



Bottom-Outlet Plug Valve A-541

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 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.

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.



WARNING

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

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.



NOTICE

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.



CAUTION

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

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.

2 Introduction

The A-541 Series Modified Bottom Outlet Plug Valves are cavity-free, corrosion-resistant devices designed for the containment of vegetable oil, biodiesel and other commodities in tank cars requiring superior product containment. The valve style was modified to accommodate unique mounting requirements by splitting the body in half for a two-piece design. This enables the valve to be installed internally to the tank onto the existing mounting saddle.

2.1 Valve Features

Direct Replacement for ACF 1576

- No modification to existing mounting or coil arrangement on car
- Meets Level A protection per AAR

Superior Construction & Features

- 304 stainless steel wetted-parts
- Optional integrated steam jacket
- Two-piece construction enables internal installation to existing mounting studs

Configuration Options

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

Optimized for Vegetable Oil, Biodiesel and Asphalt Service

- DOT 111A100W1 cars
- AAR 211A100W1 cars

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

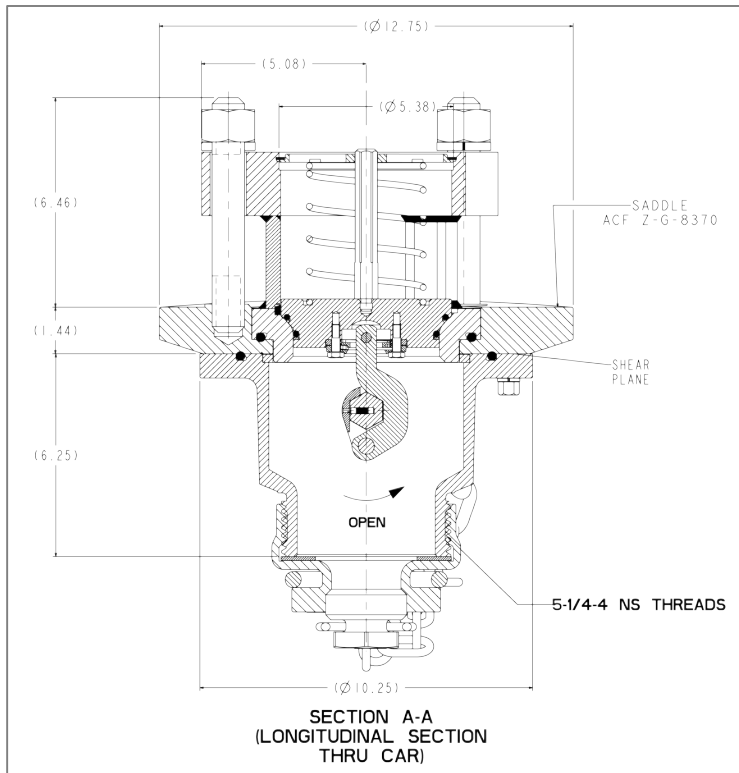


Figure 2-1 A-541-XS Dimensions (Section A-A)

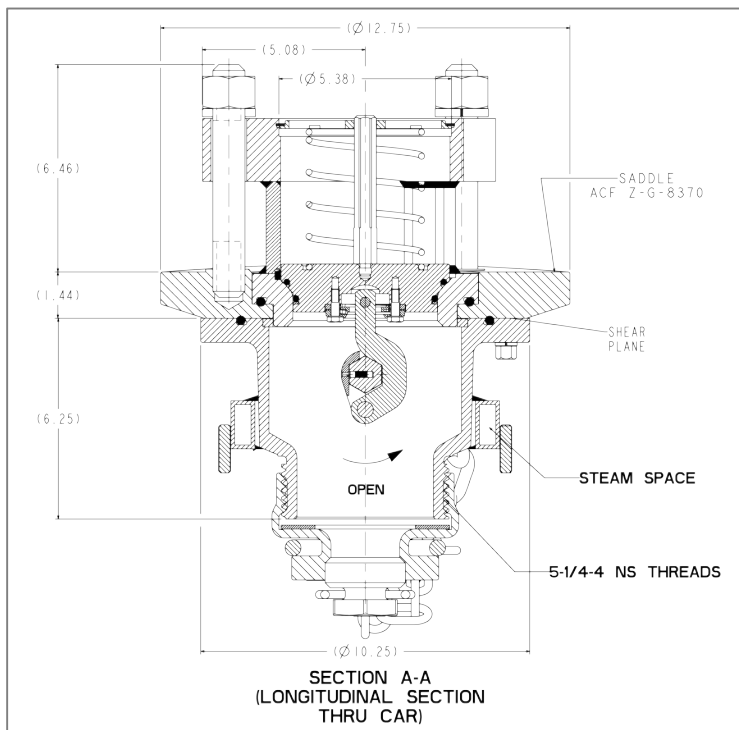


Figure 2-2 A-541-XS-SJ Dimensions (Section A-A)

2.3 Component Identification and Parts Listings

ITEM	QTY.	PART NAME	A-541-XS	
			MATERIAL	PART NO.
1	1	TOP GUIDE	STEEL	549-1-SS
2	1	SHAFT	STAINLESS STEEL	549-2-SS
3	1	RETAINER ASSEMBLY	STAINLESS STEEL	549-3-SS
4	1	BODY	STEEL/SS SEAT	541-400-XS
5	1	SPRING	STAINLESS STEEL	545-5-SS
6	1	RETAINER COVER ASSEMBLY	STAINLESS STEEL	549-61-SS
7	—	—	—	—
8	1	PACKING FLANGE	STEEL, PLATED	549-8-CS
9	1	NAMEPLATE	STAINLESS STEEL	541-91-SS
10	1	SEAT "O" RING	BUNA-N ¹	545-10-BN
11	1	BORE "O" RING	BUNA-N ¹	545-11-BN
12	1	SHAFT "O" RING	BUNA-N ¹	545-12-BN
13	1	BUSHING "O" RING	BUNA-N ¹	545-13-BN
14	1	WIPER RING	PTFE (TEFLON [®])	545-14-TF
15	1	CAM LEVER	STAINLESS STEEL	549-15-SS
16	1	CAM	STAINLESS STEEL	549-16-SS
17	1	CAM BOLT	STAINLESS STEEL	545-17-N60
18	1	RETAINER RING	STAINLESS STEEL	545-18-MO
19	1	SHAFT BUSHING	STAINLESS STEEL	545-19-N60
20	1	PACKING BUSHING	STAINLESS STEEL	545-20-N60
21	1	PACKING SET	PTFE (TEFLON [®])	549-21-TF
22	1	PACKING SPRING	STAINLESS STEEL	549-22-SS
23	1	INNER RING	STAINLESS	549-316-SS
24	1	RETAINER RING	STAINLESS STEEL	549-24-SS
25	4	PACKING BOLT	STAINLESS STEEL	545-251-MO
	4	PACKING LKW	STAINLESS STEEL	545-252-MO
26	4	RETAINER BOLT	STAINLESS STEEL	545-261-MO
	4	RETAINER LKW	STAINLESS STEEL	545-252-MO
27	1	CAM-STEM NUT	STEEL, PLATED	720-20-CS
28	1	CAM-STEM PIN	STAINLESS STEEL	545-28-SS
29	1	CAM PIN	STAINLESS STEEL	549-29-MO
30	—	—	—	—
31	1	BASE	DUCTILE IRON	549-315-D1
32	4	BASE BOLT	STEEL	541-32-CS
	4	BASE LKW	STEEL	15-17-CS
33	1	BODY "O" RING	BUNA-N ¹	549-330-BN
34	3	NUT	ALLOY STEEL	549-381-AS
35	1	PIN	STAINLESS STEEL	549-35-N60
36	1	CAP ASSEMBLY	DUCTILE IRON	55-D1
37	1	EYEBOLT, NUT, LKW	STEEL	549-37-CS
38	3	STUD	STEEL, PLATED	549-380-AS
39	1	BASE "O" RING	BUNA-N ¹	549-390-BN
40	3	LOCK WASHER	STAINLESS	549-382-SS
41-46	—	—	—	—
47	2	DRIVE SCREW	STAINLESS STEEL	763-11-SS
* NOTES: ALTERNATIVE MATERIAL AVAILABLE.				

Table 2-1 A-541-XS Valve Components

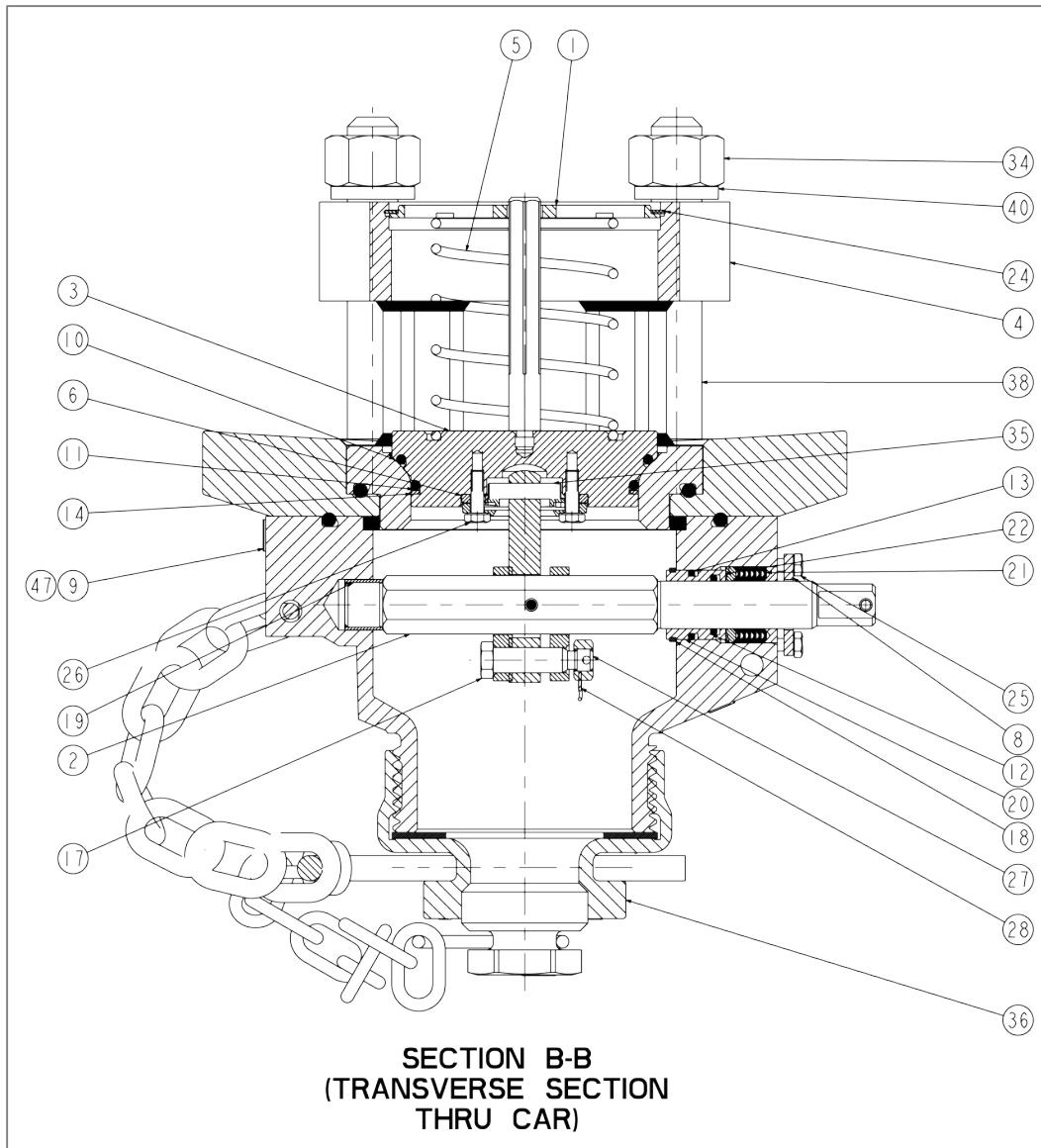


Figure 2-3 A-541-XS Component Identification (Section B-B)

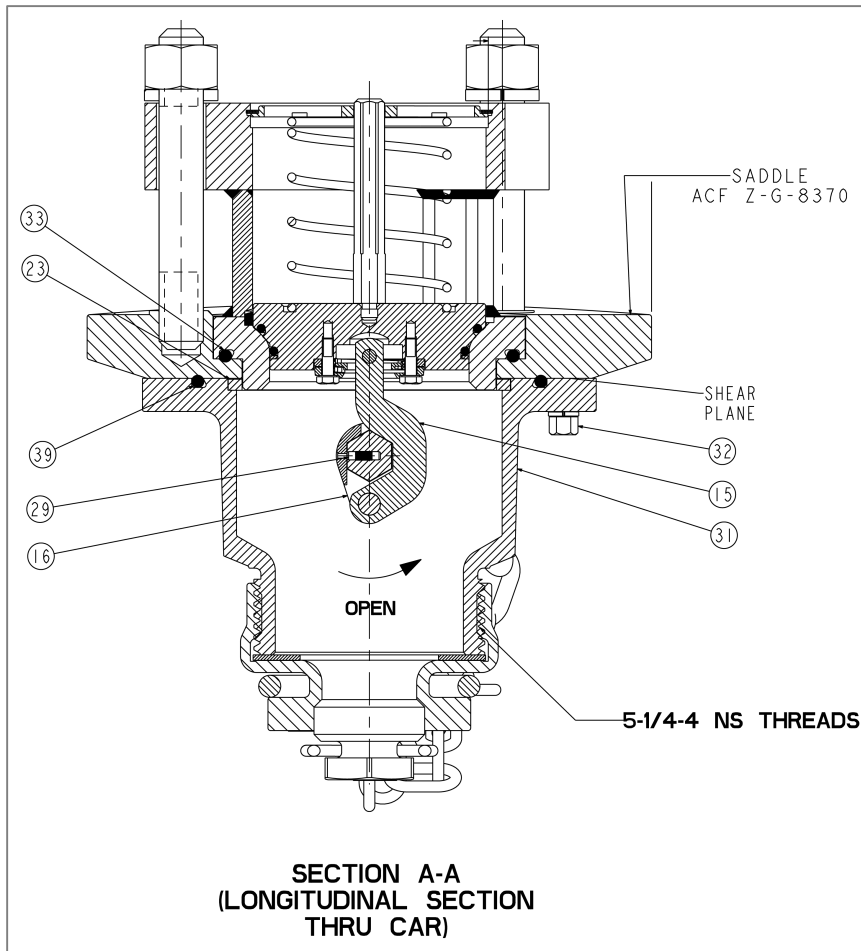


Figure 2-4 A-541-XS Component Identification (Section A-A)

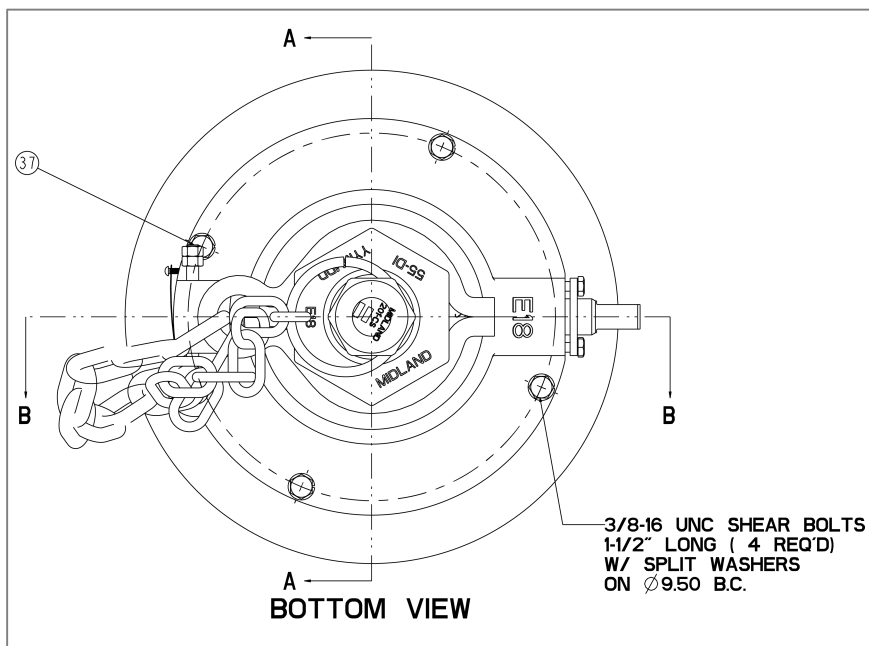


Figure 2-5 A-541-XS Component Identification (Bottom View)

ITEM	QTY.	PART NAME	A-541-XS-SJ	
			MATERIAL	PART NO.
1	1	TOP GUIDE	STEEL	549-1-SS
2	1	SHAFT	STAINLESS STEEL	549-2-SS
3	1	RETAINER ASSEMBLY	STAINLESS STEEL	549-3-SS
4	1	BODY	STEEL/SS SEAT	541-400-XS
5	1	SPRING	STAINLESS STEEL	545-5-SS
6	1	RETAINER COVER ASSEMBLY	STAINLESS STEEL	549-61-SS
7	—	—	—	—
8	1	PACKING FLANGE	STEEL, PLATED	549-8-CS
9	1	NAMEPLATE	STAINLESS STEEL	541-9-SS
10	1	SEAT "O" RING	BUNA-N ¹	545-10-BN
11	1	BORE "O" RING	BUNA-N ¹	545-11-BN
12	1	SHAFT "O" RING	BUNA-N ¹	545-12-BN
13	1	BUSHING "O" RING	BUNA-N ¹	545-13-BN
14	1	WIPER RING	PTFE (TEFLON [®])	545-14-TF
15	1	CAM LEVER	STAINLESS STEEL	549-15-SS
16	1	CAM	STAINLESS STEEL	549-16-SS
17	1	CAM BOLT	STAINLESS STEEL	545-17-N60
18	1	RETAINER RING	STAINLESS STEEL	545-18-MO
19	1	SHAFT BUSHING	STAINLESS STEEL	545-19-N60
20	1	PACKING BUSHING	STAINLESS STEEL	545-20-N60
21	1	PACKING SET	PTFE (TEFLON [®])	549-21-TF
22	1	PACKING SPRING	STAINLESS STEEL	549-22-SS
23	1	INNER RING	STAINLESS	549-316-SS
24	1	RETAINER RING	STAINLESS STEEL	549-24-SS
25	4	PACKING BOLT	STAINLESS STEEL	545-251-MO
	4	PACKING LKW	STAINLESS STEEL	545-252-MO
26	4	RETAINER BOLT	STAINLESS STEEL	545-261-MO
	4	RETAINER LKW	STAINLESS STEEL	545-252-MO
27	1	CAM-STEM NUT	STEEL, PLATED	720-20-CS
28	1	CAM-STEM PIN	STAINLESS STEEL	545-28-SS
29	1	CAM PIN	STAINLESS STEEL	549-29-MO
30	—	—	—	—
31	1	BASE	DUCTILE IRON	549-315-D1
32	4	BASE BOLT	STEEL	541-32-CS
	4	BASE LKW	STEEL	15-17-CS
33	1	BODY "O" RING	BUNA-N ¹	549-330-BN
34	3	NUT	ALLOY STEEL	549-381-AS
35	1	PIN	STAINLESS STEEL	549-35-N60
36	1	CAP ASSEMBLY	DUCTILE IRON	55-D1
37	1	EYEBOLT, NUT, LKW	STEEL	549-37-CS
38	3	STUD	STEEL, PLATED	549-380-AS
39	1	BASE "O" RING	BUNA-N ¹	549-390-BN
40	3	LOCK WASHER	STAINLESS	549-382-SS
41	1	STEAM JACKET	STEEL	549-50-CS
42	1	BOLT	STEEL	549-523-CS
43	—	—	—	—
44	8 oz	HEAT-TRANSFER CEMENT	CEMENT	549-51
45	2	WASHER	STEEL	549-524-CS
46	1	NUT	STEEL	549-525-CS
47	2	DRIVE SCREW	STAINLESS STEEL	763-11-SS
* NOTES: ALTERNATIVE MATERIAL AVAILABLE.				

Table 2-2 A-541-XS-SJ Valve Components

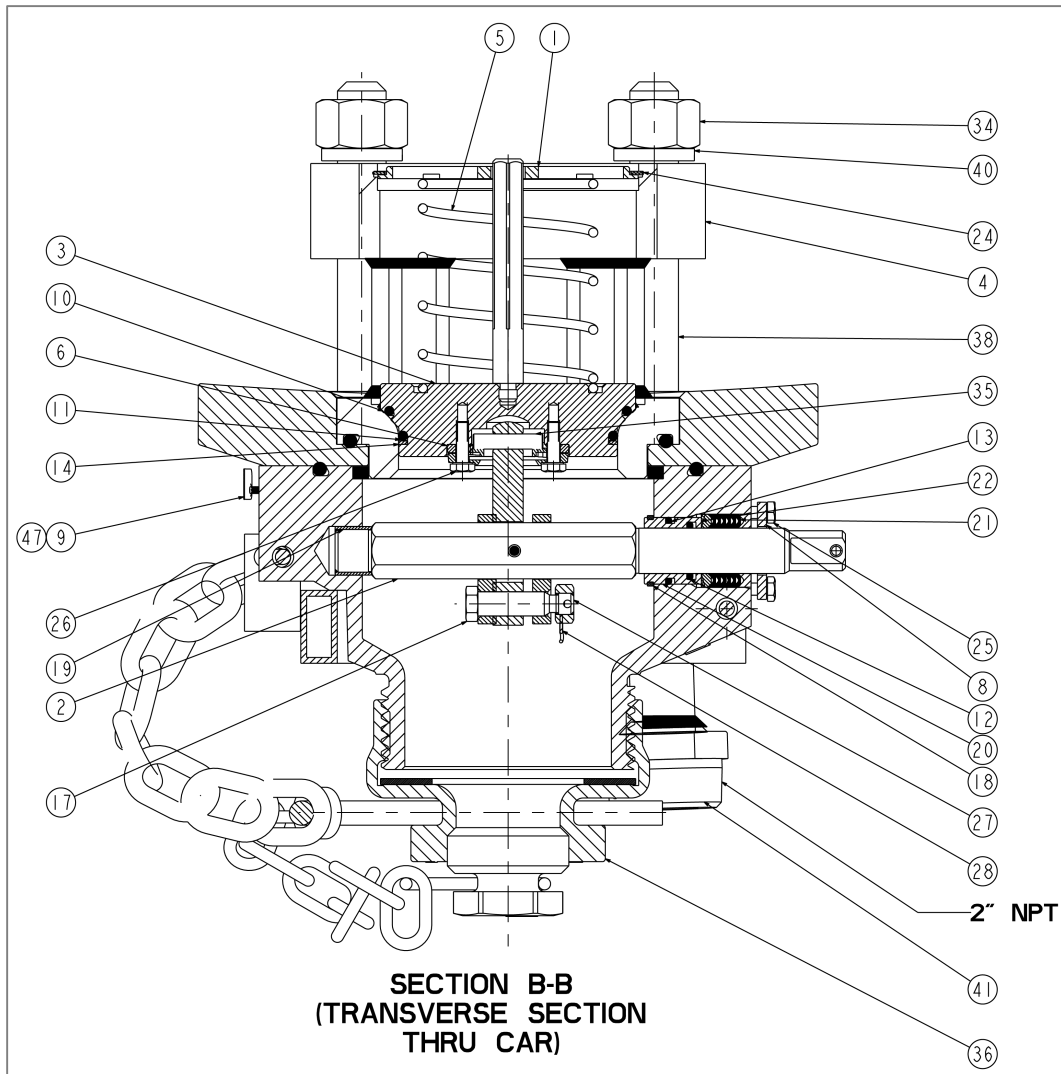


Figure 2-6 A-541-XS-SJ Component Identification (Section B-B)

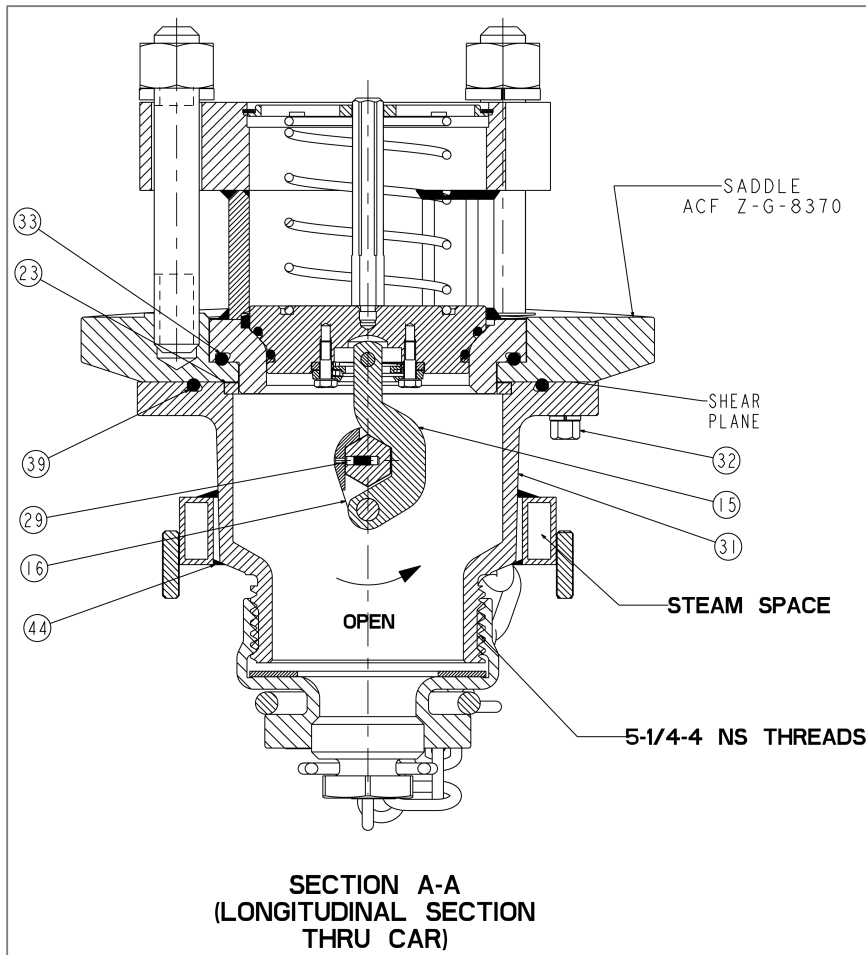


Figure 2-7 A-541-XS-SJ Component Identification (Section A-A)

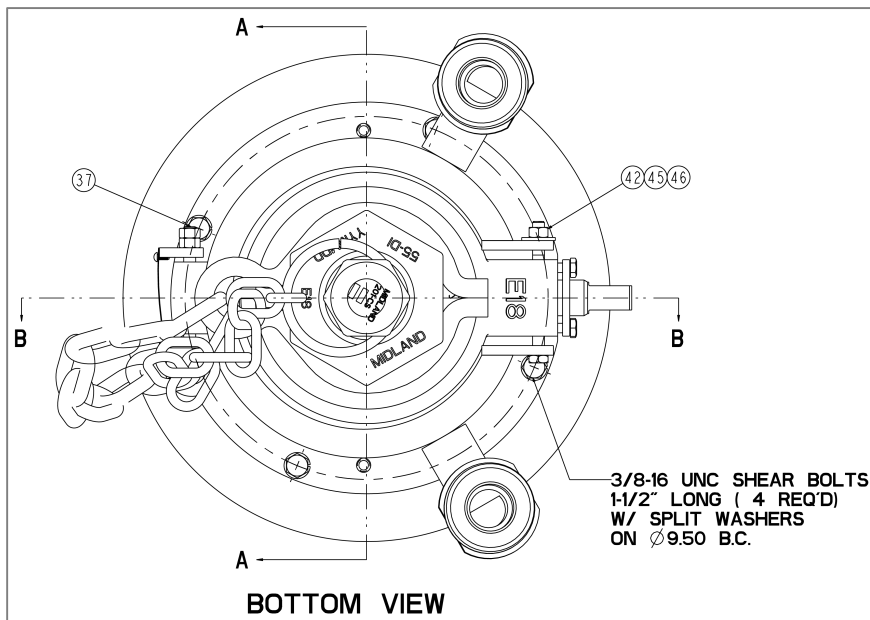


Figure 2-8 A-541-XS-SJ Component Identification (Bottom View)

3 Operating Procedure

3.1 Opening the Valve

- 3.1.1 Conform with all applicable TC, AAR, and DOT regulations when operating 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 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

- 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 Recommended Tools

SAE Wrench	Component(s)/Description
7/16" Wrench	Cam Stem Nut (item 27)
5/8" Wrench	Cam Bolt (item 17)
9/16" Wrench	Base Bolts (item 32)
1-3/8" Wrench	Upper Section Nuts (item 34)
Torque Wrenches (0 – 150 ft-lb)	
Other Tools, Supplies, and Equipment:	
Cloth	Emery Paper (400 grit)
Screwdriver	Solvent
Loctite®	

Table 4-1 Recommended Tools for Valve Assembly



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.

- 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 an ACF 2-G-8370 saddle.

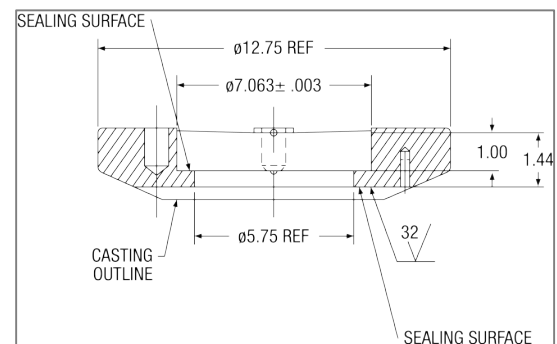


Figure 4-1 Mounting-Saddle Sealing Surfaces

4.2 Installation of Upper Section



NOTICE: The upper Section of the A-541 is installed to the existing saddle on the interior of the car.

NOTICE: The upper section of the valves weighs approximately 40 pounds (depending upon the type) so it may be desirable to have mechanical assistance or additional manpower to help.



Figure 4-2 Upper Section of Valve

- 4.2.1 Make sure the body O-ring (item 33) is in the groove of the body (item 4). If necessary, slightly stretch the O-ring and install it in the groove. Stretching helps keep the O-ring in the groove and prevents it from falling out of the groove.

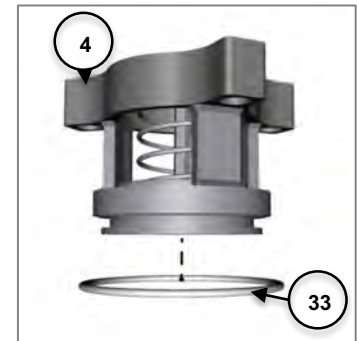


Figure 4-3 Install O-Ring

- 4.2.2 Lower the upper section of the valve in the saddle.

- 4.2.3 Align the valve body upper flange 1" threaded holes in the saddle. Apply Loctite and install the three (x3) studs (item 38), lockwashers (item 40) and hex nuts (item 34). Gradually apply torque in an alternating cross pattern at 30 ft-lb increments until 150 ft-lb. The valve body should make metal-to-metal contact with the saddle.



NOTICE: Do not torque over 200 ft-lb.



TIP: Use a 1-3/8" wrench or socket.

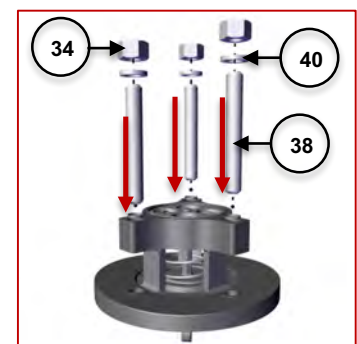


Figure 4-4 Install Studs

4.3 Installation of the Assembled Lower Section



NOTICE: The assembled lower section of the valve is installed to the existing saddle outside the tank car.

- 4.3.1 Make sure the base O-ring (item 39) is in the groove and the inner ring (item 23) is in the base flange (item 31).

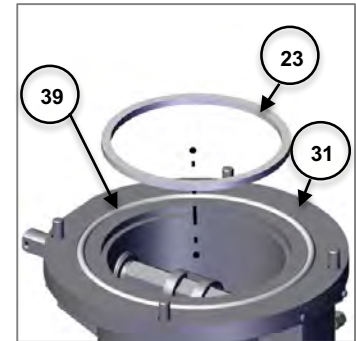


Figure 4-5 Install O-Ring

- 4.3.2 Using a jack or lift table, elevate the lower section up to the saddle to allow for link connect to the installed upper section.



NOTICE: If may be necessary to reorient the cam lever by rotating it about its verticle axis. Put a screwdriver in the 1/2" hole in the cam lever, or use a small adjustable wrench to turn the cam lever.

The cam lever must be oriented properly with the open section between the two halves of the cam facing in the same direction as the recess in the cam lever. This will then permit the cam lever to completely close without hitting the cam when the valve is closed.



Figure 4-6 Install Lower Section

- 4.3.3 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 (x2) wrenches 7/16" and 5/8".



NOTICE: The valve upper section and tank car saddles are not shown here for clarity.

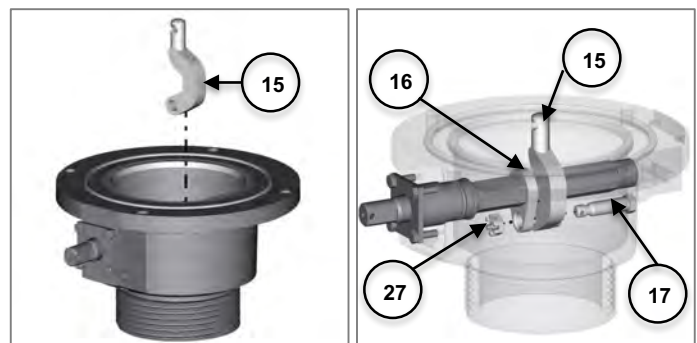


Figure 4-7 Attach Cam Lever Using Bolt and Stem Nut

4.3.4 Install the cam stem pin (item 28).



NOTICE: The valve upper section and tank car saddles are not shown here for clarity.

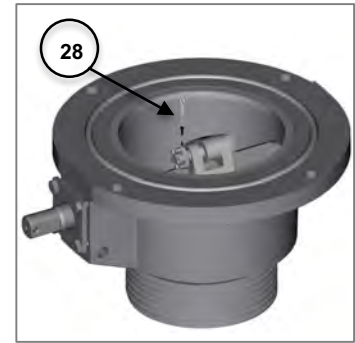


Figure 4-8 Install Cam Stem Pin

4.3.5 Rotate the valve shaft approximately 180 degrees to draw up the lower-half of the valve. It is important that the valve handle is oriented so that when the upper-half is bolted to the lower-half, the handle will fit into the bracket that locks it in the closed position.

4.3.6 Align holes in base flange with 3/8" threaded holes in saddle. Make sure stem end is perpendicular to longitudinal axis of tank car.

4.3.6.1 Install bolts and lock washers (item 32). Gradually apply torque in cross-pattern to 30 ft-lb.

4.3.6.2 That base flange should make metal-to-metal contact with the saddle.

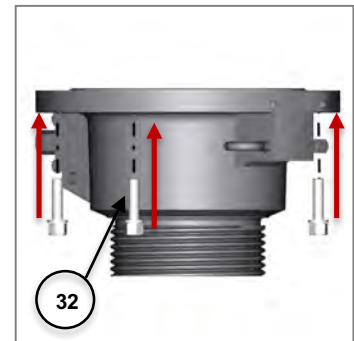


Figure 4-9 Install Base Flange

4.3.7 Install and tighten plug valve cap (Item 36).



Figure 4-10 Install Plug Valve Cap

- 4.3.8 The stenciling on the car shows the open and closed positions of the valve handle. Pin the handle in the closed position, remove the valve cap, and check that the cam is in the low position to assure that the valve is closed. Open and close the valve a few times to be sure it moves freely, and check that the valve handle fits into both the open and closed positions.

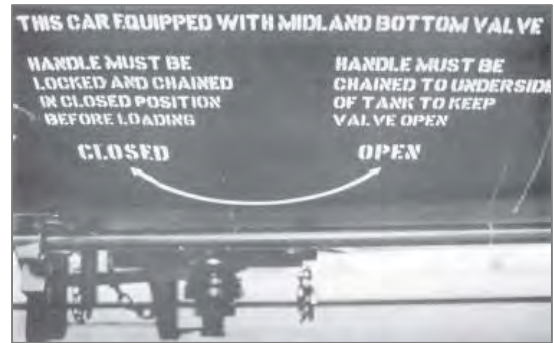


Figure 4-11 Verify Handle Functionality

4.4 Valve Testing Procedure

If your company has an approved test procedure, follow the company-approved testing procedures. If your company does not have testing procedures, these procedures provide essential guidelines regarding pressure testing.

4.4.1 Testing After Installation

- 4.4.1.1 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.
- 4.4.1.2 Slightly back off the cap to see if any air was trapped. If air escapes, this would indicate there was a leak in the orifice area of the valve.
- 4.4.1.3 Tighten the bottom cap 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.
- 4.4.1.4 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.

4.5 Leak Inspection

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

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 Recommended 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
Other Tools, Supplies, and Equipment:		
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 Recommended 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 – Remove from Car

The Midland A-541 uninstalls from the tank car into an upper section (inside the car) and a lower section.

- 5.2.1 Remove the valve lower section base (item 31) by loosening and removing four (x4) base bolts (item 32). This will allow lowering the base to disconnect it from the upper section at the cam lever.

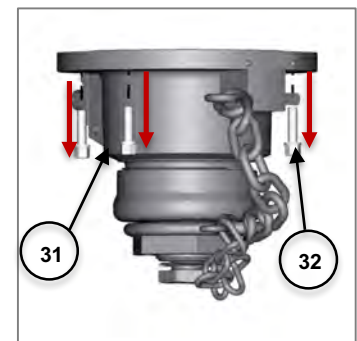


Figure 5-1 Remove Base Flange

5.2.2 While supporting the base:

- 5.2.2.1 Remove cam stem pin (item 28). Loosen the cam stem nut (item 27) and remove the nut and cam bolt (item 17). Next, loosen the base from the car.



TIP: Use two (x2) wrenches 7/16" and 5/8".

- 5.2.2.2 Base can be now be moved to another work surface for further disassembly.

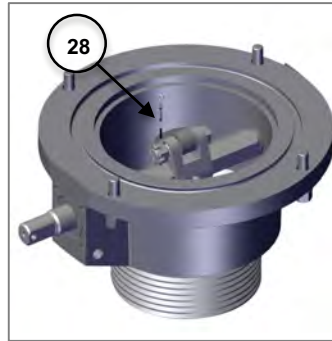


Figure 5-2 Remove Cam Bolt

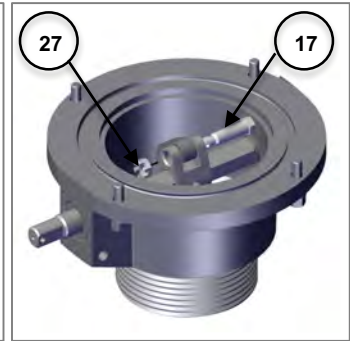


Figure 5-3 Remove Cam Stem Pin

- 5.2.3 After disassembly of the lower section from the tankcar, inside the tank car, remove the upper section body (item 4) by loosening and removing three (x3) nuts (item 34) and lockwashers (item 40).

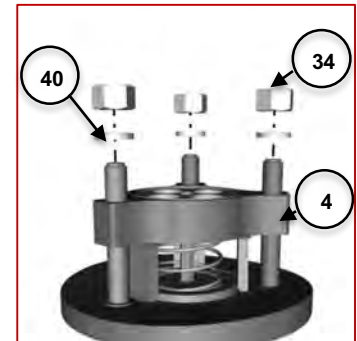


Figure 5-4 Remove Upper Section

- 5.2.4 Remove and discard the body O-ring (item 33).

- 5.2.5 The upper and lower sections can now be taken to a suitable work area for further disassembly.

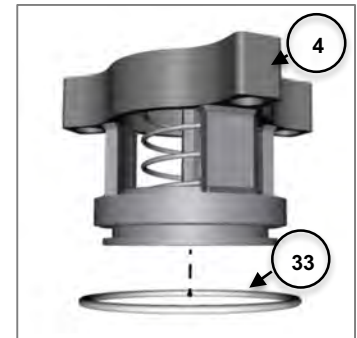


Figure 5-5 Discard O-Ring

5.3 Valve-Disassembly Procedure – Upper Section



NOTICE: Please note that following instructions are based on the A-541-XS valve model. Your specific valve model may vary from configuration shown; however, valve-disassembly procedure will be the similar.

- 5.3.1 Place valve in fixture to compress the spring (item 5) and remove spring force from the top guide (item 1).
- 5.3.2 Once the spring is compressed, 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.

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

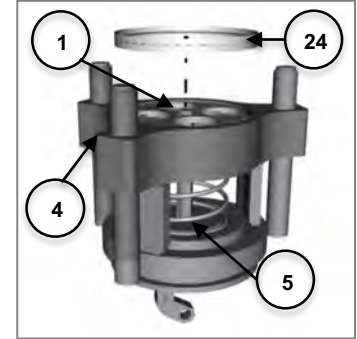


Figure 5-6 Remove Top Guide and Ring

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

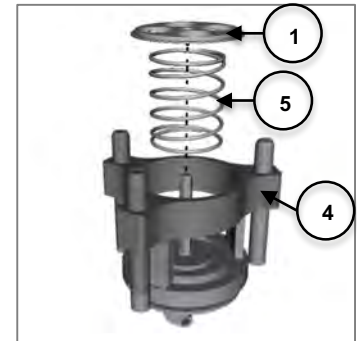


Figure 5-7 Remove Top Guide and Spring

- 5.3.5 To complete the top section of the valve disassembly, remove the plug assembly (includes plug, retainer and cam lever, as shown) with O-rings and wiper (items 3, 10, 11 and 14) from the body (item 4) and remove the O-rings and wiper.

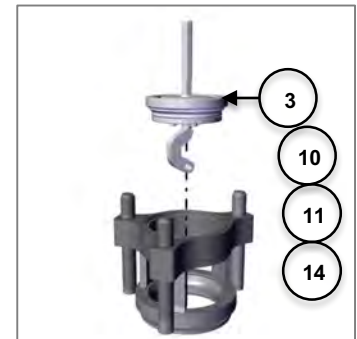


Figure 5-8 Remove Plug Assembly

- 5.3.6 Remove the cam lever assembly (items 15 and 6) from retainer assembly (item 3) by removing the retainer bolts (item 26). Remove the pin (item 35) to remove the retainer cover assembly (item 6) from the cam lever (item 15).



TIP: Use a 7/16" wrench.

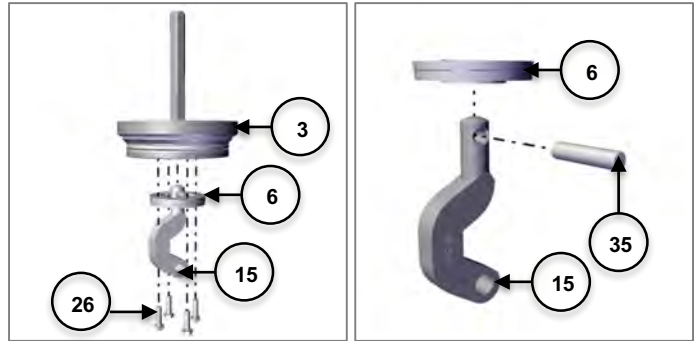


Figure 5-9 Remove Cam Lever, Pin and Retainer Cover Assembly

- 5.3.7 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.

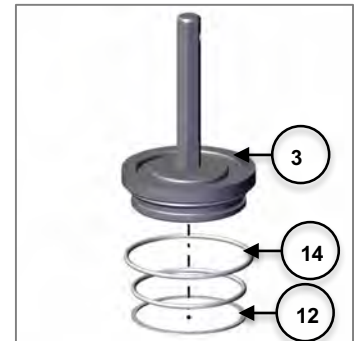


Figure 5-10 Remove Wiper Ring and O-Rings

5.4 Valve Disassembly Procedure – Lower Section

5.4.1 Remove and discard the base O-ring (item 39) and the inner O-ring (item 23).

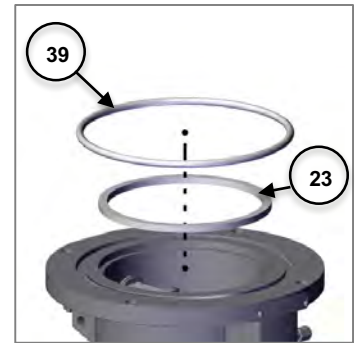


Figure 5-11 Remove O-Rings

5.4.2 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).

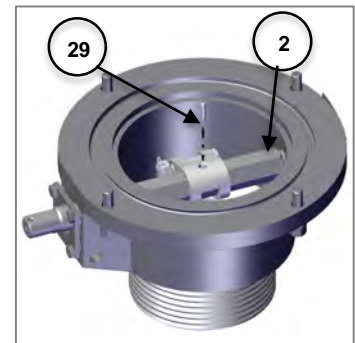


Figure 5-12 Remove Cam Assembly Pin

5.4.3 Remove the four packing bolts and lockwashers (item 25) from the shaft assembly.



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

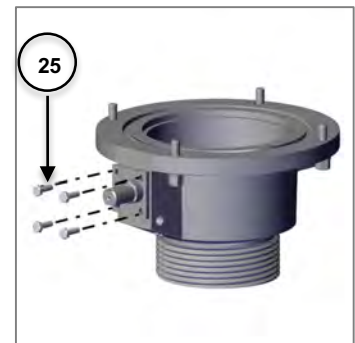


Figure 5-13 Remove Packing Bolts

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

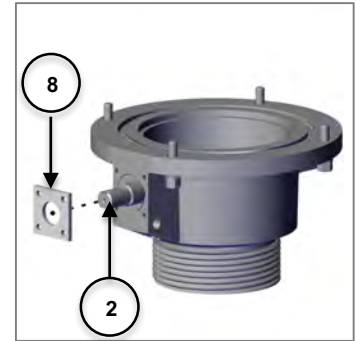


Figure 5-14 Remove Packing Flange

5.4.5 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.

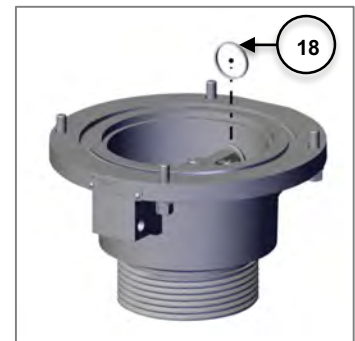


Figure 5-15 Remove Retainer Ring

5.4.6 Remove the cam stem pin (item 28).

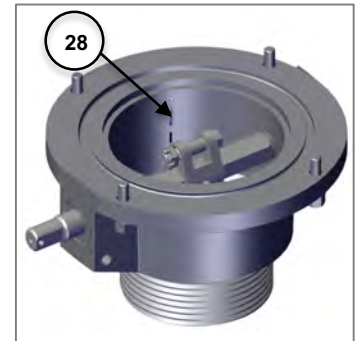


Figure 5-16 Remove Cam Stem Pin

5.4.7 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".

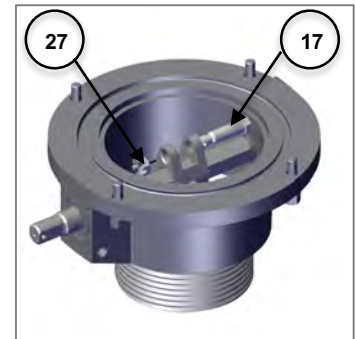


Figure 5-17 Remove Cam Bolt

- 5.4.8 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.

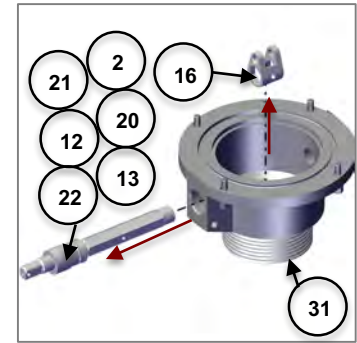


Figure 5-18 Remove Shaft

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

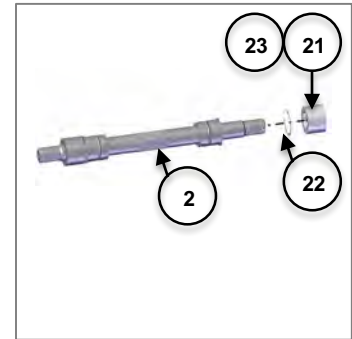


Figure 5-19 Remove Packing Set, Ring and Spring

- 5.4.10 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.

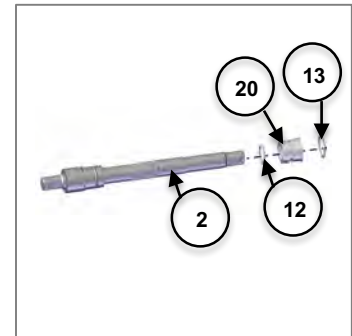


Figure 5-20 Remove Packing Bushing

- 5.4.11 From base, remove shaft bushing (item 19).

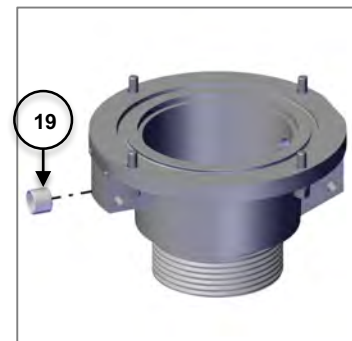


Figure 5-21 Remove Shaft Bushing

5.5 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.

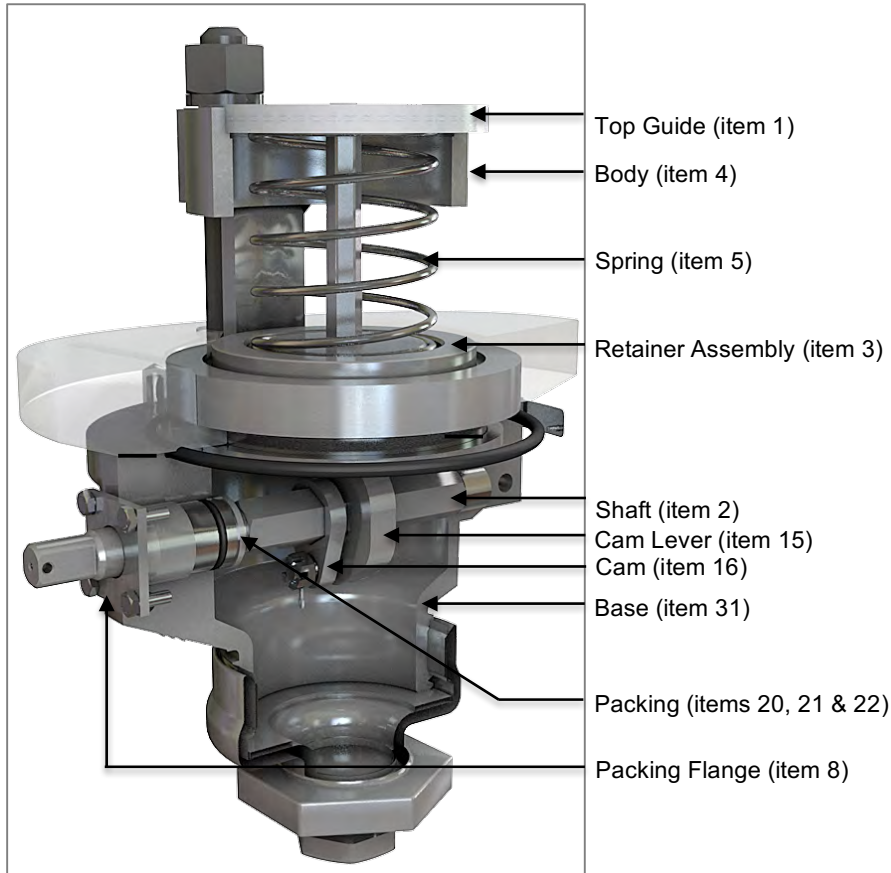


Figure 5-22 Component Inspection



NOTICE: 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: 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.

Where applicable, parts can be cleaned using solvent and a clean cloth and with application of 400-grit sandpaper for final finishing.

5.5.1 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.

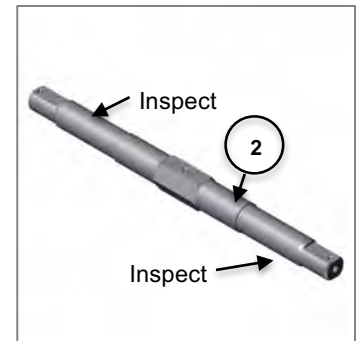


Figure 5-23 Inspect Shaft

5.5.2 Cam Lever Inspection

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

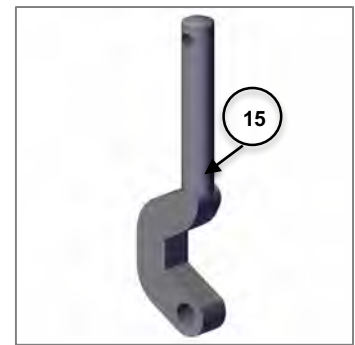


Figure 5-24 Inspect Cam Lever

5.5.3 Cam Inspection

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

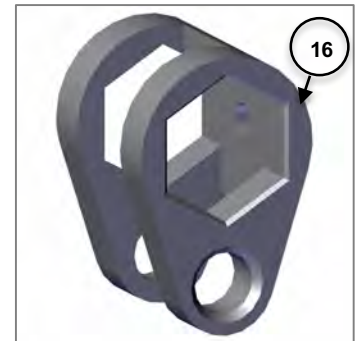


Figure 5-25 Inspect Cam

5.5.4 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.

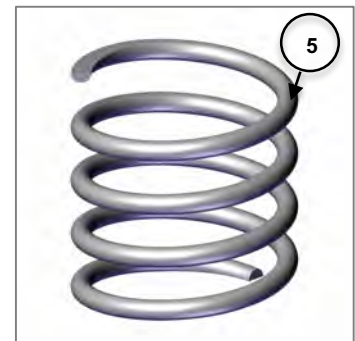


Figure 5-26 Inspect Spring

5.5.5 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.

If there are any defects in the O-ring and seat areas of the plug this could cause the valve to not seat properly and potentially for it to leak. If this is the case the plug assembly should be replaced.



Figure 5-27 Inspect Plug Assembly

5.5.6 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.

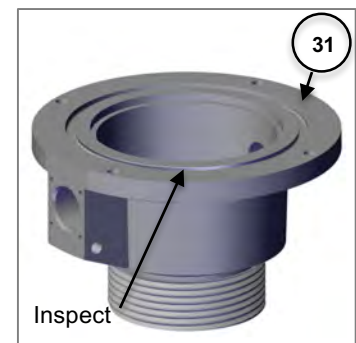


Figure 5-28 Inspect Base

5.5.7 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.

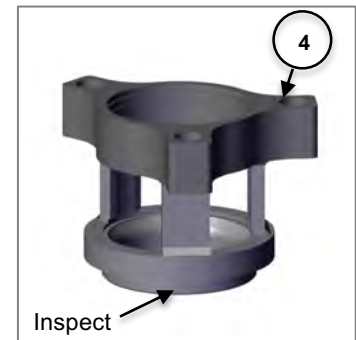


Figure 5-29 Inspect Body

5.5.8 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.

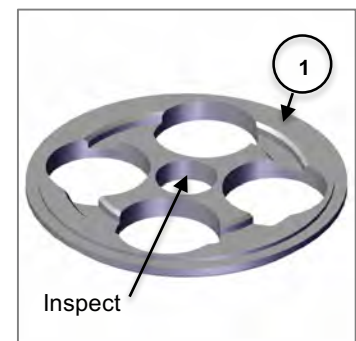


Figure 5-30 Inspect Top Guide

5.5.9 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.

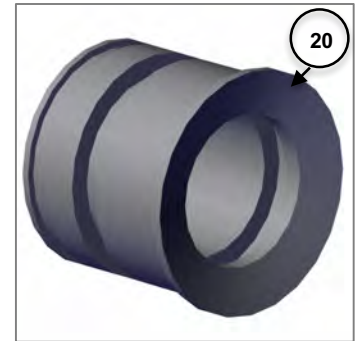


Figure 5-31 Inspect Packing Bushing

5.5.10 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.

5.5.11 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: 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.

5.5.12 Special Inspection Considerations

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.

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.

5.6 Valve Reassembly and Recommended 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
Other Tools, Supplies, and Equipment:		
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 Recommended Tools for Valve Reassembly

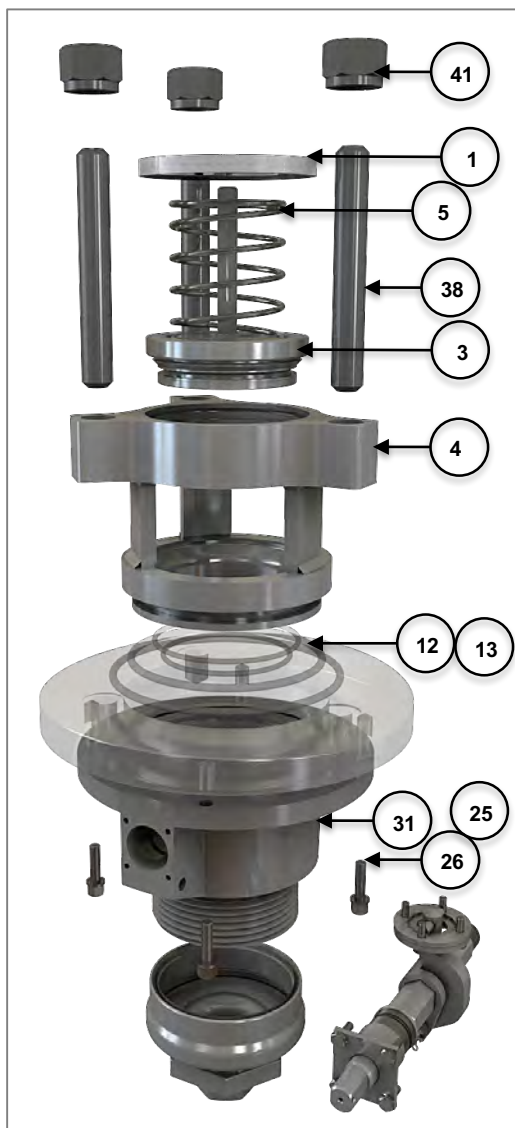


Figure 5-32 Valve Exploded View



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.

5.7 Valve-Reassembly – Lower Section

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

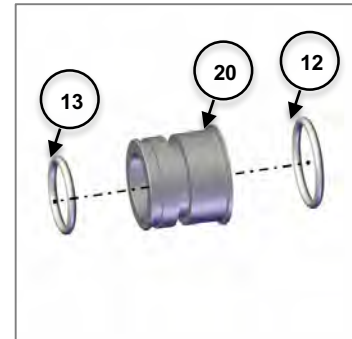


Figure 5-33 Install O-Rings

- 5.7.2 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.

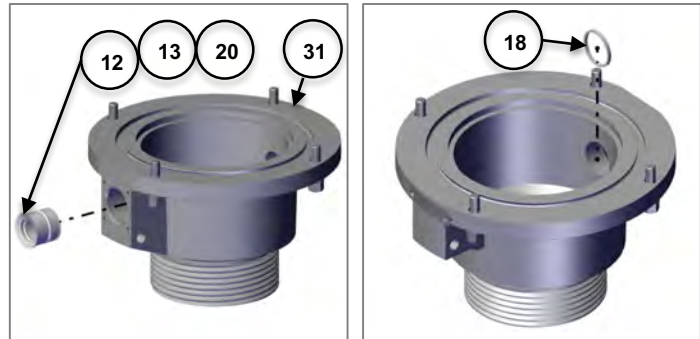


Figure 5-34 Install Packing Bushing Assembly and Retaining Ring

- 5.7.3 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.

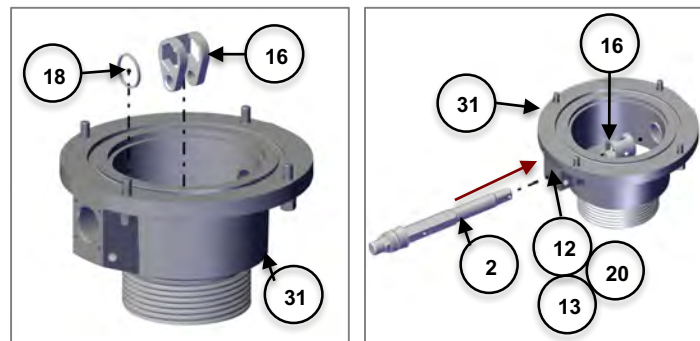


Figure 5-35 Install Shaft Assembly and Retaining Ring

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

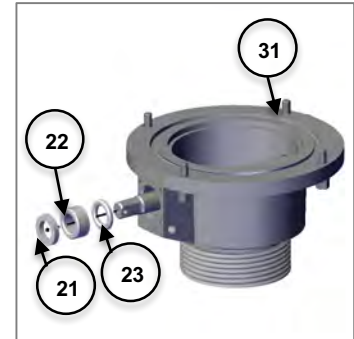


Figure 5-36 Install Packing Spring, Ring and Set

- 5.7.5 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).

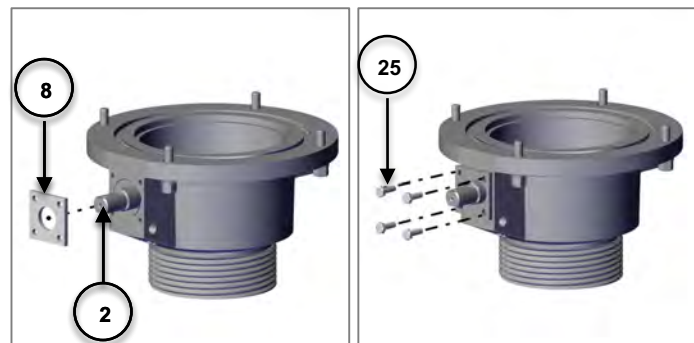


Figure 5-37 Install Packing Flange Using Packing Bolts

- 5.7.6 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.

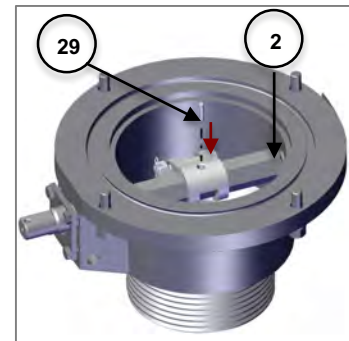


Figure 5-38 Install Cam Assembly Pin

5.8 Valve-Reassembly – Upper Section

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

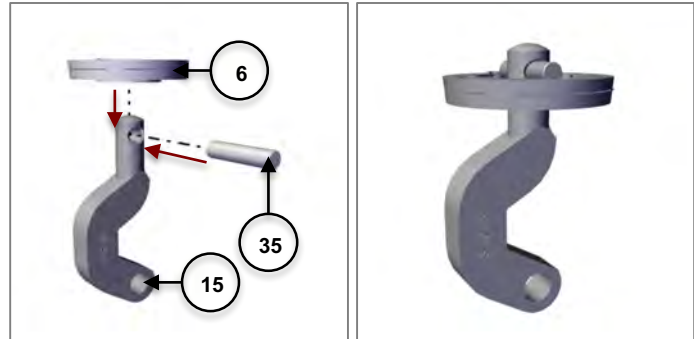


Figure 5-39 Remove Cam Lever, Pin and Retainer Cover Assembly

- 5.8.2 Attach the retainer cover assembly (item 6) using four (x4) retainer bolts (item 26) to the plug assembly (item 3).

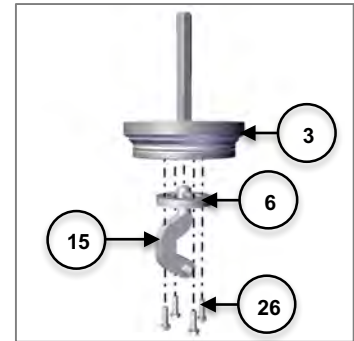


Figure 5-40 Place Plug Assembly and Attached Retainer Cover Assembly

- 5.8.3 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).

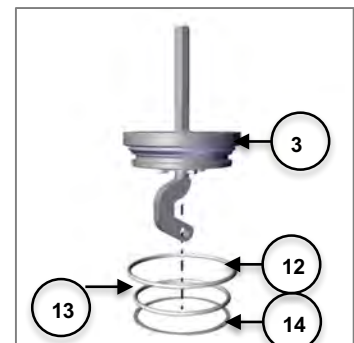


Figure 5-41 Install Wiper Ring and O-Rings

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

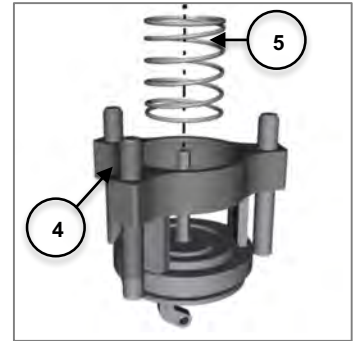


Figure 5-42 Install Spring

- 5.8.5 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 5-43 Install Top Guide

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



Figure 5-44 Install Retainer Ring

5.9 Valve-Reassembly – Installation on a Tank Car

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

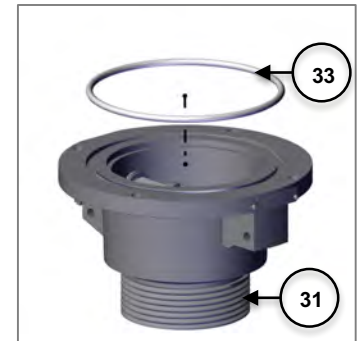


Figure 5-45 Install O-Ring onto Base

5.9.2 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".



NOTICE

NOTICE: The valve upper section and tank car saddles are not shown here for clarity.

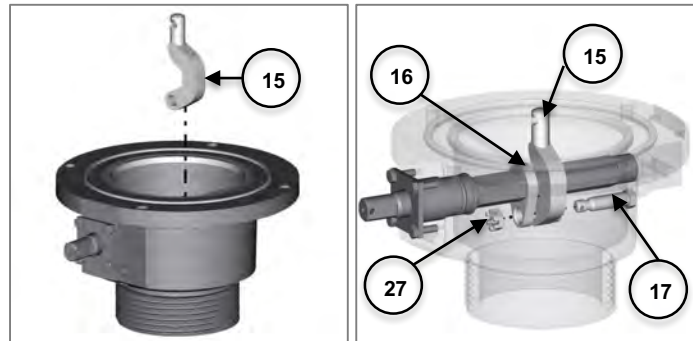


Figure 5-46 Attach Cam Lever Using Bolt and Stem Nut

5.9.3 Install the cam stem pin (item 28).



NOTICE

NOTICE: The valve upper section and tank car saddles are not shown here for clarity.

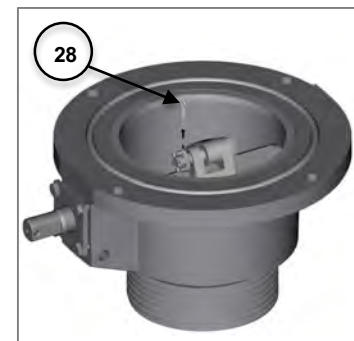


Figure 5-47 Install Cam Stem Pin

5.10 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.

5.10.1 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.

5.10.1.1 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.

5.10.2 Hydrostatic Shell Test

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

5.10.2.2 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.

5.10.2.3 Install a blank test flange on the outlet.

5.10.2.4 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.

5.10.2.5 Any leakage or deformation is cause for rejection.

5.10.2.6 Depressurize the test assembly.

5.10.3 Seat Seal Test

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

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

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

5.10.3.4 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.

5.10.4 Procedure After Installation (On Car)

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

5.10.5 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.

5.10.6 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.

5.10.7 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.

5.10.8 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.

No regular periodic maintenance of the mechanical workings of this valve is required outside of regular standard qualification. However, Midland recommends that the installed valve be inspected on a regular basis to ensure that it is securely attached to the tank car and that there is no evidence of commodity leaking from the valve and its components.

6.1 Valve Mounting



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

If there is evidence of leaking from the actuator shaft packing flange (item 8) (an indication of possible packing failure), this procedure can be followed to change out the packing components.



NOTICE: It is necessary to remove the lower-half of the valve to repack the packing gland. Follow the procedure in valve disassembly steps 5.4.9 through 5.4.10.

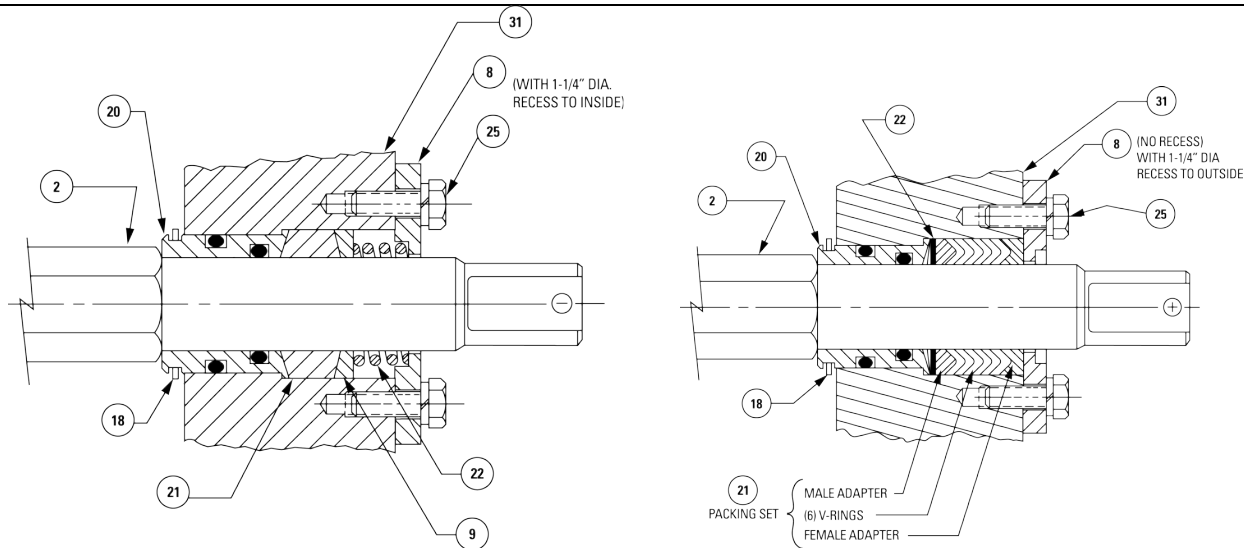


Figure 6-1 Valve-Component Maintenance [Sectional View]

- 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.
- 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, Teflon[®] packing and washer out of the valve base (item 31).
- 6.2.7 If changing the packing from the old-style, one-piece Teflon[®] to the chevron V-rings, it will be necessary to insert a chamfer, or tapered lead-in, about 1/8" long by 15 degrees, in 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 that 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 Teflon[®] packing, use an ample amount of grease to facilitate the reassembly.
- 6.2.9 Replace the parts in reverse order. Then follow the previously described instructions in Section 2.0 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 3.0 Valve-Testing Procedure.

