainable only from Midland.

**CAUTION: Defective Parts.** If any parts appear defective, it is recommended they be replaced, or consult with Midland for recommended repair techniques when applicable.

### 5.3.13 Special Inspection Considerations

Previous procedures may not cover all conditions encountered in the field. Therefore, it is the responsibility of the repair agency to obtain approval from Midland for inspection, evaluation, repair and maintenance procedures not covered herein.

Facilities performing recommended dye-penetration and magnetic-particle testing must carry out such testing according to a qualified procedure conducted by certified trained personnel.

Evaluation of critical-component metal surfaces of the valves after cleaning, inspection and specialized testing performed by agencies other than the repair facility are the responsibility of the repair facility.

Where numerical tolerances cannot be provided, the disposition of the integral integrity and surface quality of parts is under the jurisdiction of the repair facility and dependent on its experience and judgment.

## 5.4 Valve Reassembly and Required Tools

SAE Wrenches	Component(s)/Description	Item #
7/16" Socket Wrench	Retainer Bolts	26, 25
1" Wrench	Nuts	41
5/8" Wrench	Cam Bolt	17
<b>Other Tools, Supplies, and Equipment:</b>		
Hammer/Pin Pusher	Cam Assembly Pin	29
Flat-Head Screw Driver	Retainer Ring	18
Non-Scratching Tool to Remove O-Rings	O-Rings	12, 13

Table 5-2 Required Tools for Valve Reassembly

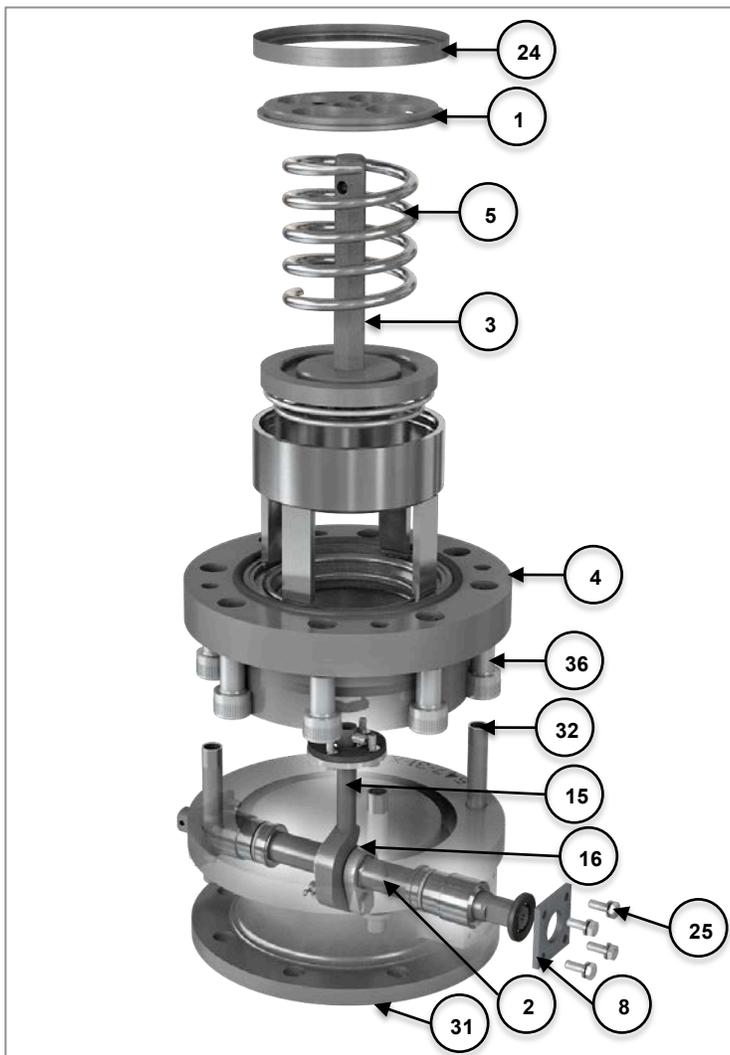


Figure 5-32 Valve Exploded View



**CAUTION: Mounting Interference. DO NOT** paint the sealing surfaces of the valve that will contact the manway's cover-plate surfaces or valve cracking may result.

5.4.1 Install the seat O-ring (item 10), the bore O-ring (item 11), and the wiper ring (item 14) onto the plug assembly (Item 3).

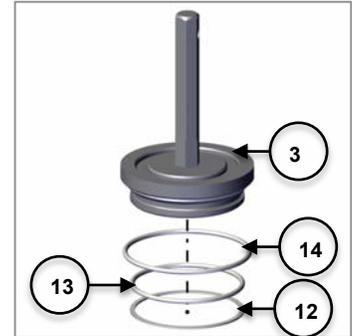


Figure 5-33 Install Wiper Ring and O-Rings

5.4.2 Install O-rings (items 12 and 13) onto the packing bushing (item 20). Repeat this step for second packing bushing assembly.

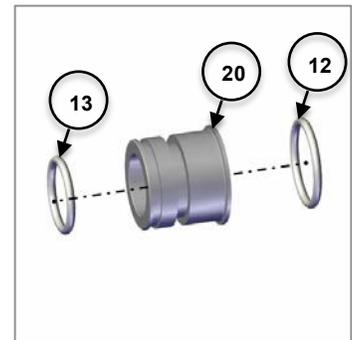


Figure 5-34 Install O-Rings

5.4.3 Into the base (item 31), install one packing bushing assembly (items 12, 13 and 20) into the base shaft opening. Then, install retaining ring (Item 18) to secure in place.

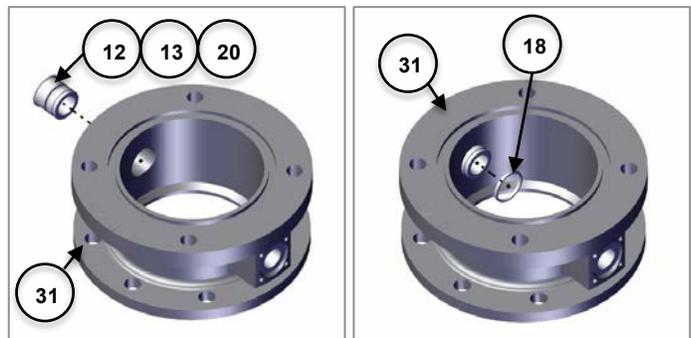


Figure 5-35 Install Packing Bushing Assembly and Retaining Ring

5.4.4 Into the shaft (item 2), install one packing bushing assembly (items 12, 13 and 20).

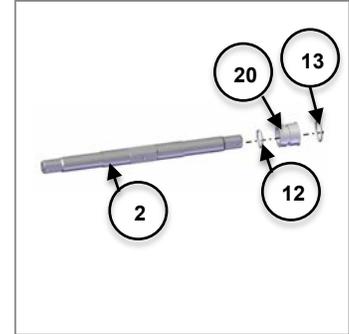


Figure 5-36 Install Packing Bushing

5.4.5 Insert the shaft assembly through the open end of the base, through the retaining ring (item 18) and the cam (item 16), and into the bushing assembly (items 12, 13 and 20) already installed in the opposite end of the base. Then, install retaining ring (item 18) to secure in place.

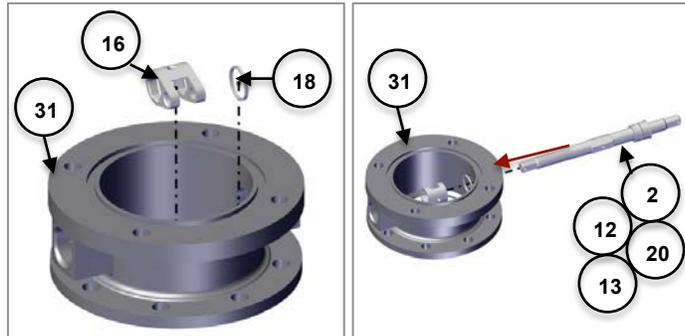


Figure 5-37 Install Shaft Assembly and Retaining Ring

5.4.6 In one end of the base (item 31), install the packing spring (item 22), packing set (item 21) and the packing ring (item 23).

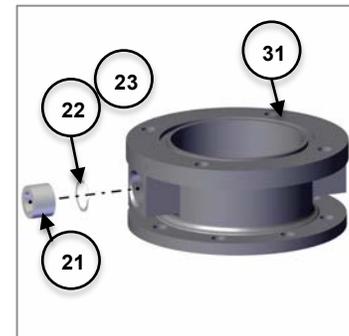


Figure 5-38 Install Packing Spring, Ring and Set

5.4.7 Attach the packing flange (item 8) using four (x4) packing bolts with lockwashers (item 25).



**TIP:** Use a 7/16" socket or wrench to tighten packing bolts (item 25).

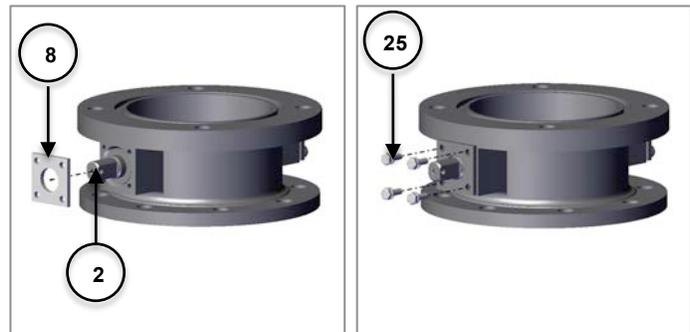


Figure 5-39 Install Packing Flange Using Packing Bolts

5.4.8 Repeat steps 5.4.7 and 5.4.8 for the other end of the shaft/base assembly.

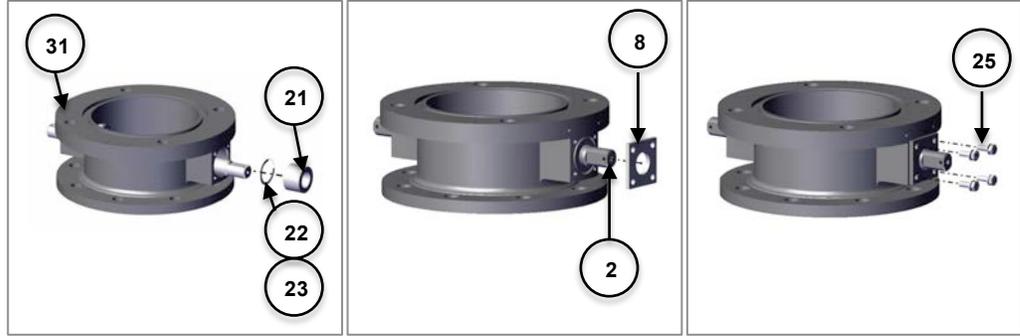


Figure 5-40 Install Packing Ring, Packing Set, Packing Flange and Packing Bolts

5.4.9 Rotate the shaft (item 2) to locate the hole in the cam (item 16) for the assembly pin (item 29). Affix the cam (item 16) to the shaft (item 2) by inserting the cam assembly pin (item 29).



**TIP:** Use a hammer to lightly tap pin (item 29) inward.

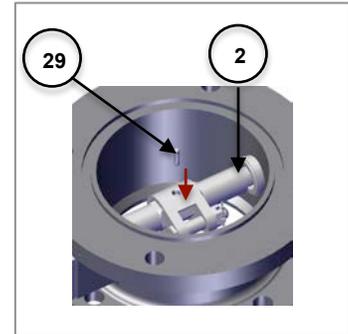


Figure 5-41 Install Cam Assembly Pin

5.4.10 Attach the cam lever (item 15) to the cam (item 16) with the cam bolt (item 17) and cam stem nut (item 27).



**TIP:** Use two wrenches 7/16" and 5/8".

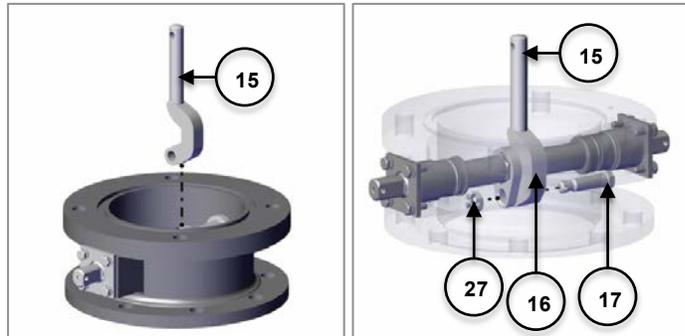


Figure 5-42 Attach Cam Lever Using Bolt and Stem Nut

5.4.11 Install the cam stem pin (item 28).

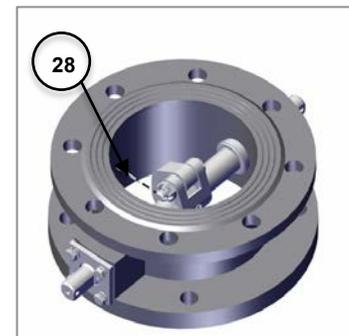


Figure 5-43 Install Cam Stem Pin

5.4.12 Install the base O-ring (item 33) onto the adaptor flange (item 40).

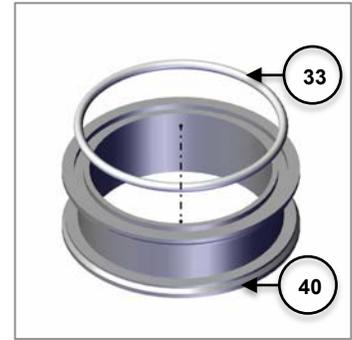


Figure 5-44 Install O-Ring on Adapter Flange and Place in Body

5.4.13 Put in-place the eight (x8) body bolts with lockwashers (Items 36 and 37) into the body (Item 4).

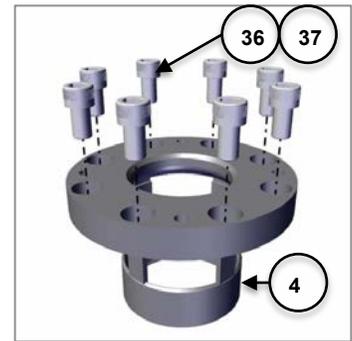


Figure 5-45 Place Bolts and Lockwashers into Body

5.4.14 Install the base O-ring (item 33) onto the base (item 31).

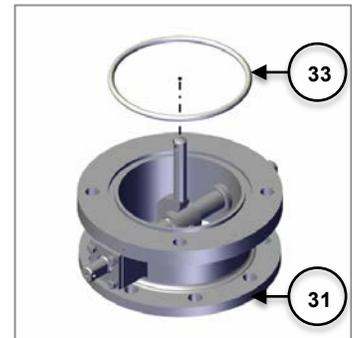


Figure 5-46 Install O-Ring onto Base

5.4.15 Install the four (x4) studs (item 32) onto the body (item 4).

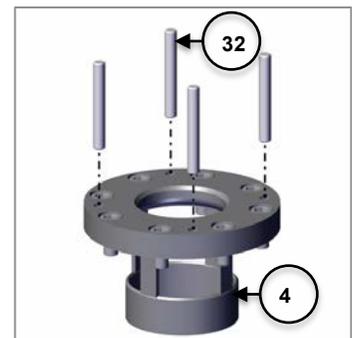


Figure 5-47 Install Studs on Body

5.4.16 Install base O-ring (Item 33) onto body/flange assembly.

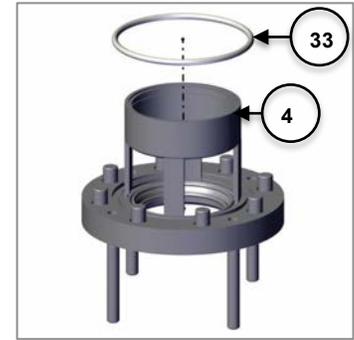


Figure 5-48 Install O-Ring onto Body

5.4.17 Secure the base/flange/body assembly together by first threading on and hand tightening the four (x4) nuts (item 41) with lockwashers (item 38).

5.4.18 Tighten the four (x4) nuts (item 41) in a cross-diagonal pattern.

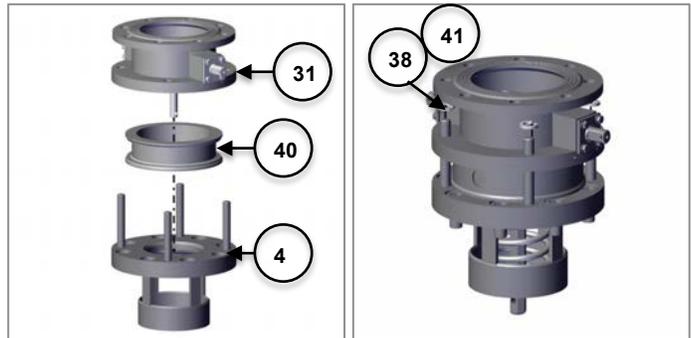


Figure 5-49 Secure Valve Assembly with Nuts and Lockwashers

5.4.19 Attach the retainer cover assembly (item 6) to the cam lever (item 15) with the pin (item 35).

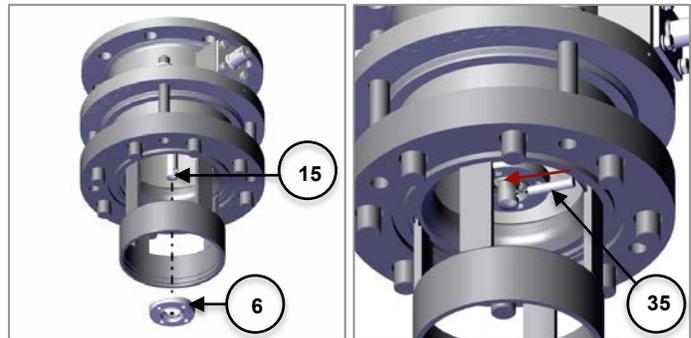


Figure 5-50 Attach Retainer Cover Assembly with Pin

5.4.20 Position the plug assembly (item 3) into the body (item 4) and attach the retainer cover assembly (item 6) using four (x4) retainer bolts (item 26).

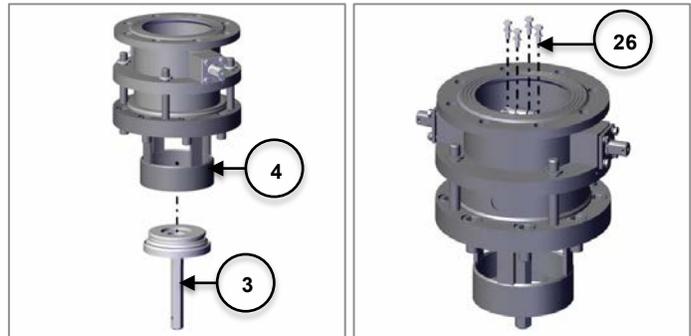


Figure 5-51 Place Plug Assembly and Attached Retainer Cover Assembly

5.4.21 Place the spring (item 5) in the body (item 4) on top of the plug assembly (item 3).

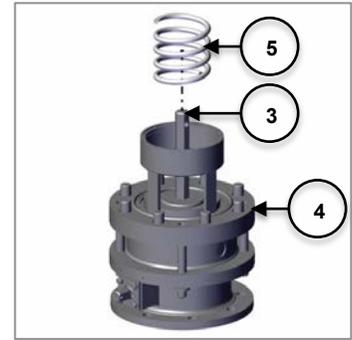


Figure 5-52 Install Spring

5.4.22 Install the top guide (item 1) on top of the spring and place assembly in a press to compress the spring and top guide.

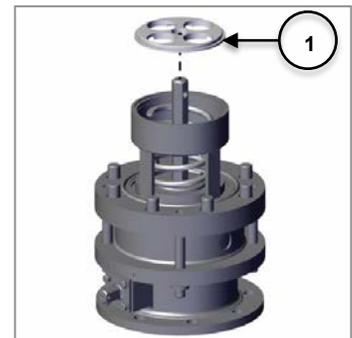


Figure 5-53 Install Top Guide

5.4.23 Secure the top guide (item 1) in the body (item 4) by installing the retainer ring (item 24).

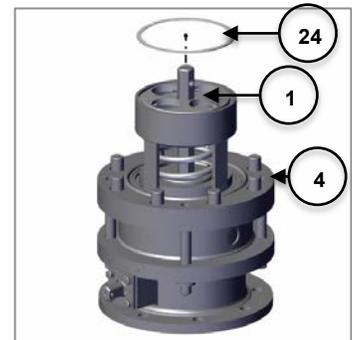


Figure 5-54 Install Retainer Ring

5.4.24 Attach a tag to the threaded rods/bolts that connect the base to the body with repair/test date, repair-facility identification, and technician I.D.

## 5.5 Testing Process



**CAUTION: Safety Protection.** Wear appropriate safety glasses or face shield and protective clothing when conducting this procedure. Valve testing involves high-velocity air and water flow that can cause injury.

### 5.5.1 Test Stand and Gauge Requirements

It is recommended that the test-stand mounting must be equivalent to the AAR M1002 figures E19.14 through E19.23 for the valve being tested. The pressure gauge must meet the requirements of D4.5 Test Gauge Standards and must be date-tagged.

5.5.1.1 Place assembled valve in a suitable test fixture that can secure the valve and pressure the “wet” side. In most cases, this means that the valve is upsidedown.

### 5.5.2 Hydrostatic Shell Test

5.5.2.1 Rotate the shaft of the valve so that the poppet moves down into the open position.

5.5.2.2 Fill the test fixture with water by pumping through the inlet valve on the side of the test fixture until it reaches the highest point (BOV outlet flange). Make sure that the interior is completely filled with liquid and that no air pockets have formed.

5.5.2.3 Install a blank test flange on the outlet.

5.5.2.4 Ensure that the exterior surface of the valve is completely dry and apply 220 psi pressure to the liquid in the body for two minutes. During this time, observe for any leakage or distortion.

5.5.2.5 Any leakage or deformation is cause for rejection.

5.5.2.6 Depressurize the test assembly.

### 5.5.3 Seat Seal Test

5.5.3.1 Remove blank test flange used in Section 5.5.2 Hydrostatic Shell Test.

5.5.3.2 Rotate the shaft so that the poppet moves up in the closed position. Seals should be seated at this point.

5.5.3.3 Fill the plug assembly with water until it fills up the cone and the water surface just covers the downstream seal.

5.5.3.4 Apply 160 psi air pressure to the inlet valve of the test fixture (located on the side) for two minutes. Apply leak detection fluid (such as Snoop) through the outlet of the valve and observe for any bubbles.

### 5.5.4 Procedure After Installation (On Car)

If your company has an approved test procedure, follow it. If it does not, these procedures provide essential guidelines in regard to pressure testing.

5.5.5 With the valve closed and the bottom cap in-place, pressurize the car to check for leaks between the flange/saddle and the upper flange of the valve.

5.5.6 Slightly back off the cap or the 2” pipe plug to see if any air was trapped. If air escapes, this would indicate there was a leak in the orifice area of the valve.

5.5.7 Tighten the bottom cap or pipe plug and open the valve. Inspect for leaks between the valve flange connection, between the upper and lower halves of the valves, the valve and valve cap and plug, and finally the packing gland on the side of the valve handle.

5.5.8 It may be necessary to loosen the valve cap slightly to relieve trapped liquid in order to fully close the valve since the valve cannot be closed when the bottom outlet leg is full of an incompressible liquid.

## 6 Routine Maintenance

**NOTICE:** Routine Maintenance involves valve inspection and component replacement for valves in-service on tank cars in accordance to the car owner's standard maintenance program to ensure the valve performs the intended function without failure until the next qualification, or for the design life. Routine maintenance may be done with the valve installed on the rail car.



**NOTICE:** It is essential to establish a periodic retesting and preventive maintenance program for pressure relief valves. The DOT and AAR have set forth a retesting interval that should be considered the maximum length of time between tests. If your company's experience indicates that a shorter interval is advisable, a program with more frequent retesting should be implemented.

**NOTICE:** It is an AAR requirement (refer to D4.04) that new O-rings be installed when a valve is retested.

### 6.1 Maintenance Procedure



**CAUTION:** Under no circumstances should the valve be operated unless the tank car is empty and the valve is free of product.

- 6.1.1 Verify that the four (4) 5/8" shear bolts (item 32) have not loosened. The split lock washers must be flat.
- 6.1.2 Inspect for evidence of leakage along the external flange surfaces and in the shaft packing gland area.
- 6.1.3 Check the threads and gasket of the outlet cap to verify that they are in good condition.
- 6.1.4 Inspect the threads and the flat surface of the valve that seals against the outlet cap gasket. They should be free of solidified product, nicks, or other impediments to a tight seal.

## 6.2 Shaft Packing Gland Leakage



NOTICE

**NOTICE:** It is necessary to remove the lower-half of the valve to repack the packing gland. Follow the procedure in 6.4 Leakage Through the Valve for steps 5.4.1 through 5.4.9.

- 6.2.1 Note the orientation of the valve handle. Mark the top or bottom side, since the handle is not symmetrical or reversible.
- 6.2.2 Tap out the handle pin (item 30) and remove the handle.
- 6.2.3 Unscrew the packing gland bolts.



CAUTION

**CAUTION:** In many of the older valves a compressed coil spring (item 25) is beneath the square packing flange (item 9). Newer valves have a wave spring and chevron V-ring packing in place of a coil spring and a one-piece tubular-shaped Teflon® packing.

- 6.2.4 Remove the square packing flange and the coil spring, if present.
- 6.2.5 Remove the retainer ring (item 18) from the packing bushing (item 20) groove and leave it on the hex surface of the shaft (item 2).
- 6.2.6 Use the shaft to press the packing bushing, packing, and washer out of the valve base (item 31).
- 6.2.7 If changing the packing from the old-style, one-piece to the chevron V-rings, it will be necessary to put a chamfer, or tapered lead-in, about 1/8" long by 15 degrees, in to the side hole in the base (item 31). This is done with a burr knife or a small rat-tail file. This is necessary to ensure the outside edges of the chevron V-rings do not get scraped by the sharp edge of the hole.
- 6.2.8 When renewing the O-rings and/or the packing, use an ample amount of grease to facilitate the reassembly.
- 6.2.9 Replace the parts in the reverse order. Then follow the previously described Section 3 Valve Installation.
- 6.2.10 After the reconnection of the lower section of the valve with the upper section, test it in accordance with Section 4 Valve Qualification.

