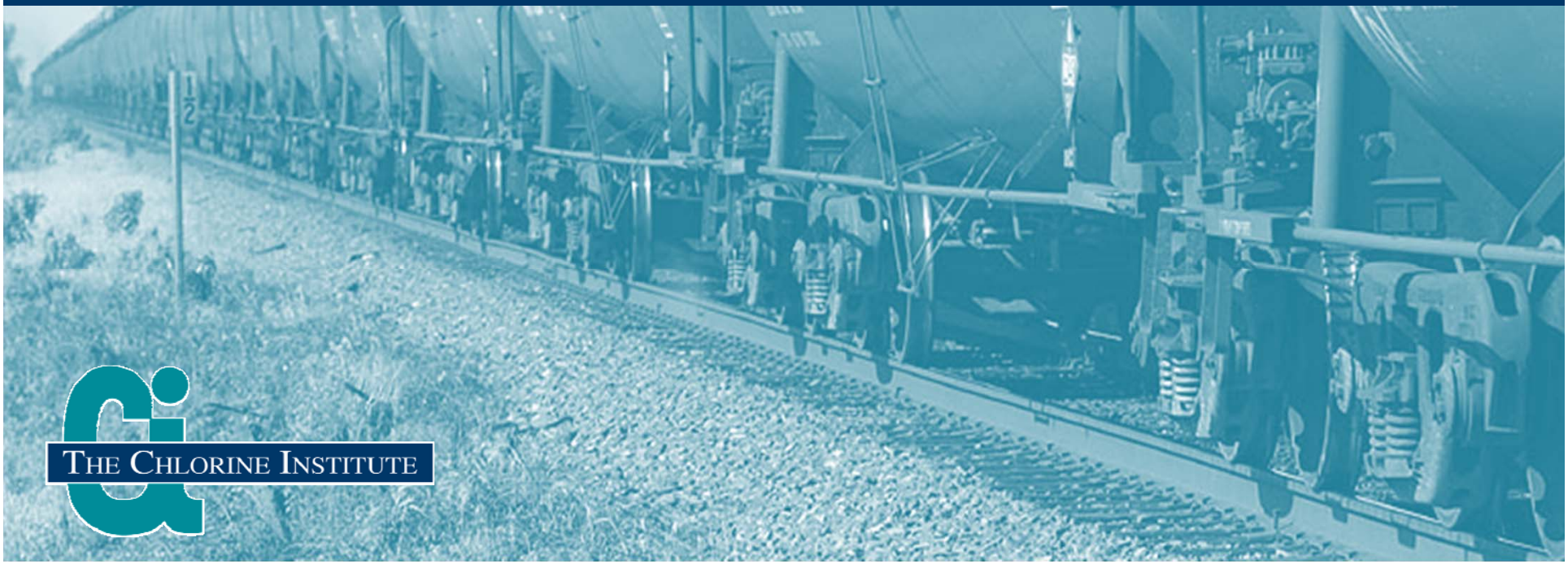
FRA Hazmat Seminar

Houston, TX

August 21-23, 2018

Best Practices for Securing Tank Cars Used to Transport Chlorine, Caustic & Hydrochloric Acid



THE CHLORINE INSTITUTE

Why should we be concerned with NARs?

SAFETY FIRST!

Preventing NARs should be a top priority to ensure protection of the public and our own personnel.

Additional costs of NARs

- Medical costs for personnel exposures
- Environmental clean-up
- On-going environmental monitoring
- Railroad fines - assessed fines and charges for operational upsets
- Disruption in facility operations
- Lost utilization of tank car
- FRA fines
- Lawsuits
- Damaged public perception

Shipper of Record

The party preparing and offering a tank car for transport becomes the ***shipper of record***

Proper securement is the responsibility of the shipper of record

CI Transportation Incident Goals

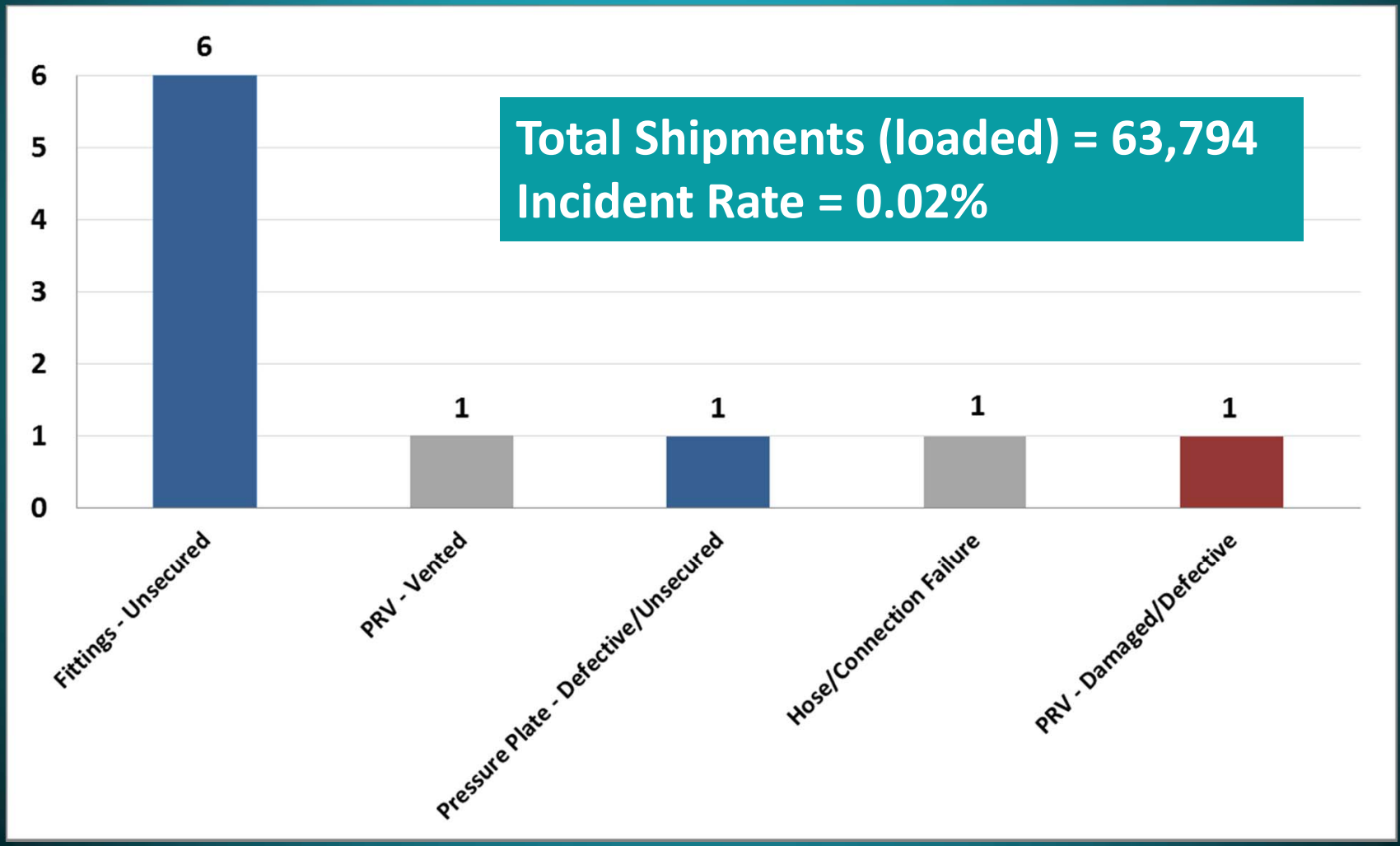
<u>Long-Term:</u> ZERO releases

<u>Intermediate:</u> Continued reduction of transportation incidents while aiming for zero.

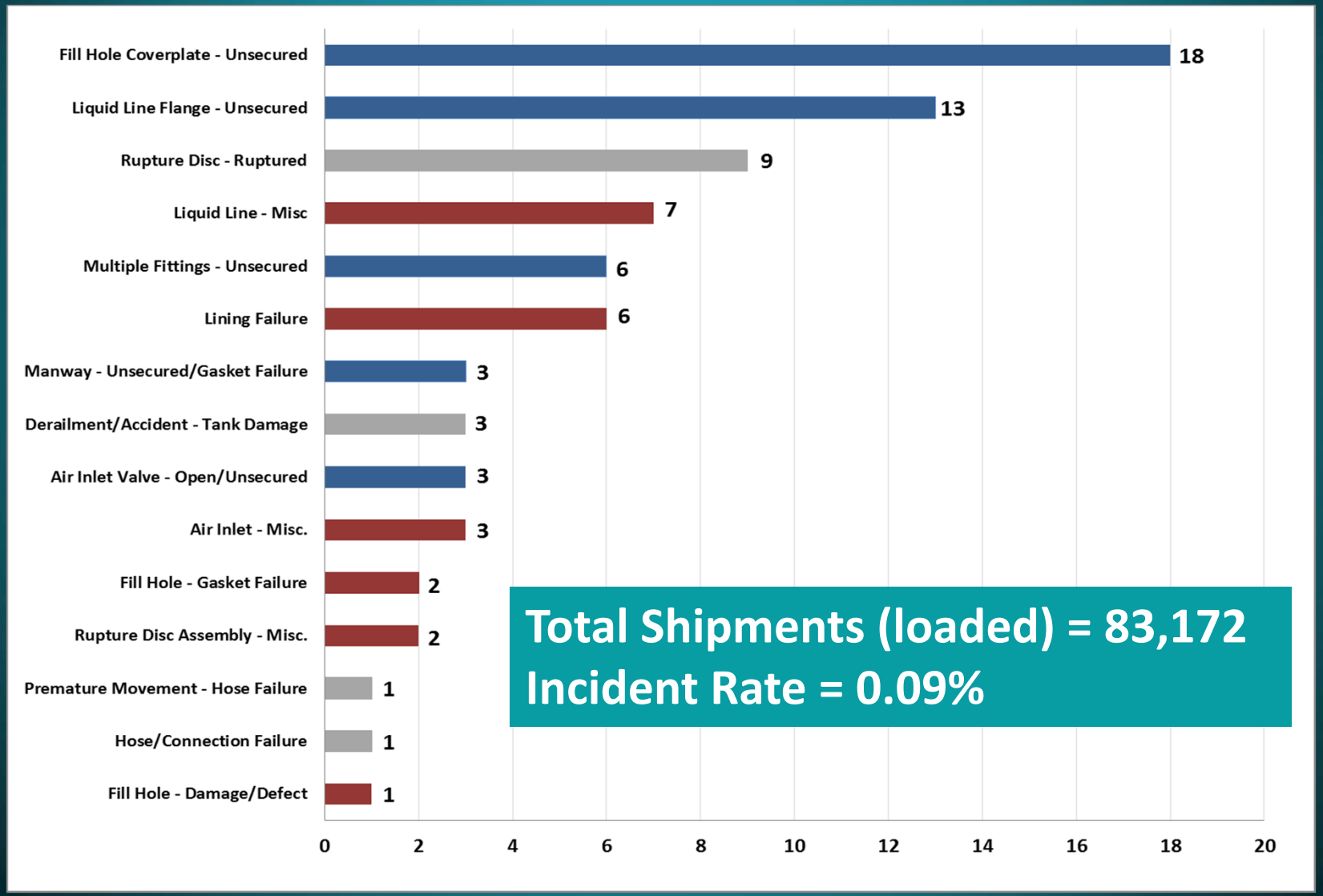
- ***Analyze 3-year cumulative periods***
- ***Focus on top two or three causes for each product/mode***
- ***Prioritize based on risk and/or recent efforts***

<u>Annual</u>: Focused efforts based on trends identified

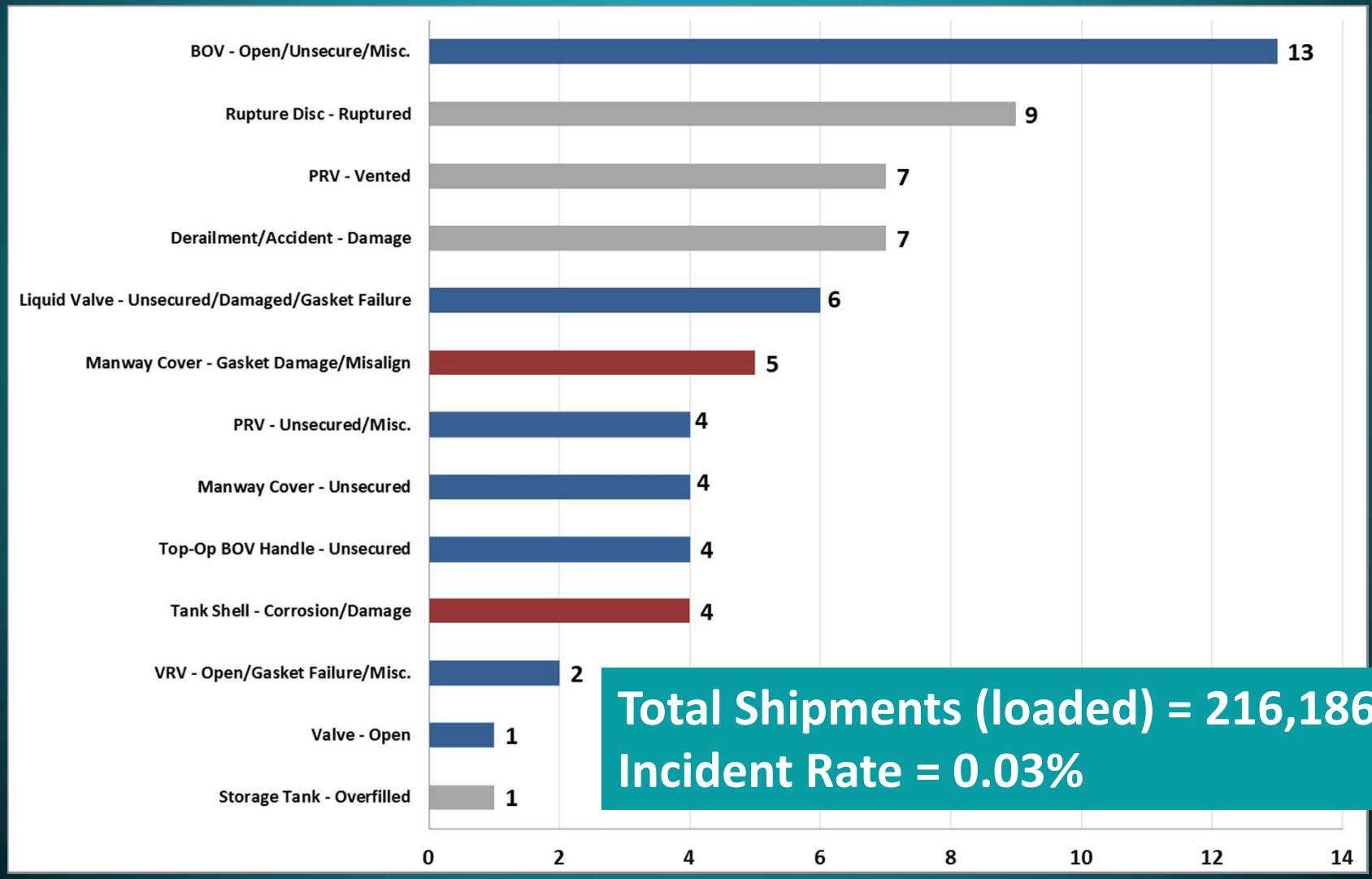
Chlorine Tank Car Incidents 2015-2017



Hydrochloric Acid Tank Car Incidents 2015-2017



Caustic Tank Car Incidents 2015-2017



Total Shipments (loaded) = 216,186
Incident Rate = 0.03%

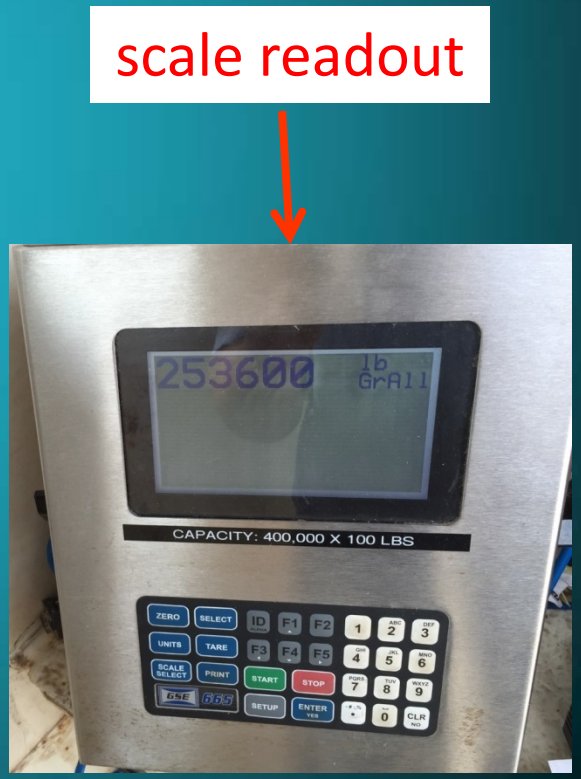
Best Practices for Preventing NARs

Always use a checklist to document the leak check and securement process

Be sure procedures / checklist include the following important steps

Best Practices for Preventing NARs

1. Confirm quantity of product in tank car to ensure that the car is not overloaded.



Best Practices for Preventing NARs

2. Inspect valves, closures, fittings gaskets and fasteners for damage, defects or foreign matter.

Chlorine

(Pressure Car – DOT 105)

- **Liquid valves**
- **Vapor Valves**

Hydrochloric Acid

(Non-Pressure Car – DOT 111 – no insulation/jacket)

- **Liquid Line**
- **Air Inlet Valve**
- **Fill Hole**

Caustic

(Non-Pressure Car – DOT 111 – insulation/jacket/exterior heater coils)

- **Liquid Valve**
- **Air Inlet Valve**
- **Hinged and Bolted Manway**
- **Bottom Outlet Valve**
- **Top-Operating Handle for BOV (if installed)**

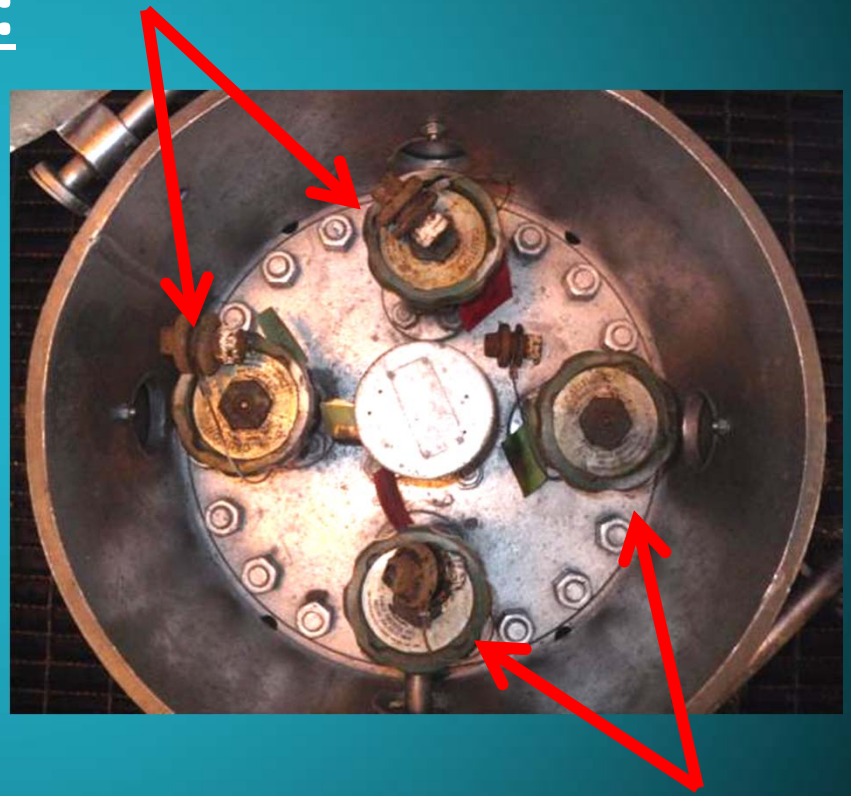
Best Practices for Preventing NARs

Chlorine Tank Cars

Chlorine Tank Cars

<u>Check valves for leaks by:</u>

- Closing the valves
- Leave ***the plugs out***
- Be sure to check all valves for leaks, even if not used during the process
- Use aqua ammonia vapor to check for leaks



Chlorine Tank Cars

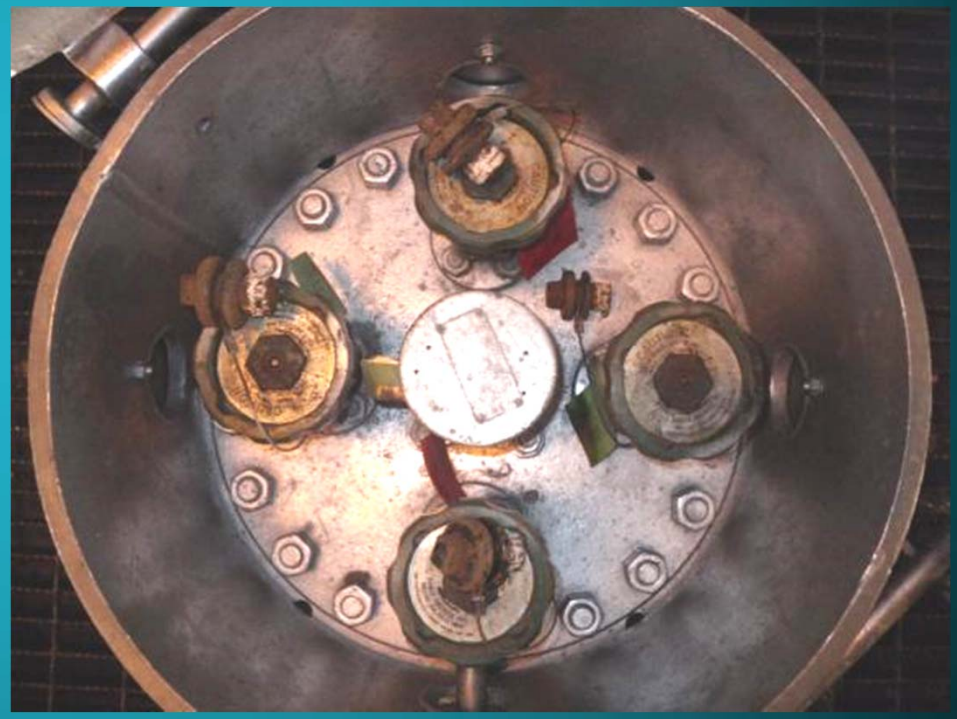
Aqua ammonia leak checking tips

- ✓ It is recommended to use a 10-30% lab grade aqua ammonia (ammonium hydroxide) solution.
- ✓ Use a squeeze bottle with a tube that extends ***only*** into the vapor space of the bottle
- ✓ When checking for leaks, always use fumes. ***Never*** use a liquid stream.
  - If there is a leak , the liquid will make the leak worse

Chlorine Tank Cars

- Wait as long as possible before doing the leak check (8-24 hours suggested).
- Leave the plugs out

This will allow the smallest of leaks to be detected



Chlorine Tank Cars

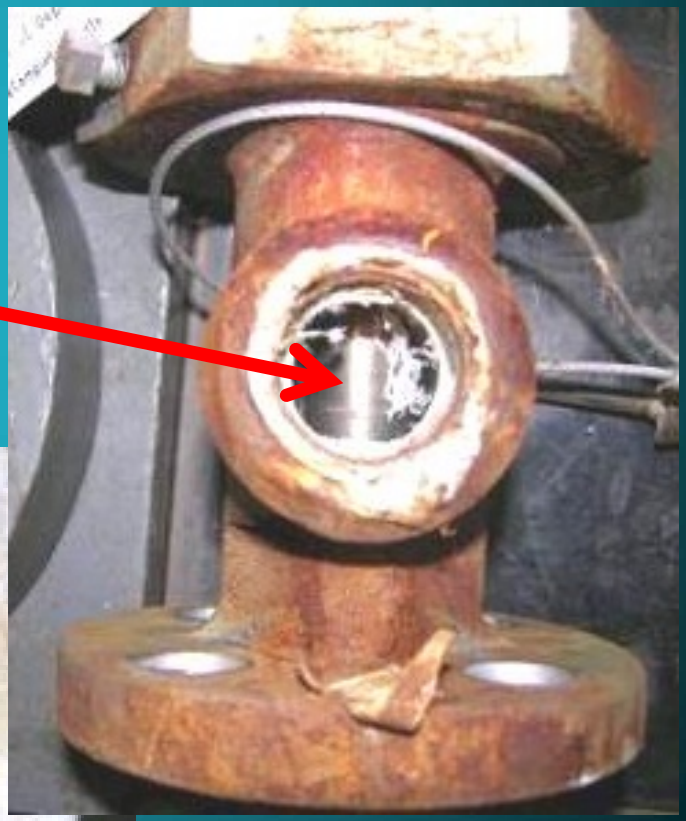
Thoroughly inspect and clean the threads on valve inlets and plugs

- Rusty threads can create torque before sealing
- Mark threads in poor condition and contact supplier

Chlorine Tank Cars

Use of Teflon® tape on stabber pipes or plugs is not generally recommended

- Tape debris can get caught in the valve seat and threads
- Can prevent proper sealing



Chlorine Tank Cars

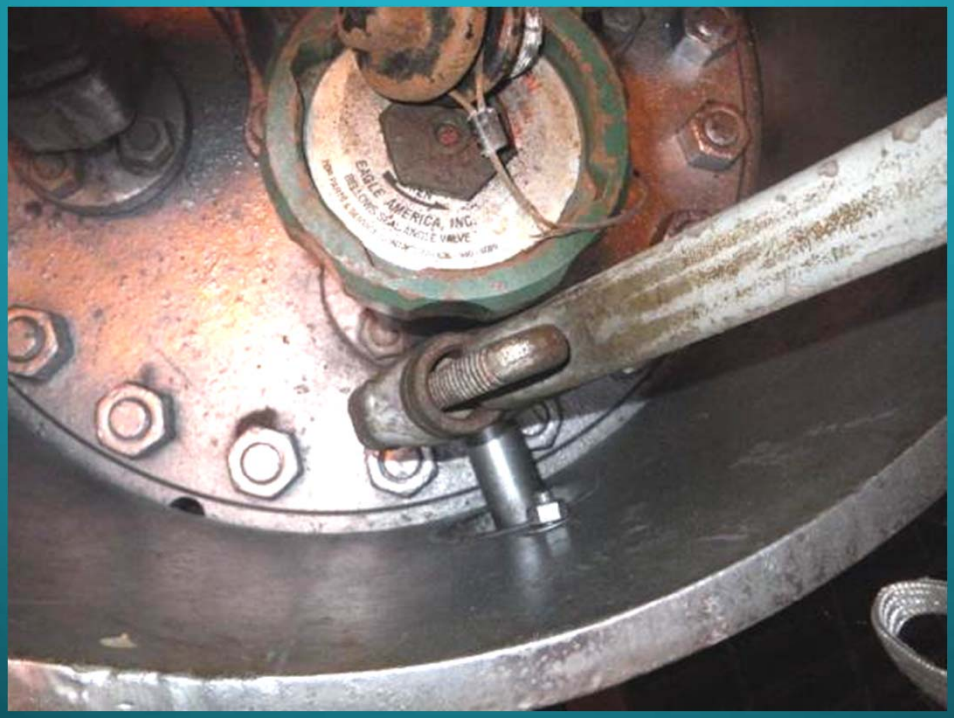
Known acceptable sealing lubricants that are compatible with chlorine:

- ✓Fluorolube® grease grade GR-470 (0 to 300 °F)
- ✓Fluorolube® grease grade GR-362 (-40 to 300 °F)
- ✓ Krytox® grade GPL-205 grease

Chlorine Tank Cars

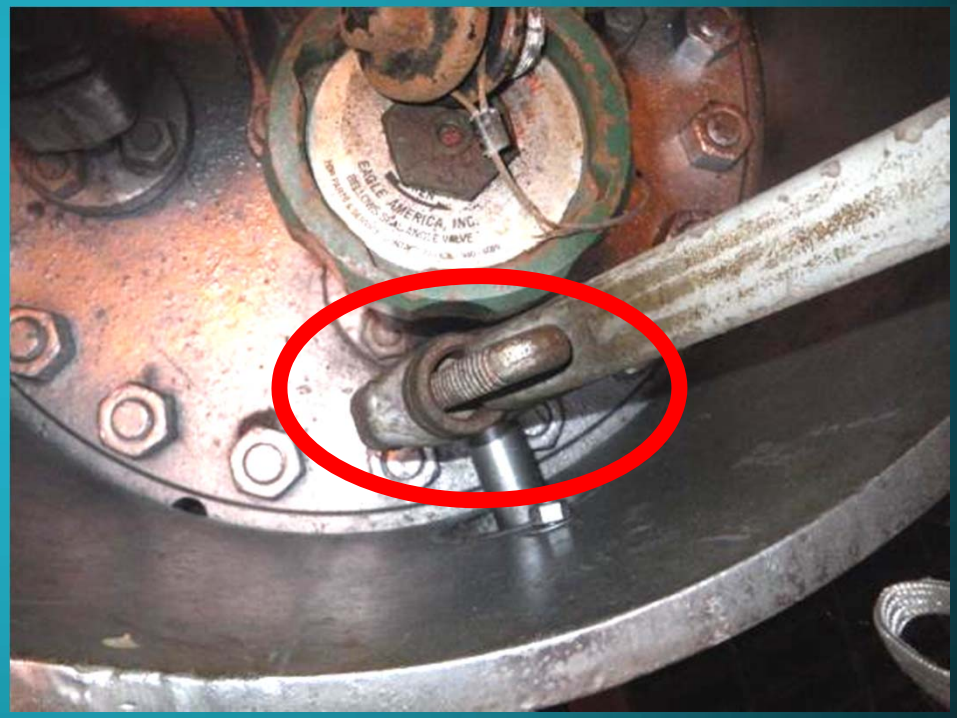
Re-install valve plugs

- ***Always use a wrench to apply plugs.***
- ***Plugs MUST be tool tight .***



Chlorine Tank Cars

Check all valves again to make sure they are **completely** closed ***after*** installing the plugs.



The wrench can bump the valve handle open slightly.

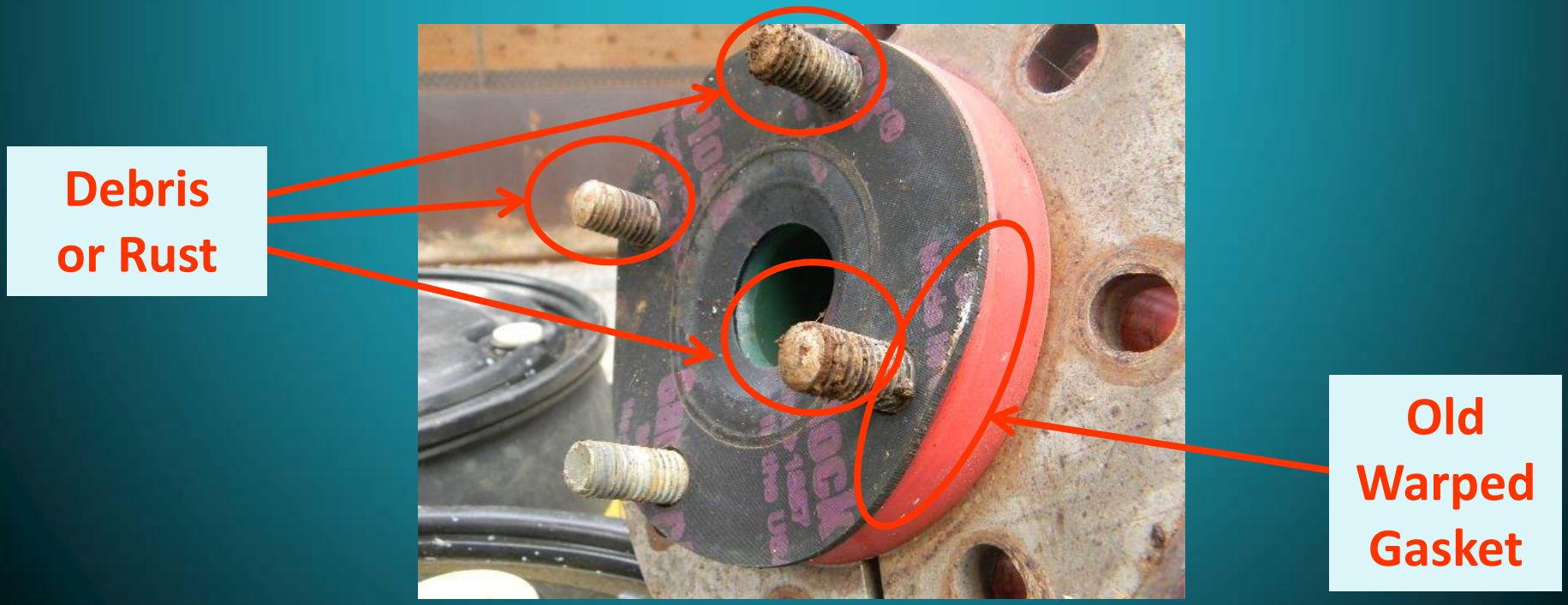
Best Practices for Preventing NARs

Hydrochloric Acid Tank Cars

Hydrochloric Acid Tank Cars

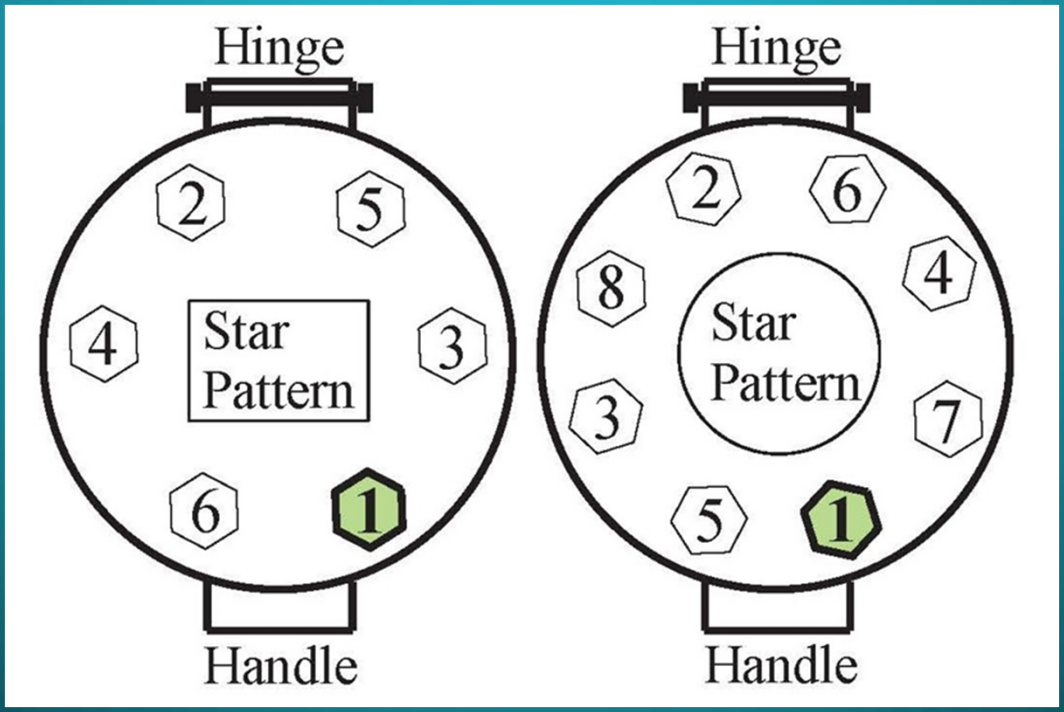
Inspect and clean gaskets and fasteners on valves, closures and other fittings.

Replace damaged or old gaskets and fasteners



Hydrochloric Acid Tank Cars

Verify that all fasteners are tightened by using proper torquing methods (crisscross pattern)



Hydrochloric Acid Tank Cars

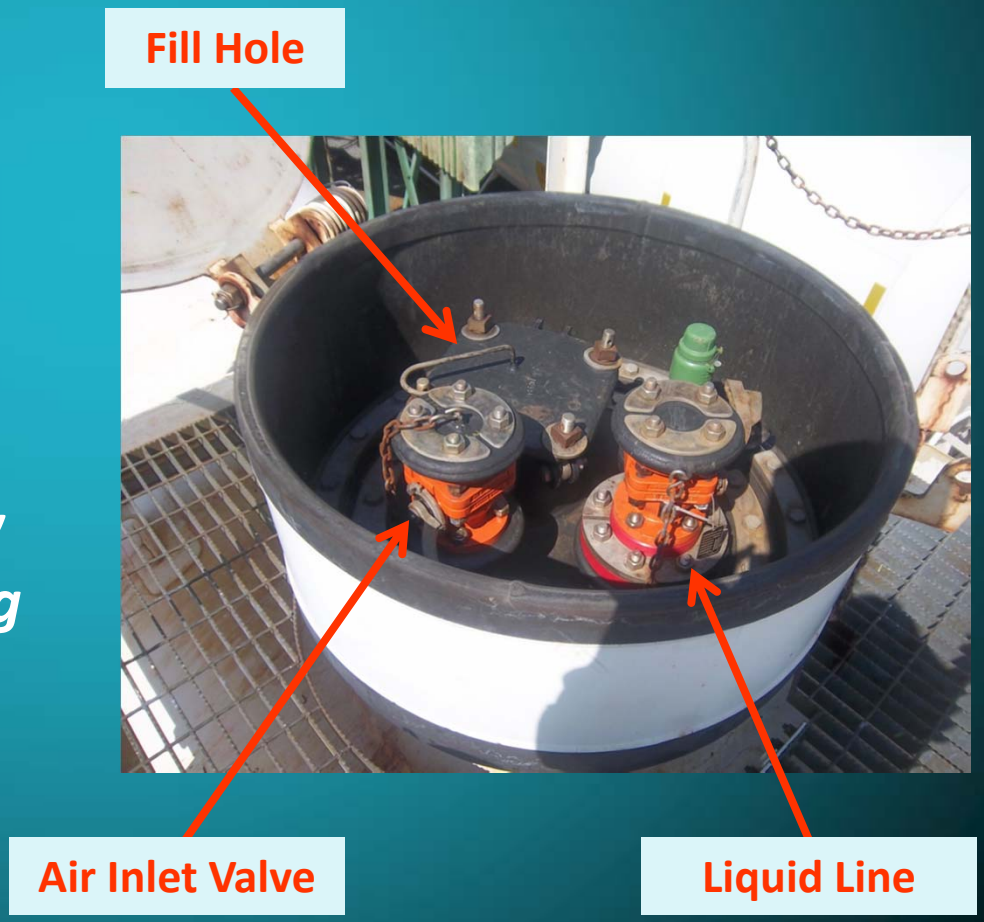
The use of segmented washers is recommended to help ensure proper torquing and securement of fasteners.

Hydrochloric Acid Tank Cars

Verify that all valves, closures and other fittings are closed:

- Close the valves
- Install and fasten fill hole cover
- Close/fasten all other openings to tank car

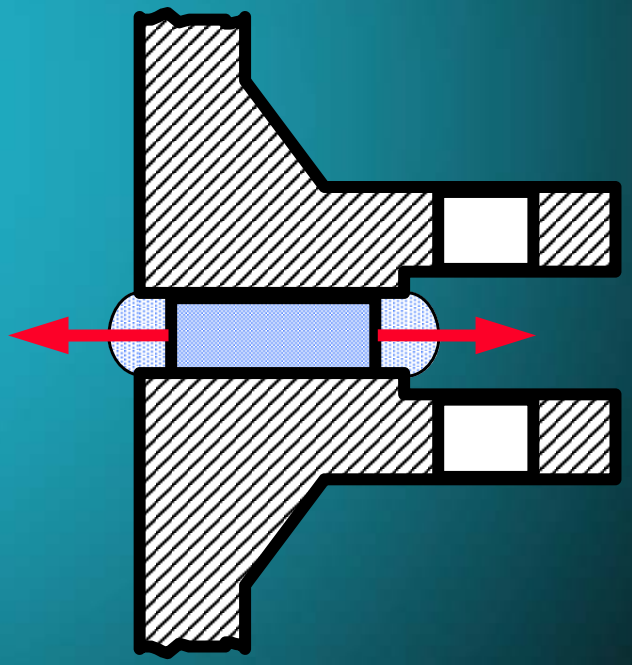
Ensure all openings to the tank cars closed, even if they were not used during loading or unloading.



Hydrochloric Acid Tank Cars

When securing HCl railcar closures and fittings, allow for rubber relaxation (creep/cold flow)

- Typical for newer rubber
- Tighten multiple times until relaxation no longer appears to be present
- One final time should be immediately prior to shipping



Hydrochloric Acid Tank Cars

Natural Rubber Lining

Lining/Coating alternatives for various acid car fittings

UHMW PE Flange Faces & PVDF Coating

PTFE Coating

TranZcoat Coating

Hydrochloric Acid Tank Cars

Leak check all fittings. Common methods/solutions used:

- Aqua Ammonia Solution
- Bubble Leak Solution

Leak check with aqua ammonia shown here

General leak checking tip: Wait as long as possible (8-24 hours suggested) before doing the leak check.

This will allow the smallest of leaks to be detected

Hydrochloric Acid Tank Cars

Bubble Leak Checking Tips:

- Application of solution can be any suitable method.
- Be sure to reference and follow your company's procedures.

Hydrochloric Acid Tank Cars

Some commercial grade bubble leak check solutions include:

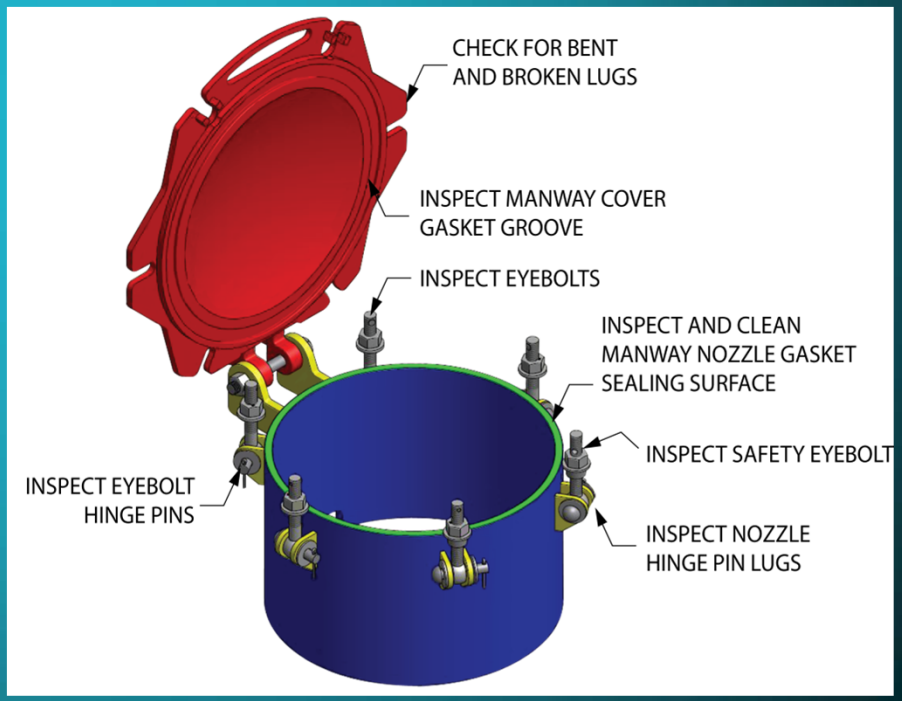
- Snoop® by Swagelok Company
- Leak-Tec® by American Gas & Chemical Co.
- Sherlock® by Winton Products Company, Inc.
- Big Blu® and Super Blu®, both by Refrigeration Technologies
- Trax by Highside Chemicals, Inc.
- D'Tec by Highside Chemicals, Inc.

Best Practices for Preventing NARs

Caustic Tank Cars

Caustic Tank Cars

Inspect hinged & bolted manway gasket and eyebolts for damage, defects or foreign matter.



Caustic Tank Cars

Hinged & Bolted Manway Gasket Inspection

- **Inspect gasket for:**
  - **Dirt**
  - **Debris**
  - **Cuts**
  - **Tears**
  - **Gouges**
  - **Pits**
  - **Scratches**
  - **Other defects**
- **Clean dirt and debris from gasket**
- **Replace gasket (in kind) if damage or defects are present**
- **Ensure manway cover sealing surface is clean and free from damage**
- **Contact your caustic supplier, if needed**

Caustic Tank Cars

Hinged & Bolted Manway Gasket Inspection

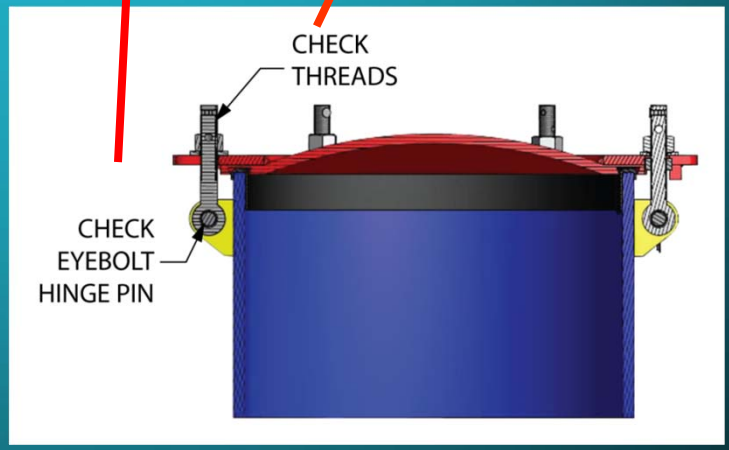
New Gasket

Damaged Gaskets

Caustic Tank Cars

Hinged & Bolted Manway Eyebolt Inspection

- Inspect eyebolt, threads, nuts and washers for:
  - Dirt
  - Corrosion
  - Fatigue
  - Cracks
  - Stripping (threads)
  - Other wear
- Ensure eyebolts are same diameter
- Ensure nuts are same shape
- Ensure eyebolt hinge pins are not missing or damaged
- Clean dirt and debris



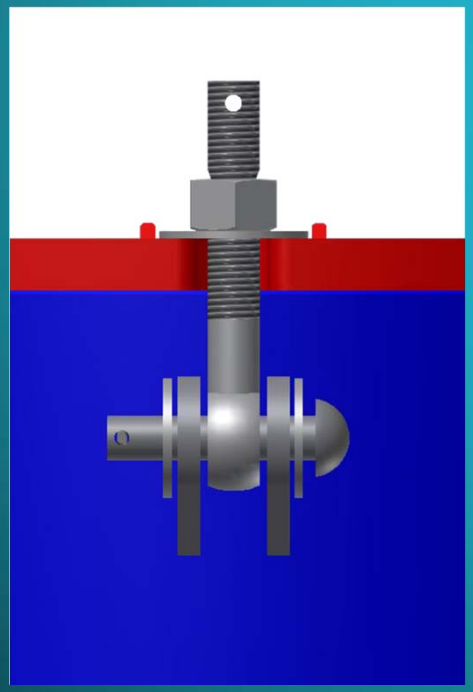
Caustic Tank Cars

Cleaning Eyebolt Threads with Wire Brush

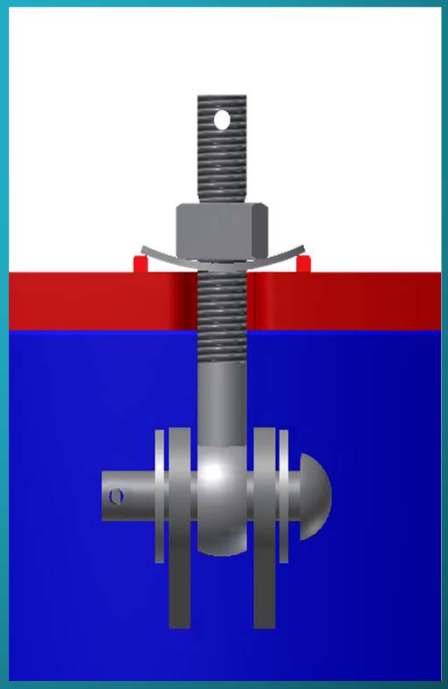
Caustic Tank Cars

Eyebolt Washer Fit

Correct washer fit

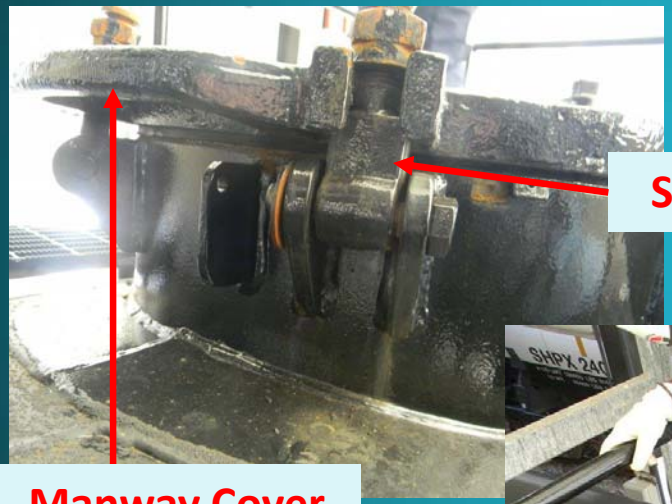


Incorrect washer fit



Caustic Tank Cars

Manway *Safety* Eyebolt



Safety Eyebolt

Manway Cover Handle

Safety eyebolt slightly loose in place with nut still attached.

Safety eyebolts still in place.

All other eyebolts unthreaded from cover.

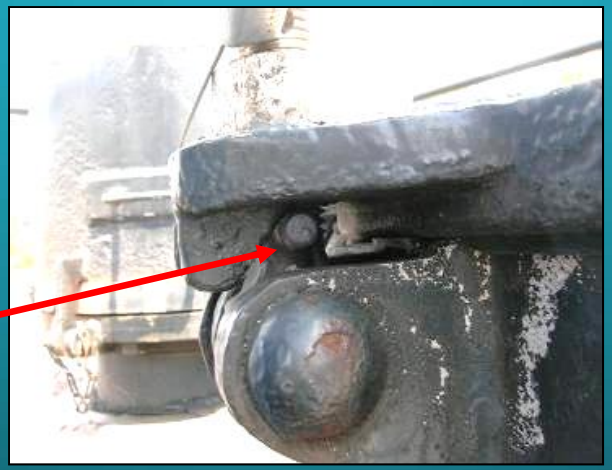
Operator slightly opening manway to verify little or no pressure

Caustic Tank Cars

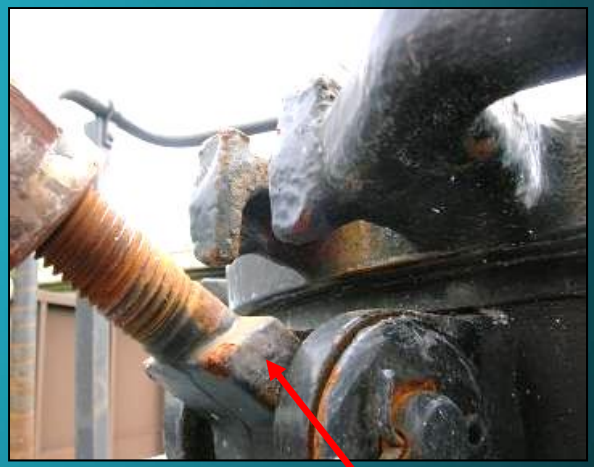
Safety Eyebolt Inspection

Collar Style

Pin Style



Wedge Style



Caustic Tank Cars

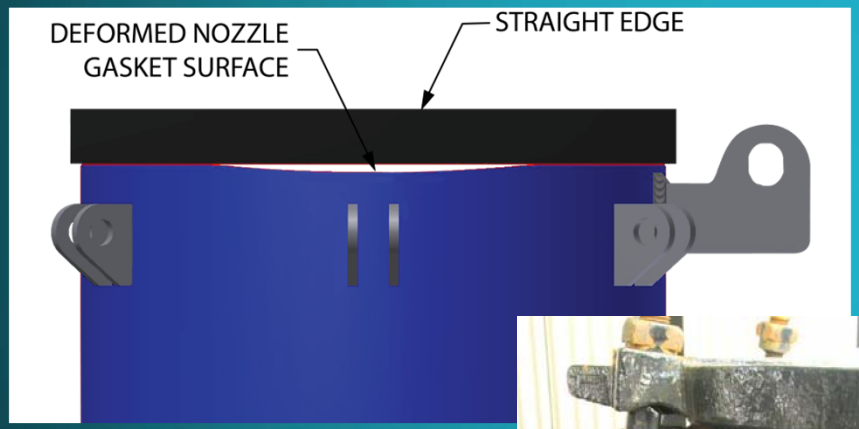
Hinged & Bolted Manway
Eyebolt Inspection

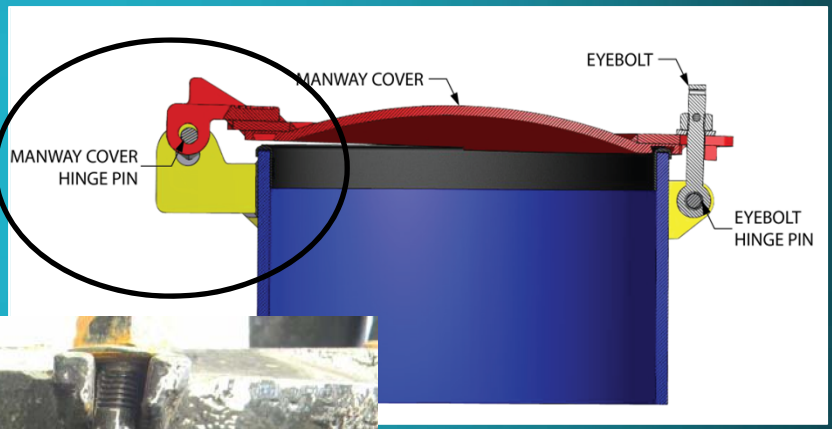
Replace eyebolts, nuts and/or washers if:

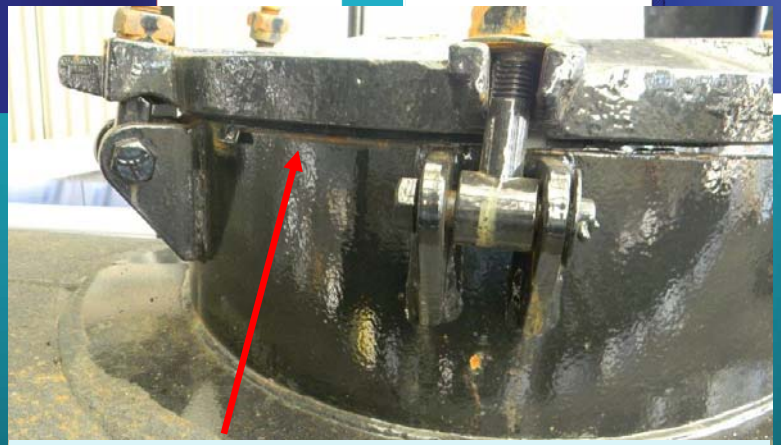
- Missing parts have been identified
- Eyebolts are a different size than they should be
- Nuts are a different shape than they should be (square or hex)
- Enough damage to prevent effective securement

Caustic Tank Cars

Check for manway alignment issues



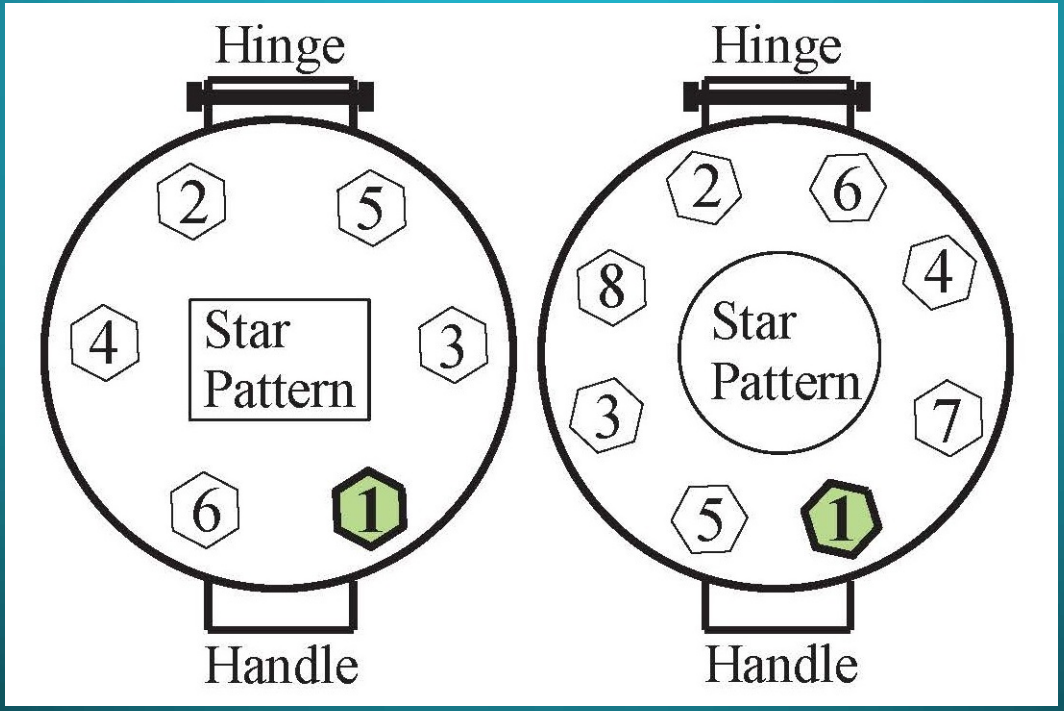




Manway cover, gasket and nozzle in alignment with a good seal.

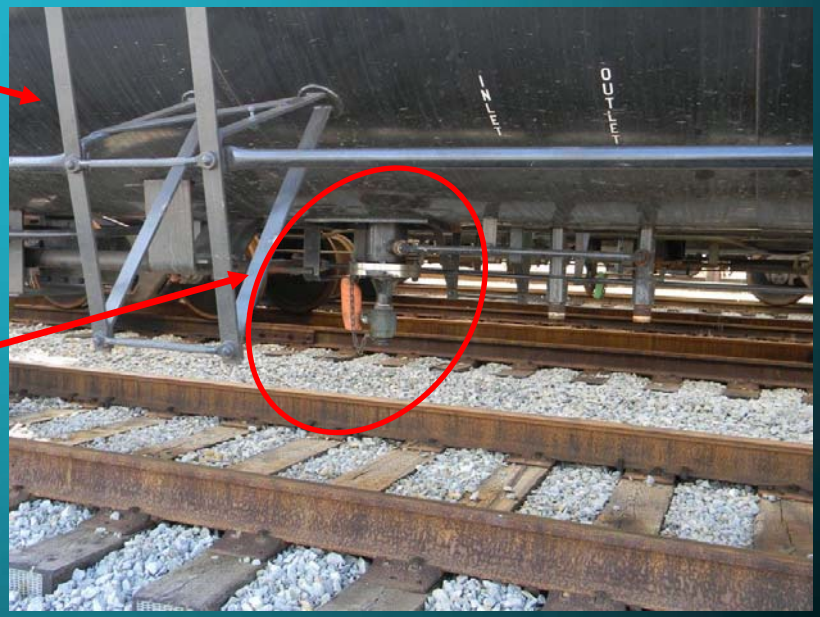
Caustic Tank Cars

Verify that all fasteners on the hinged manway are in place and tightened by using proper torquing methods



Caustic Tank Cars

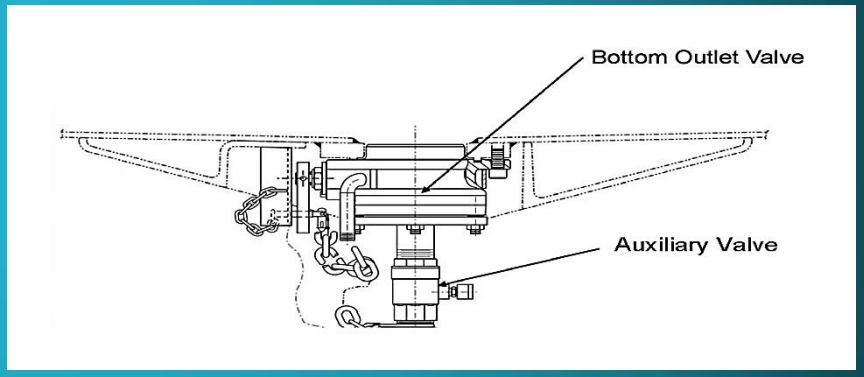
Ensure the bottom outlet valve is properly secured



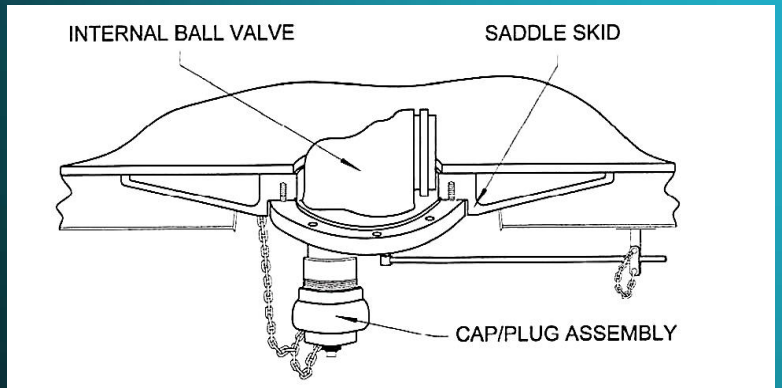
Caustic Tank Cars

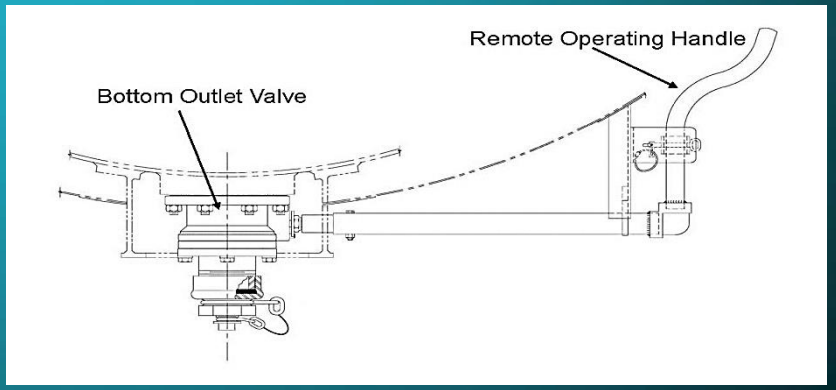
Various Bottom Outlet Valve Arrangements

External
Bottom Outlet Valves



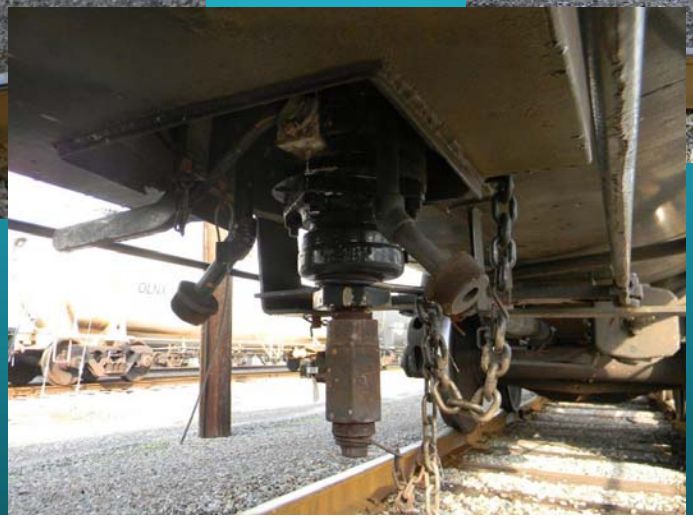
Internal
Bottom Outlet Valve





Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)



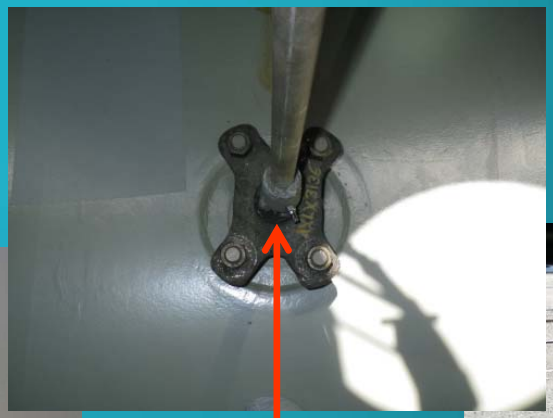
Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)

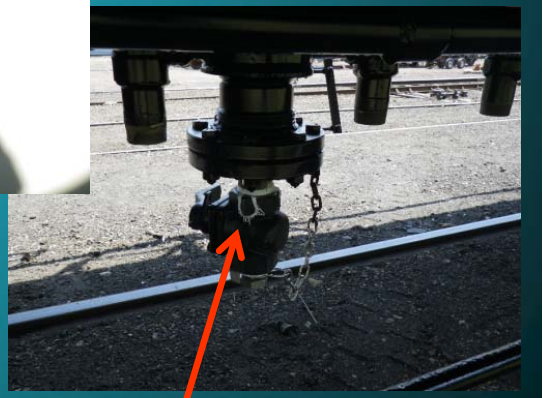
Top-Operated, Internal BOV with External Auxiliary Valve:

Top-Operating Handle

Internal Valve Stem



Valve Stem Connection to Internal BOV



External Auxiliary Valve

Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)

New BOV handles must be:

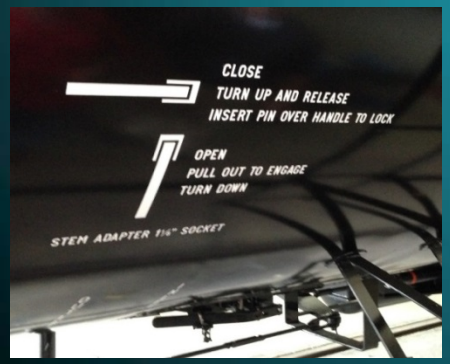
- Stowed separately;
- Located completely within the skid; or
- Disengaged from valve when in the closed position.

More details can be found in AAR M-1002, Appendix E, 9.1.2.8

Caustic Tank Cars

Various Bottom Outlet Valve Arrangements (cont.)

Examples of Disengaging BOV Handles



Example of Detachable BOV Handle

Caustic Tank Cars

Leak check all service equipment:

- Check for leaks on all service prior to shipment, even if not used during the process.
- Wait as long as possible to check for leaks again prior to shipping.
- Ensure all fasteners are tool tight.

Caustic Tank Cars

Example of pressurizing tank car for leak check

Example of leak checking fittings with leak test solution

Caustic Tank Cars

Some commercial grade leak check solutions include:

- Snoop® by Swagelok Company
- Leak-Tec® by American Gas & Chemical Co.
- Sherlock® by Winton Products Company, Inc.
- Big Blu® and Super Blu®, both by Refrigeration Technologies
- Trax by Highside Chemicals, Inc.
- D'Tec by Highside Chemicals, Inc.

Best Practices for Preventing NARs

3. Ensure that pressure relief devices are properly secured and free of leaks

Pressure Relief Device
(Chlorine – Combination)

Rupture Disc Housing
(Non-pressure – Non-reclosing)

Pressure Relief Valve
(Non-pressure – Reclosing)

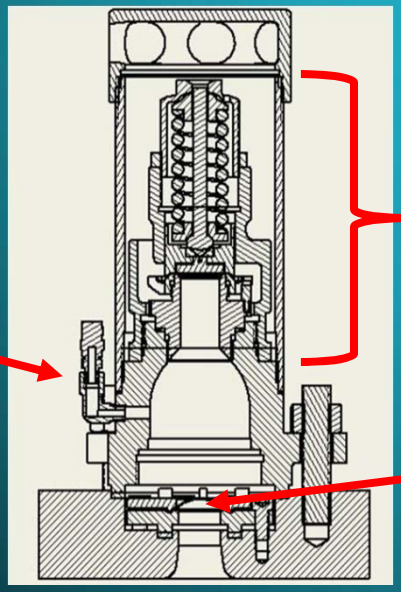
Chlorine Tank Cars

Combination Pressure Relief Devices (PRDs)

Reclosing valve & non-reclosing rupture disc

- Crosby (JQ-RD-375)
- Midland (A-1402, A-14377, A-14378)

Sample Crosby Design

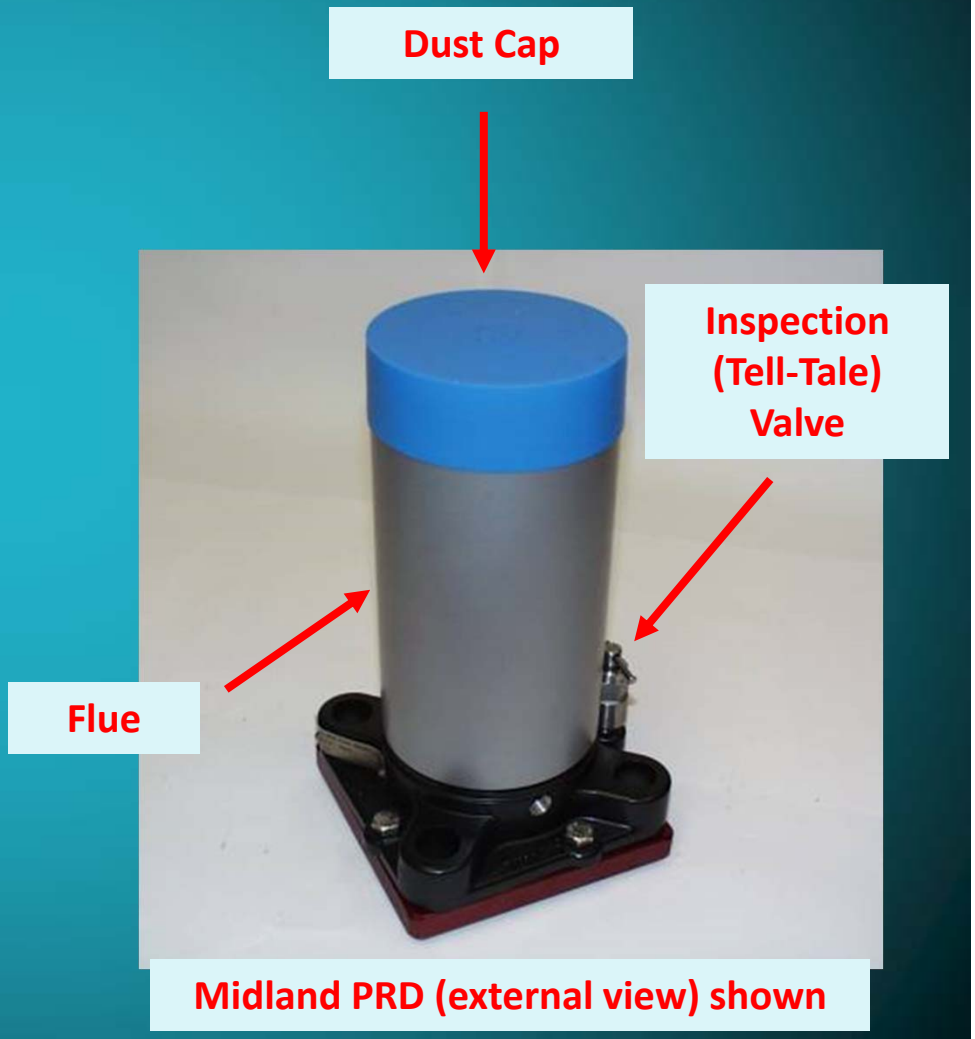


Sample Midland Design

Chlorine Tank Cars

Inspect PRD, including tell-tale valve, prior to shipment.

- If leak detected around bolts, tighten bolts
- If leak detected from tell-tale valve,
  - Close valve
  - Contact supplier



Hydrochloric Acid & Caustic Tank Cars

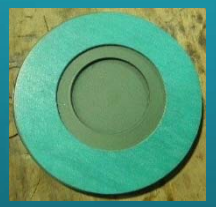
Pressure Relief Device Options

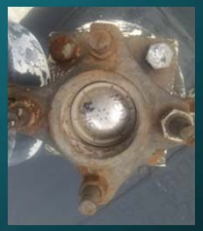
Hydrochloric Acid

Caustic

Reclosing Safety Valve

Rupture Disc Assembly





Hydrochloric Acid & Caustic Tank Cars

If the car is equipped with a rupture disc, careful inspection of the disc and its assembly are required:

- If a cable seal is in place on the rupture disc assembly, cut or remove it;
- Remove the assembly's cap;
- Inspect both sides of the rupture disc;
- Re-apply and tighten the cap; and
- Install a new cable seal, if needed

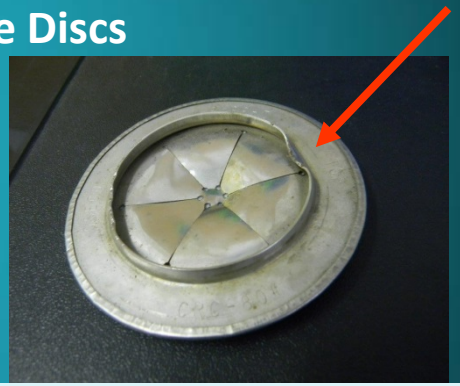
Hydrochloric Acid & Caustic Tank Cars

Rupture Disc Inspection

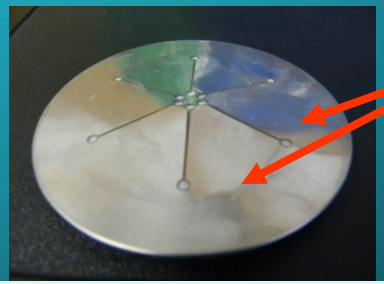
Unaltered Rupture Disc

Examples of Blown or Damaged Rupture Discs

Blown Rupture Disc



Dented Rupture Disc Lip



Dented Rupture Disc

Caustic rupture discs shown for example.

Hydrochloric Acid & Caustic Tank Cars

After inspection, ensure proper assembly and securement of the rupture disc

- Ensure disc is installed with proper flow direction (non-unidirectional discs)
- Follow OEM assembly and installation instructions

Hydrochloric Acid & Caustic Tank Cars

Sample Rupture Disc Assembly Instructions for Hydrochloric Acid Tank Cars

INSTALLATION INSTRUCTIONS FOR RUPTURE DISCS IN SALCO QUICK INSPECTS

To inspect the rupture disc and gaskets:

1. Remove the top cap, the rupture disc securement cap and rupture disc.
   a. Inspect the rupture disc (Figure 2).
   Replace disc if it is missing a white gasket, or a clear teflon gasket, any signs of discoloration or if the disc is blown.
2. Remove the Hazarsolve surge protector and the surge protector gasket. If the surge protector and surge protector gasket are located underneath the body, please skip this step.
   a. Inspect the surge protector gasket for defects and replace if necessary.
   Gasket defects may include: stretching, mis-shaping, flattened or missing. Replace and/or install as necessary.

Reinstall the components in this order (Figure 1):

3. 1/8" thick, narrow gasket - surge protector gasket (Salco P/N: QI261G6)
4. Hazarsolve Surge protector
5. 1/32" thin, wide gasket - rupture disc gasket (Salco P/N: QI261RDG6)
6. Rupture disc. DO NOT REMOVE ANY CLEAR TEFLON OR WHITE GASKET FROM THE DISC (Figure 2)
   Make sure that rupture disc is centered in housing.
7. Replace the rupture disc securement cap. Tighten until it is HAND tight.
8. Using the SALCO Quick Inspect Wrench (blue wrench, Figure 4) - lay the wrench across the tabs (Figure 3) and make 1/4 turn.
   If you do not have a Quick Inspect Wrench, place a 3/8" flat bar across the set of tabs. With a rubber mallet, tap the bar so it makes 1/4 turn
   DO NOT OVERTIGHTEN - over tightening can distort the disc and may affect performance. The ring around the cap is supposed to spin around.
9. Install the top cap HAND TIGHT.
10. Perform leak test.
    If there is a leak, re-check all gaskets, disk and assembly and then re-test. If there is a leak after the second test, please contact PVS to schedule mobile crew for assistance.

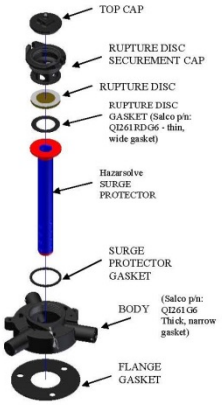
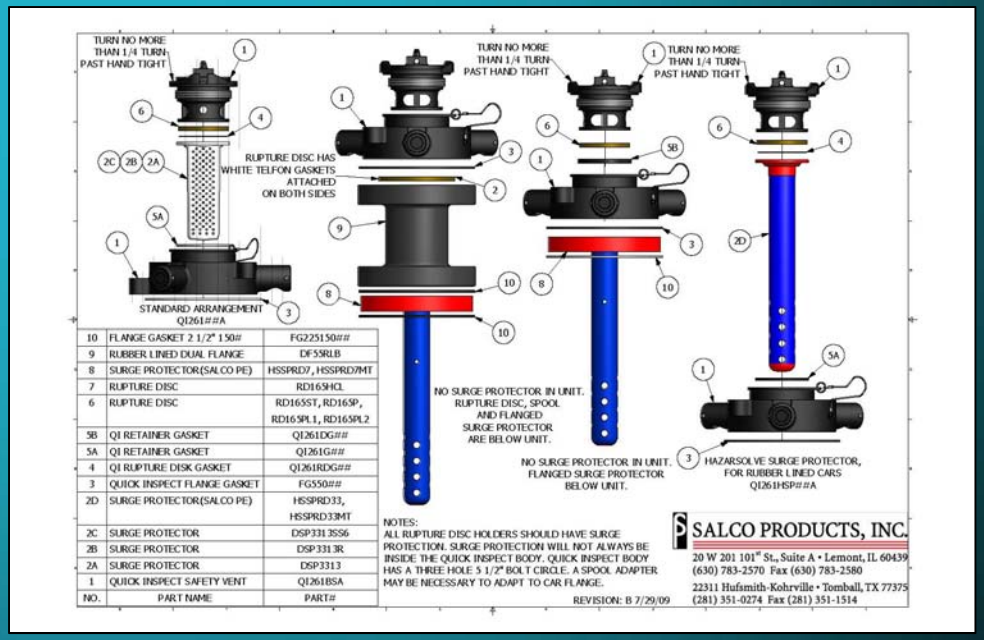


Figure 2
Salco Part # RD165PL2
Oseco 165 psi Ryton disc with teflon liner both sides, 3-1/8" OD

Figure 4
Quick Inspect Wrench

Figure 3



NO.	PART NAME	PART#
10	FLANGE GASKET 2 1/2" 150#	FG225150##
9	RUBBER LINED DUAL FLANGE	DF55RLB
8	SURGE PROTECTOR(SALCO PE)	HSSPRD7, HSSPRD7MT
7	RUPTURE DISC	RD165HCL
6	RUPTURE DISC	RD165ST, RD165P, RD165PL1, RD165PL2
5B	QI RETAINER GASKET	QI261DG##
5A	QI RETAINER GASKET	QI261G##
4	QI RUPTURE DISK GASKET	QI261RDG##
3	QUICK INSPECT FLANGE GASKET	FGS50##
2D	SURGE PROTECTOR(SALCO PE)	HSSPRD33, HSSPRD33MT
2C	SURGE PROTECTOR	DSP3313SS6
2B	SURGE PROTECTOR	DSP3313R
2A	SURGE PROTECTOR	DSP3313
1	QUICK INSPECT SAFETY VENT	QI261BSA

NOTES:
ALL RUPTURE DISC HOLDERS SHOULD HAVE SURGE PROTECTION. SURGE PROTECTION WILL NOT ALWAYS BE INSIDE THE QUICK INSPECT BODY. QUICK INSPECT BODY HAS A THREE HOLE 5 1/2" BOLT CIRCLE. A SPOOL ADAPTER MAY BE NECESSARY TO ADAPT TO CAR FLANGE.

REVISION: B 7/29/09

SALCO PRODUCTS, INC.
20 W 201 101st St., Suite A • Lemont, IL 60439
(630) 783-2570 Fax (630) 783-2580
22311 Hufsmith-Kohrville • Tomball, TX 77375
(281) 351-0274 Fax (281) 351-1514

Best Practices for Preventing NARs

4. Wash car down to clean off visible product to provide evidence that the car left the plant clean and secure

Hydrochloric Acid **Caustic**

Clean Car

Stained Car & Service Equipment

Best Practices for Preventing NARs

5. Reduce the pressure in the car to zero, or as low as possible.

- For chlorine, less than 50 psig for return shipments is recommended
- Extra pressure increases the possibility of a leak

Best Practices for Preventing NARs

6. Install security measures for service equipment

- Various options
  - Protective Housings
  - Cable Seals
  - Tamper-evident bags
  - GPS
- Visual documentation (photo or video) also recommended

Chlorine Tank Cars

Security Measure Options

GPS Units

Protective Housing

Cable Seal

Hydrochloric Acid Tank Cars

Security Measure Options

Protective Housing

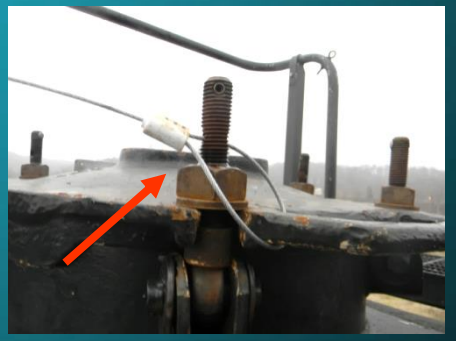
Cable Seals

Tamper-Evident Bag

Caustic Tank Cars

Security Measure Options

Cable Seals



If leaks are detected and cannot be stopped

Do not ship the car

- Mark the location of the leak
- Cars with active leaks prohibited for transport by DOT regulation
- FRA movement approval required if leak cannot be resolved on-site
- Unloaders, contact your caustic supplier for further instructions

Chlorine Institute Resources

Chlorine :

- Pamphlet 1 – *Chlorine Basics*
- Pamphlet 6 – *Piping Systems for Dry Chlorine*
- Pamphlet 66 - *Recommended Practices For Handling Chlorine Tank Cars*
- CLS-DVD - *Preventing Non-Accident Releases from Chlorine Railcars by Properly Securing Return Shipments*

Chlorine Institute Resources

Hydrochloric Acid:

- Pamphlet 98 – *Recommended Practices for Handling Hydrochloric Acid in Tank Cars*
- *Pamphlet 169 - Hydrochloric Acid Solution Bulk Transports Emergency Response Guidelines Handbook*
- HCLS-DVD - *Preventing Non-Accident Releases by Properly Securing Hydrochloric Acid (HCl) Railcars*
- HCL-DVD - *Safe Handling of Hydrochloric Acid*

Chlorine Institute Resources

Caustic Resources:

- Pamphlet 87 – *Recommended Practices for Handling Sodium Hydroxide and Potassium Hydroxide (Caustic) Tank Cars*
- CAUS-DVD - *Preventing Non-Accident Releases by Properly Securing Caustic Railcars*

Chlorine Institute Resources

Chlorine Institute Resources:

- Hard copy pamphlets (member and non-members fees)
- PDF copy of pamphlets – FREE for download
- Securement-related DVDs – FREE (shipping cost may apply for more than 5)
- Online videos – FREE streaming or download

Visit CI's Bookstore at:

www.chlorineinstitute.org

Thank You! Questions?