MIDLAND™

PART OF OPW FLUID TRANSFER GROUP

A DOVER COMPANY

Pressure Relief Valves

Instructions for NGRTC EXTERNAL-STYLE Valve

A-14378-ML
A-14308-ML
A-14228-ML
A-1403 series
A-1406 series

Installation
Operation

Doc. No. A-14378, Rev. 1.6, 03/26
Supersedes: Rev. 1.5, 03/26

ITEM	QTY	PART NAME
1	1	TOP GUIDE
2	1	STEM
3	1	PLUG
4	1	BODY
5	1	OUTER SPRING
6	3	FOLLOWER
7	1	GUIDE
8	1	TOP NUT
9	1	TOP GASKET
10	1	SHAFT SEAL
11	1	ADJUSTING SCREW
12	1	SEAL RETAINER
13	1	INNER SPRING
14	1	CAP
15	1	SET SCREW
16	4	STUD
17	4	NUT
18	1	WIRE SEAL
19	1	RETAINER
20	1	SEAT “O” RING
21	1	PLUG “O” RING
22	1	FLUE “O” RING
23	1	RUPTURE DISC
24	1	FLUE
25		
26		
27	1	1/8” VALVE
28	1	NAMEPLATE
29	1	FLANGE GAP FILLER
30		
31	1	PROTECTIVE CAP/CHAIN
32	1	RUPTURE DISC HOLDER – TOP FLANGE
33	1	RUPTURE DISC HOLDER – BOTTOM FLANGE
34		
35	6	HEX SOCKET CAP SCREW – MOUNTING
36	6	HEX SOCKET CAP SCREW – RUPTURE DISC HOLDER

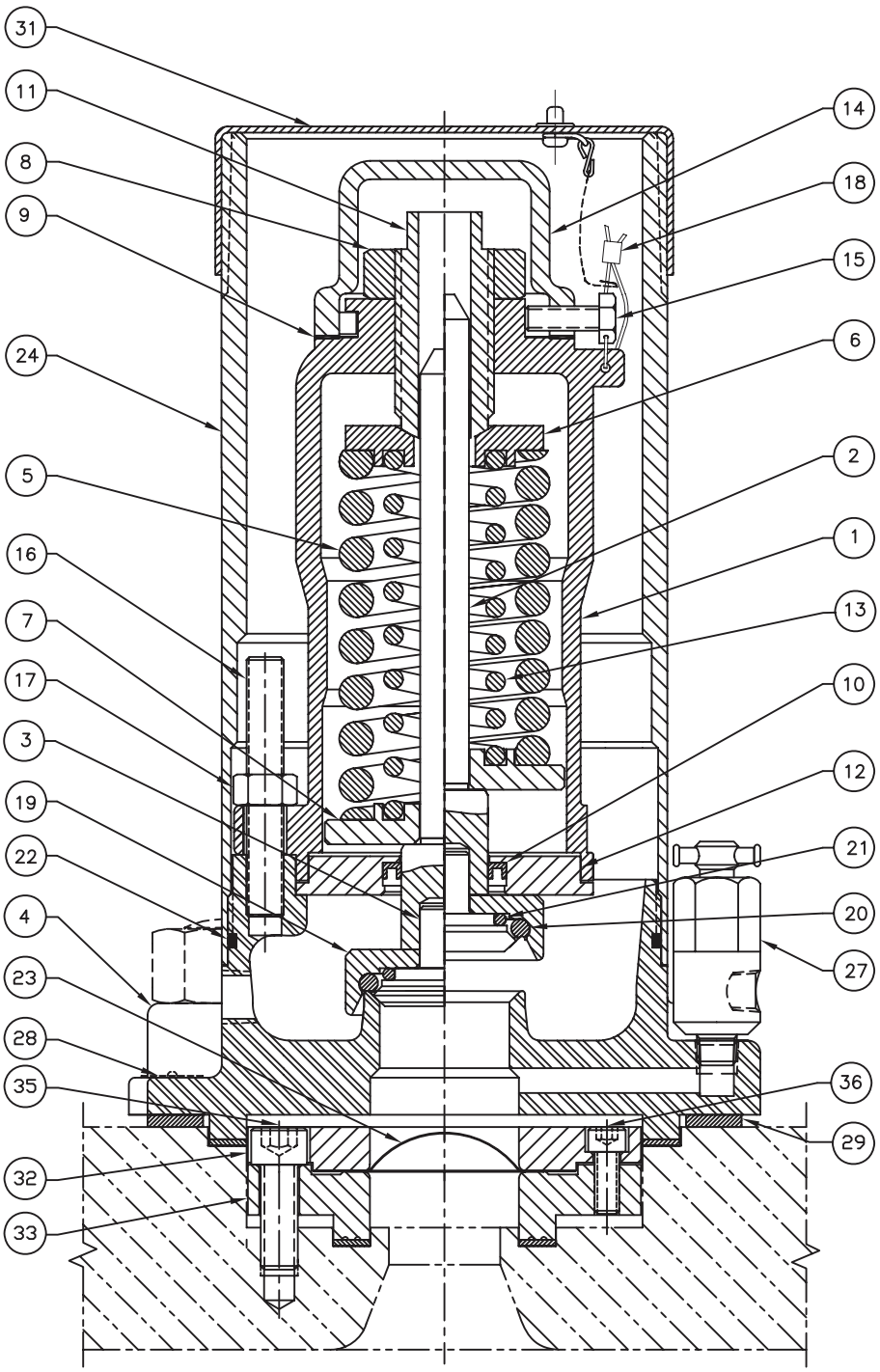


Figure 1 - External-Style Valve Components

1.0 Valve Installation

CAUTION: Toxic Hazard
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.

WARNING: These external-style pressure relief valves are spring loaded assemblies with a large amount of stored potential energy in the spring. Handle with care to avoid damage to the valve stem, which could result in breakage and ejected piece.

WARNING: When assembling or disassembling the valve, DO NOT position oneself directly in front of the spring and stem. Instead, position oneself to the side away from the valve. Unexpected component failure – valve-stem or spring breakage may cause a sudden energy release that can discharge component parts a short distance in an uncontrolled manner. Personal injury may be a result.

1.1 Preliminary Considerations

New valves are tested, adjusted and sealed at Midland. If a new valve has been left in its original packaging, is undamaged, and is not more than six months old, it may be installed on a tank car without retesting or recalibration. Prior to installation, ensure that the valve remains clean and that the gasket sealing surfaces (Fig. 2) are not damaged.

1.2 Procedure

1.2.1 Remove the old valve and then insert a soft rubber plug into the tank opening to prevent debris from entering the tank during cleaning of the valve mounting groove and studs on the manway coverplate.

1.2.2 Wire brush the threads of the mounting studs to remove rust or scale. Nuts should run freely on clean studs. Studs should not exhibit excessive corrosion.

1.2.3 Remove and discard all used gasket material.

CAUTION: Groove damage
Do not scratch the metal in the bottom of the groove when removing the old gasket.

1.2.4 Using a lint-free cloth and appropriate cleaning solvent, wipe clean the valve and coverplate sealing surfaces and the mounting stud threads.

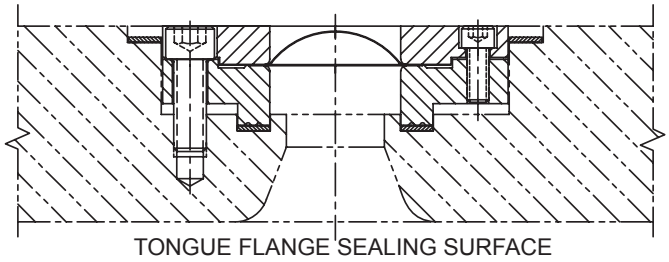


Figure 2 - Gasket Sealing Surfaces

1.2.5 For tongue and groove mountings, examine the sides of the groove. Because the valve tongue fits tightly into the groove, any peening-over of the edges of the groove may make it difficult to properly fit the valve tongue into the groove. If the sides of the groove are peened over, make corrections to meet the AAR groove tolerances.

1.2.6 Install the new gasket. Ensure it is fully seated. When a groove gasket is fully seated, 1/16” of free space should remain above the gasket to permit locating and entry of the valve tongue.

CAUTION: Gasket Damage
Do not use a sharp tool to press the new gasket into place or gasket damage may result.

1.2.7 Inspect the tongue of a reconditioned or retested valve by running your fingernail around its inner and outer edges to check for damage. The tongue dimensions have diameter tolerances of ±0.003”, thus any excess material on these diameters will make it difficult to fit the tongue into the groove. If the tongue is peened oversize, remove excess material to meet AAR tongue tolerances.

CAUTION: Tongue Damage
Do not install a valve having damaged sealing surfaces.

1.2.8 Remove the rubber plug (inserted in step 1) from the cover plate.

1.2.9 Rupture Disc Holder Installation: Install the rupture disc holder onto the cover plate by lining-up the holes for the 3/8” HSCS. Install and tighten 3/8” HSCS in 1/3" torque increments in a diagonally

1.0 Valve Installation (cont.)

alternating sequence to a torque specified by the gasket specifier.

1.3 Hold the valve by the top guide/or flute (Fig. 3) and lower it gently into the mounting. Align the body holes over the studs and lower the valve while positioning the valve tongue in the coverplate

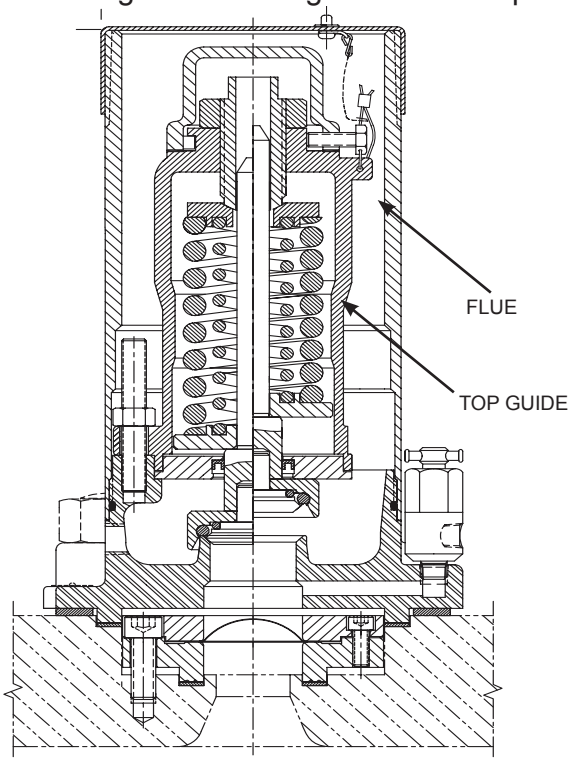


Figure 3 - Valve Top Guide/Flue

groove.

CAUTION: Tongue not in groove

Verify that the valve tongue has fit into the coverplate groove. It must be so engaged before continuing with the next step or valve damage may result.

1.3.1 Install the nuts and tighten them in 1/3 torque increments in a diagonally alternating sequence to a torque specified by the gasket specifier, as shown in Figure 4.

CAUTION: Uneven gasket compression

Do not over tighten the nuts on one side of the valve as this may tilt the valve and result in uneven gasket compression.

1.3.2 Inspect for leaks. Test all newly installed valves under pressure to confirm that no leaks are present.

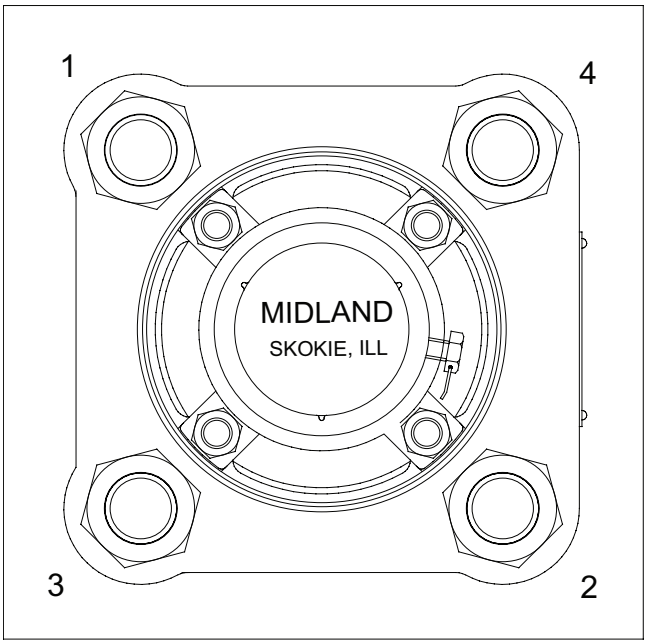


Figure 4 - Mounting Nut Tightening Sequence

WARNING: Valve Leakage

Improper valve tongue seating in the flange groove, loose nuts and damaged gaskets may result in leaks at the valve mounting joint.

1.3.3 Valve Operation Notes and Precautions

- Operation of the valve must conform with all applicable TC, AAR, DOT specifications (Parts 173.31, 174.67, etc.), Other governmental bodies, and the operating instructions of your company.
- The pressure relief valves are spring loaded and are actuated by overpressure in the railcar tank. There are no provisions for manual activation of the valve.

CAUTION: Needle Valve Closure

For valves equipped with rupture discs, be sure that the needle valve is closed and the plug is installed, if required.

1.0 Valve Installation (cont.)

CAUTION: Incorrect Setting
Never adjust the spring compression of a valve while it is mounted on the vessel cover plate or incorrect settings may result.

2.0 Valve Disassembly (Disassembly is required for inspection per para 3.0)

2.1 Procedure

CAUTION: Spring-Loaded Assembly
During valve-spring disassembly, the valve contains springs under load. DO NOT attempt to disassemble the valve without first reading these instructions or injury may result. Spring pressure must be adjusted to minimum and a bench clamp or press used for disassembly.

2.1.1 Remove the protective cap (Fig. 5) and cut the seal wire (item 18) to release the cap chain. Unscrew and remove the flue (tube) from around the valve.

2.1.2 If present, remove the plastic protector from

Figure 5 - Flue and Protective Cap

the base or tongue of the valve.

2.1.3 If present, remove the flue o-ring (item 22).

CAUTION: Flange Damage
Handle the valve body carefully after disassembly. Avoid allowing their machined surfaces to contact the metal workbench and hand tools or damage may result.

2.1.4 Loosen the set screw (item 15) securing the cap (item 14).

2.1.5 Use a pipe wrench and unscrew the cap as shown in Figure 7. Remove the cap.

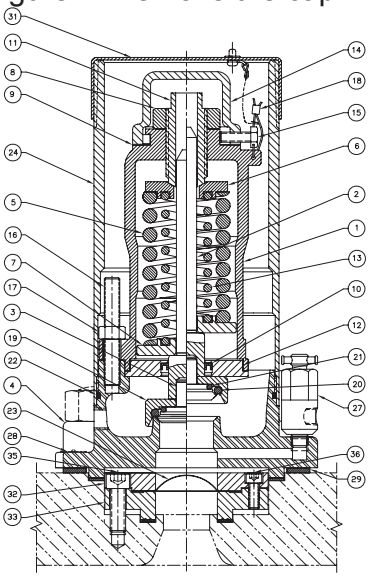


Figure 6 - Valve Components

2.1.6 Remove the top gasket or bumper (item 9).

2.1.7 Loosen the top nut (item 8) one turn counterclockwise. Loosen the adjusting screw (item 11) until it can be easily rotated (is at minimum adjustment limit).

Figure 7 - Valve Cap Removal

2.1.8 With a locking bench clamp (Fig. 8), apply pressure to the adjusting screw (item 11). While so clamped, remove the four nuts (item 16) securing the top guide (item 1) to the valve base.

CAUTION: Tongue Damage
When clamping the valve, protect the valve body to avoid damage.

2.1.9 Slowly release the clamp to relieve remaining valve spring pressure and then lift the top guide housing off the valve base.

2.0 Valve Disassembly (cont.)

2.1.10 Remove the adjusting screw (item11) and top nut (item 8) from the top guide and from one another.

2.1.11 From the valve stem (item 2) remove the follower (item 6), outer spring (item 5), inner spring (item 13) and the guide (item 7).

2.1.12 Lift the stem (item 2) and seal retainer (item 12) straight up and off the shaft off the plug (item 3).

Figure 8 - Clamping for Top Guide Removal

2.1.13 Remove the shaft seal (item 10) from the seal retainer (item 12).

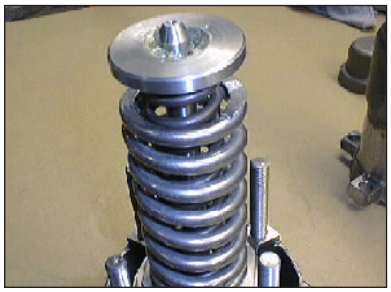


Figure 9 - Valve After Top Guide Removal

2.1.14 Lift or pry up the retainer (item 19). It will likely lift off with the valve plug (item 3) as a single unit.

2.1.15 Remove the plug from the retainer.

Figure 10 - Valve Stem and Seal Retainer

CAUTION: O-Ring Groove Damage
Remove the o-rings from the retainer using only a non-scratching tool or scratching and gouging of the o-ring grooves may result.

2.1.16 Remove the two o-rings (items 20 & 21) from the retainer using only a non-scratching tool.

2.1.17 Unscrew and remove the needle valve (item 27) from the valve base, if applicable.

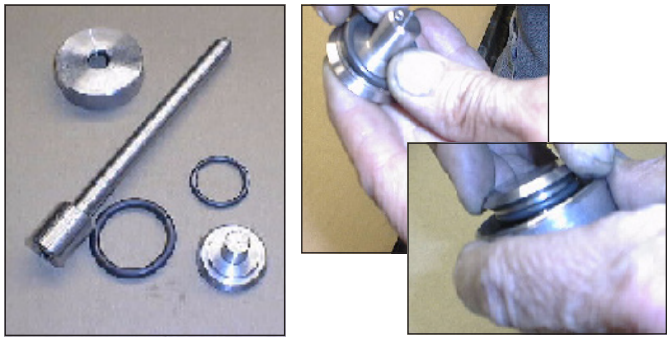


Figure 11 - Retainer, Valve Stem, O-rings and Plug

2.2 Valve Reassembly

2.2.1 Reverse the disassembly instructions.

3.0 Valve Inspection

After disassembly per para 2.0, follow the guidelines in this section for inspecting the condition of valve components. In some instances a component can be properly evaluated for damage or cracks only with the use of specialized techniques, such as dye penetration or magnetic particle testing, according to a qualified procedure by certified trained personnel. Such testing is indicated where mandatory.

Additionally, specific inspections must be performed during and after reassembly of the valve to ensure proper and reliable operation.

3.1 Inspection Procedures

3.1.1 Top Guide

The top guide (Fig.12) is principally a structural part. There should be no paint on any components

covered by the cap, or between adjacent surfaces of the top guide and valve body. The vent area of the valve body must be unobstructed by foreign matter that would hinder free flow of discharging fluid.

3.1.2 Adjusting Screw Threads

The threads of the adjusting screw (Fig. 12) should be clean and lightly lubricated.

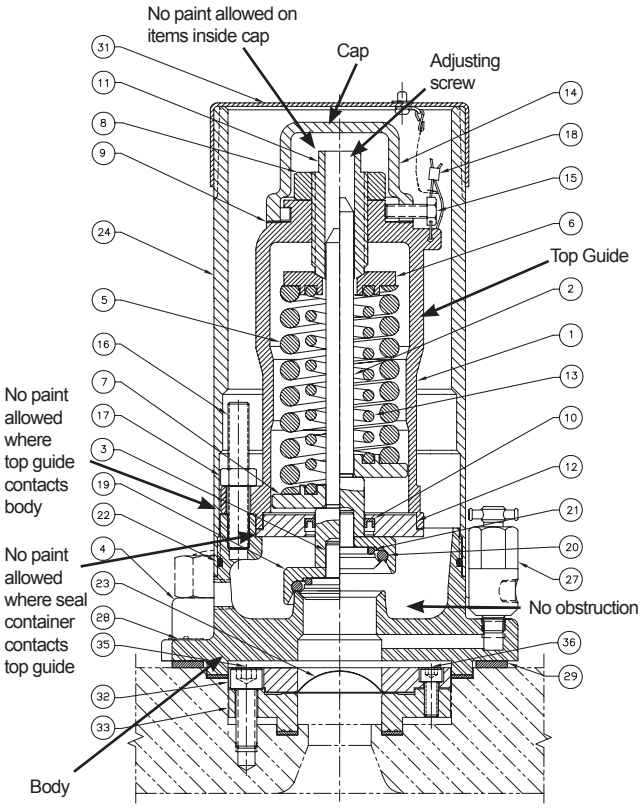


Figure 12 - Valve Components (Inspection)

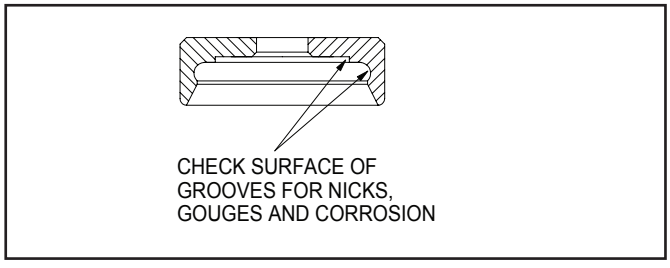


Figure 13 - Retainer O-Ring Grooves

3.1.3 O-Ring Retainer Grooves

The grooves (Fig. 13) must be free of gouge marks, corrosion, pits and rust. Since the O-rings must seal against these surfaces, any irregularities can cause the valve to leak. Clean the groove by sanding it lightly with emery paper (400 grit). If this does not effectively clean it, replace this part.

3.1.4 Valve Body and Plug:

Valve Body: The sealing surface is the crown of the seat (Fig. 14). Clean the seat with emery paper (400 grit) then wipe it clean with a cloth and a suitable solvent. Run your fingernail around the surface to detect any flaws. Repair work is limited to cleaning and polishing (Paragraph A4.11.1 of the Tank Car Specifications).

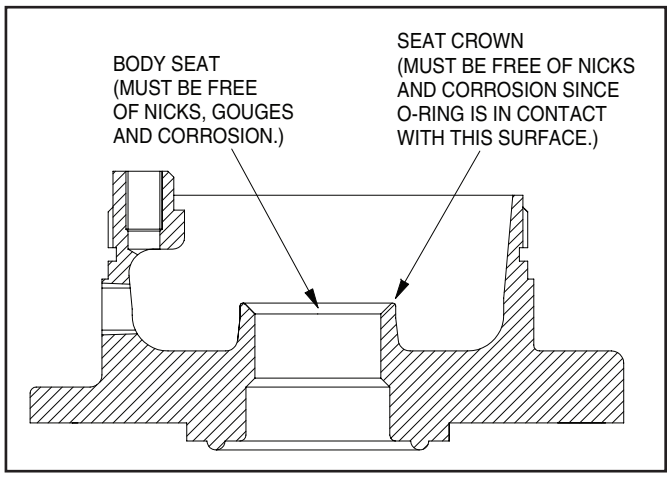


Figure 14 - Valve Body Seat

Valve Plug: The sealing surface is the plug seat (Fig. 15). Clean the plug with emery paper (400 grit) then wipe it clean with a cloth and a suitable solvent. Run your fingernail over the seat surface to detect any flaws. Repair work is limited to cleaning and polishing.

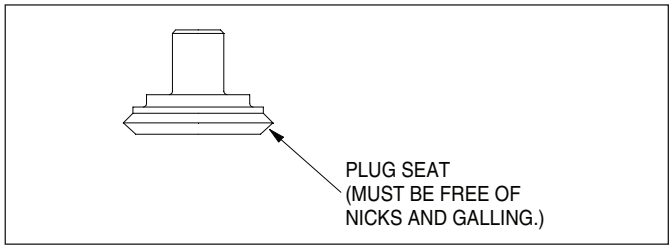


Figure 15 - Plug Seat

WARNING: Machining not allowed
Machining, grinding, welding or other alterations to the valve seat or plug seat is not allowed per AAR M1002, paragraph A4.11.1 of the Tank Car Specifications.

3.1.5 Sealing Surface (Valve Mounting)

The underside of the valve body is the surface that seals to the mounting plate on the railcar (Figs. 16). Machining of this surface is permitted. (Refer to paragraph A4.11.2 of the Tank Car Specifications. Consult Appendix E for dimensions and applicable tolerances.) A good seating surface is necessary to ensure there are no leaks in this area.

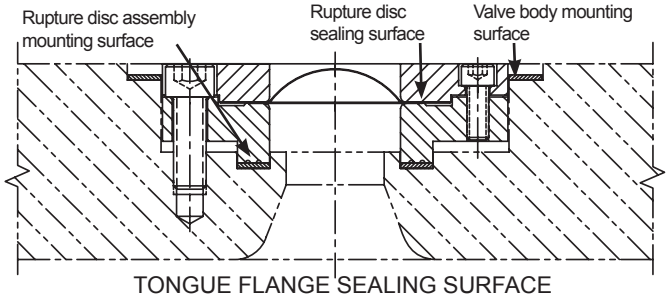


Figure 16 - Machinable Surfaces - Tongue Flange

3.1.6 Valve Spring

This part is highly stressed. The exterior surface must be free of pitting, cracks, and corrosion. If any corrosion is observed on the spring, use magnetic particle or dye penetration inspection (performed by certified trained personnel) to evaluate the exterior surface and ensure that it is free of cracks and corrosion pits.

WARNING: Valve Spring Failure
Defects in coil springs, such as cracks and corrosion pits, can act as stress concentrators. Failure to detect these defects can result in coil spring breakage and uncontrolled valve venting.

Test the springs by pressing them to 80% of solid height in a press for 2 minutes. Remove from the press and then measure the spring free height. If free height is less than the minimum indicated in Table 1 (next page), replace the spring.

WARNING: Deficient Valve Travel
Coil springs that have taken a "set," resulting in an undersize free height, will not allow the valve to open fully.

Table 1
MINIMUM FREE HEIGHTS FOR SPRINGS
AFTER PRESSING SOLID FOR 2 MINUTES

SPRING PART NUMBER	WIRE SIZE (REF) (IN)	MINIMUM FREE HEIGHT (IN)
14-13-SS	0.19	4.82
15-225-SS	0.28	4.80
15-375-SS	0.34	4.99

3.1.7 Spring Guide

This structural part has guides on its outer edges (Fig. 17). Move it up and down the length of the top guide as indicated below. If it binds, look for dents or gouged surfaces inside the top guide. Repair the damage to allow free movement of the spring guide.

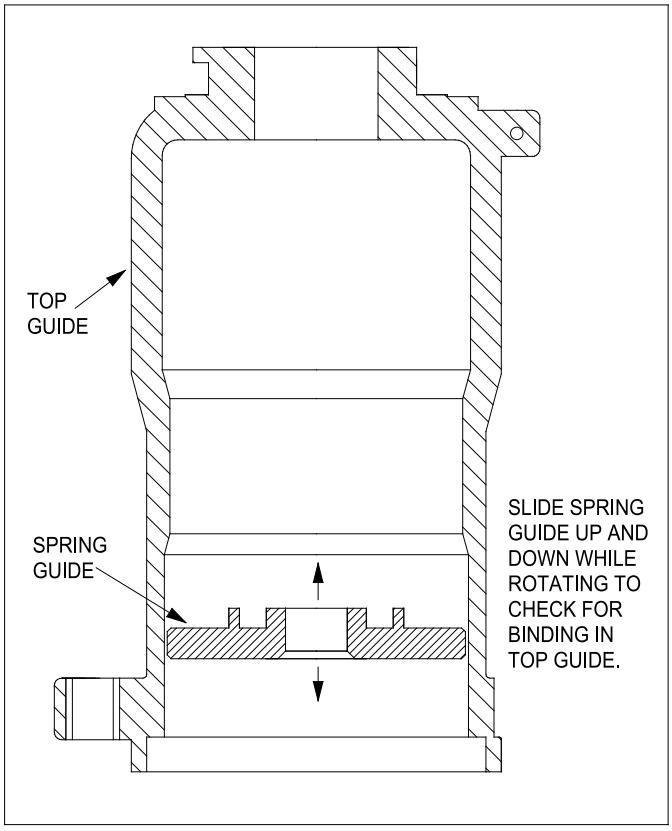


Figure 17 - Spring Guide

3.0 Valve Inspection (cont.)

WARNING: Valve Sticking
If the spring guide binds in the top guide bore, the valve may stick in the open position or be prevented from opening. Always ensure free travel of the spring guide before reassembling the valve.

3.1.8 Rupture Disc

The rupture disc should not be reused. Install a new rupture disc each time a valve with a rupture disc is serviced.

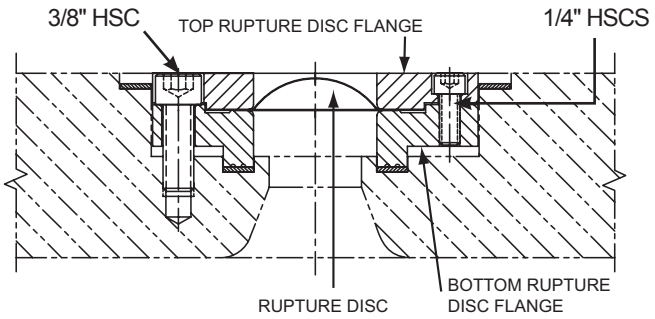


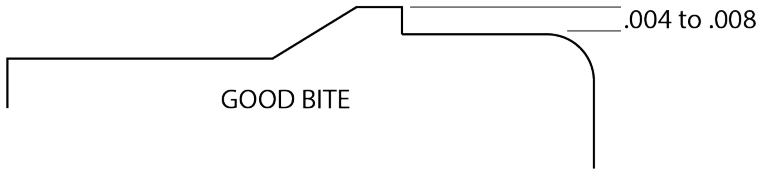
Figure 18 - Rupture Disc and Disc Flange

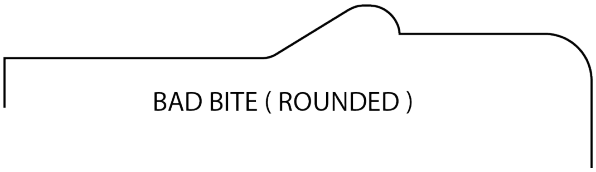
3.1.9 Rupture Disc Flange:

Look very carefully at the bite section of the bottom disc flange (Figure 18) that is contoured to hold the disc. No scratches, radial tool marks, nicks, burrs, or corrosion can be present in the groove or the disc will fail to maintain a pressure-tight seal. If dents, pits or gouges are observed, do not attempt to remove them by machining. Discard the flange and obtain a new one.

A good bite is smooth, uninterrupted 360°, raised, and will catch finger nail. If surface finish or bite feature wear cannot be determined by visual inspection, quantitative inspection may be performed.

Step feature should measure .004-.008” and surface finish should not exceed 32 Ra.





3.1.10 O-Rings

O-Rings 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 nonstandard sizes and are obtainable only from Midland.

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

3.2 Special Inspection Considerations

3.2.1 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.

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

3.2.3 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.

3.2.4 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.

NOTE: 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

4.0 Maintenance

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.

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

4.1 Retesting of Valves in Storage

Midland valves are factory set and sealed. If they have been left in their original shipping containers, are undamaged, and are not more than six months old, they may be installed without being retested.

4.2 Precautions for Mounted-Valve Repair

When performing maintenance on a pressure relief valve that is mounted on a railcar, observe the following precautions.

- 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 with a partner who can help you in the event of an emergency.
- Follow approved safety precautions for hazardous or toxic materials.

4.3 Required Tools

Obtain the required tools and supplies before attempting maintenance procedures.

Recommended Wrenches

SAE	METRIC	Component
3/4"	19 mm	1/2" top guide nut
7/8"	23 mm	5/8" top lock nut
15/16"	24 mm	3/4" top lock nut
1-1/16"	27 mm	Flats on small valve O-ring retainer, 5/8"

		mounting stud nuts
1-1/4"	32 mm	Flats on large valve O-ring retainer, 3/4" mounting stud nuts
1-7/16"	37 mm	mounting stud
5/16" Allen		3/8" HSCS (Rupture Disc Holder)
3/16" Allen		1/4" HSCS (Rupture Disc Holder)

Other Tools and Supplies

Screwdrivers	Vise Grips
Wheel puller	Lint-free cloth
	Emery paper (400 grit, cut in 1" strips)

4.4 Special Guidelines and Precautions on Pressure Testing and Adjustment

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.

Determining Applicable Pressure Values

Refer to AAR publication “Regulations for Tank Cars.” Appendix A applies specifically to valves. This section prescribes the start-to-discharge pressure (STD), the vapor tight pressure (VTP) and their tolerances.

NOTE: A “popping pressure” is not specified. It is only necessary to ascertain the STD pressure as pressure is increased, and to establish the vapor-tight pressure as pressure is being reduced. (STD is defined as a continuous discharge in contrast to the start-to-leak pressure, which is defined as the first bubble leak. Vapor-tight is defined as being bubble-tight.)

Test Stand and Gauge Requirements

It is recommended that the test stand have a mounting 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 date tagged.

4.5 Pressure Testing and Valve Adjustment Procedures

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

4.5.1 Valve Testing Procedure

4.5.1.1 Install the valve on the test fixture and tighten down all the nuts alternately. Remove the protective cap and discharge flue from the valve body (Fig. 5), if required.

4.5.1.2 Fill the valve body to the top surface of the retainer with water to allow bubble detection at the valve seat.

4.5.1.3 Take a position allowing observation of the pressure gauge and bubbling of air in the valve body.

4.5.1.4 Increase the test air pressure slowly.

4.5.1.5 Increase the air pressure until the valve STD is reached. The initial opening of the valve may be slightly high and not indicative of the actual STD because the O-ring may have been partially stuck to the valve seat.

4.5.1.6 Reduce the air pressure until leakage stops and then reduce pressure to less than one half of the STD pressure. Then slowly increase the pressure.

4.5.1.7 Observe the STD pressure and then bleed off the pressure slowly to observe the VTP.

4.5.1.8 Repeat this procedure at least two more times. The STD and VTP should be consistent in all three occurrences.

4.5.1.9 AAR Specifications state that the VTP is 80% of the STD. Valves with good seats and O-rings should exhibit a VTP above 80% of the STD (usually up to 95% of the STD).

4.5.2 Valve Adjustment Procedure

4.5.2.1 Remove the wire seal from the valve cap set screw. Loosen the set screw and remove the valve cap to expose the top nut (spring adjustment screw nut).

4.5.2.2 Loosen the top nut to allow rotation of the spring adjustment screw.

4.5.2.3 Loosen the spring adjustment screw two turns (counterclockwise).

4.5.2.4 Tighten the top nut to lock the setting. Make sure that the spring adjustment screw does not rotate when tightening the top nut.

4.5.2.5 Retest the valve STD and determine how much pressure change occurred when the adjusting screw was loosened two turns. Based upon this calculation, re-compress the valve spring and alter the valve adjustment for the midpoint in the STD tolerance range.

4.5.2.6 Retest the valve.

4.5.2.7 If the test results are erratic, trouble-shooting is more complex. Consult your super-vising engineer or a Midland representative.

4.5.2.8 When the test results are acceptable, tighten the top nut to a torque of 45 ±3 ft-lbs.

4.5.2.9 Reinstall the valve cap, tighten the set screw and install a new wire seal through the cap setscrew hole. Reinstall the discharge flue and the protective cap.

4.5.2.10 If the valve does not include a rupture disc, go to Post-test Procedures and perform them.

4.0 Maintenance (cont.)

Rupture Disc Holder Procedure:

4.5.2.11 Install the rupture disc holder. Install and tighten the 3/8" HSCS in 1/3 torque increments in a diagonally alternating sequence to a torque a torque specified by the gasket specifier.

4.5.2.12 Install the assembled combination valve on top at the test stand and bolt it in place. Screw the stud nuts down evenly.

4.5.2.13 If there is a needle valve (Fig. 19), pipe plug, or indicator on the side of the valve, open the needle valve or remove the plug or indicator. This is necessary to equalize pressure in the chamber above the disc.

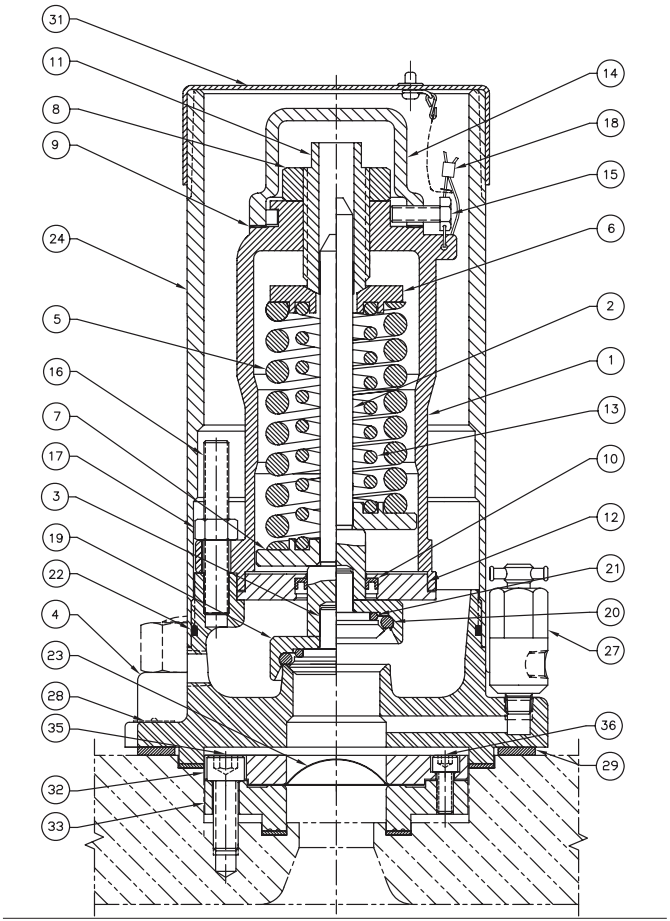


Figure 19 - Valve Components (Inspection)

4.0 Maintenance (cont.)

4.5.2.14 Slowly increase pressure in the test stand to 50% of the disc's burst pressure.

WARNING: Disc Damage
Do not permit the pressure to exceed 50% of the disc's rating (or the disc may be damage or distorted). For example, if the disc is rated at 100 psi, do not allow the pressure to exceed 50 psi.

4.5.2.15 Put leak solution over the bleed hole opening or needle valve outlet and around the circumference of the flange joint. A bubble may form initially that is only the result of the disc slightly deforming upward and displacing air in the chamber above it. After two (2) minutes, if there is no change in the size of the bubble, slowly vent the pressure from the test stand and unmount the valve.

4.5.2.16 If the bubble on the bleed hole or needle valve continues to grow in size, a pressure leak through the disc is indicated. Vent the pressure from the test stand, unmount the valve and unscrew the bolts securing the rupture disc holder to the plate. Loosen the 1/4" HSCS holding the top and bottom rupture disc flanges together.

CAUTION: Rupture Disc Damage
Rupture discs are made of very thin metallic films (only .001 or .002 thick). Handle the discs only by their edges and do not dent them.

4.5.2.17 Inspect the disc flanges for any imperfection as noted in section 3.0. If there is no visible cause for the leak, consult with your Midland representative. Do not reuse the rupture disc; replace with new.

[Section 4.5.2.18 has been eliminated]

4.5.2.19 Close the needle valve or reinstall the plug or indicator. Place the disc on the bottom flange and then place the top flange on top of the rupture disc holder assembly. Tighten the 1/4" HSCS in 1/3" torque increments in a diagonally alternating sequence to a torque of 7ft-lbs (84in-lbs) regardless of bolt material of construction. After rupture disc holder assembly is assembled together, install rupture disc holder per 4.5.2.11.

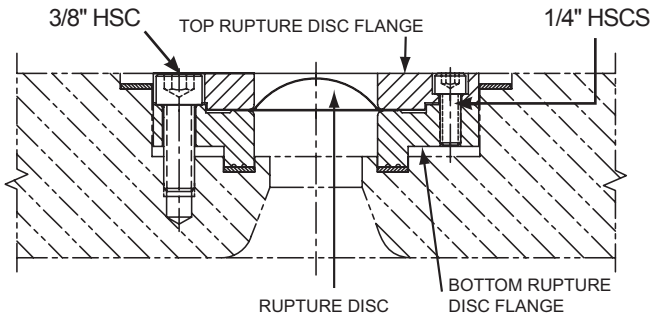


Figure 20 - Rupture Disc and Disc Flange

Post-test Procedures

4.5.2.20 After testing the valve, close the pressure inlet valve to the test chamber, vent the pressure in the test stand. Remove putty and drain water. Then remove the valve from the test fixture.

4.5.2.21 Wipe or blow away any remaining soap suds and water used in the testing.

4.5.2.22 Install a plastic protector over the valve body tongue to prevent tongue damage.

WARNING: Tongue Damage
A damaged valve tongue may prevent proper sealing on the tank-car mounting and result in leakage of the tank contents.

4.5.2.23 Apply an appropriate preservative or paint to the exterior of the valve. Be sure to mask the nameplate so that it will be readable afterward.

CAUTION: Mounting Interference
DO NOT paint the sealing surfaces of the valve that will contact the manway cover plate surfaces or valve cocking may result.

4.5.2.24 Permanently attach a metal tag to the valve body with repair/test date, repair facility identification and technician I.D.

4.5.2.25 Store the valve in a clean, dry place until ready to use.

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