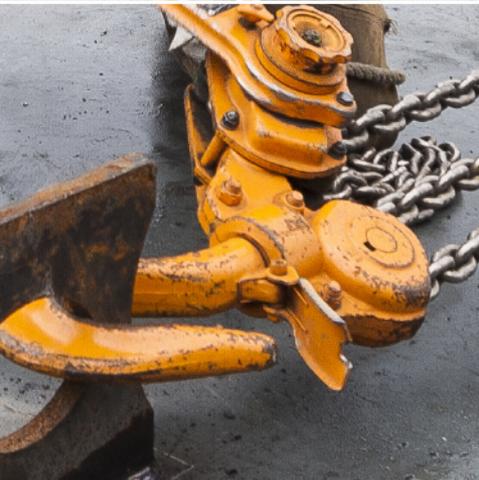




Best Practices in Tank Car Pre-Load & Post-Load Inspections

A Practical Tank Car Inspection Checklist



SAFETY SET UP

- 1) Caution signs ("Blue Flags") are in place
 - Securely block access to the track by use of derails, aligned and locked switches, bumper blocks, or other such apparatus.
 - Equipment used to blocking access must be capable of protecting the loading / off-loading operations by diverting or stopping rail equipment.
 - Place caution signs (sometimes known as "blue flags") on the track to warn persons approaching the cars
- 2) Track is secure against access (locked switch / derail in place)
- 3) Hand brake set
 - The car must have the hand brake set before starting loading / offloading operations
- 4) Tank car wheels chocked to prevent movement.
 - The car must have one wheel blocked against movement in both directions before starting loading / offloading operations



- ✓ Apply Caution Sign
- ✓ Secure Track

- ✓ Set the Hand brake



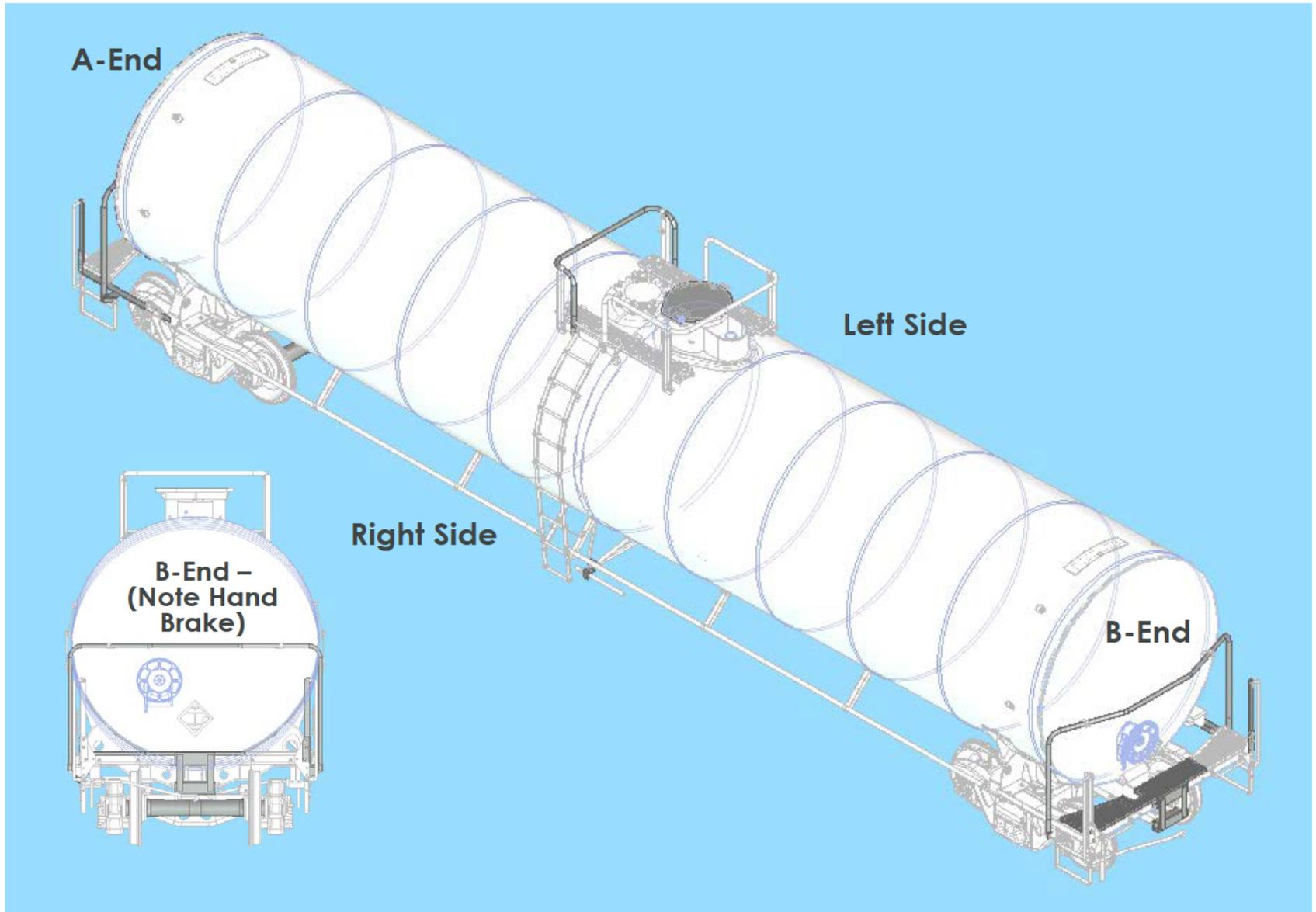
- ✓ Chock the wheels

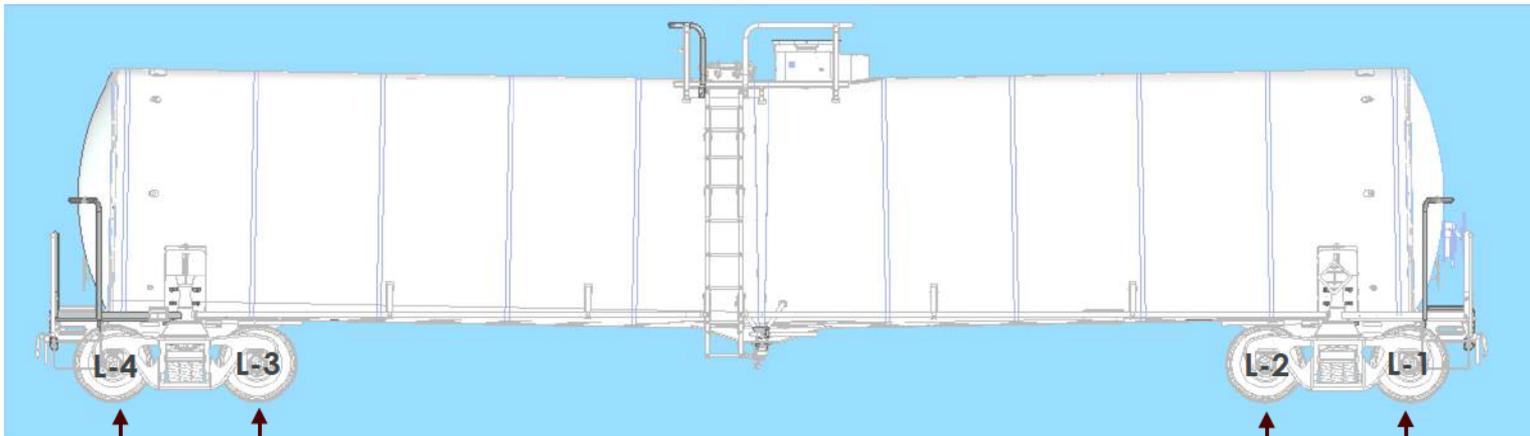
VERIFICATION OF TANK CAR

- 5) Note "Tank Capacity" (Gallon / Liter)
- 6) Note "Quantity" of product requested & required outage
- 7) Ensure placards and identification numbers are legible and correct
- 8) If required, ensure subsidiary hazard class placards are in place
- 9) Verify "Special Permit" number is marked on tank, if applicable.
- 10) Verify "Proper Shipping Name" is marked on tank, if required (see 49 CFR 172.330 (ii))
- 11) Verify "INHALATION HAZARD" is marked on tank, if applicable.
- 12) Verify "CHEMTREC" decals/markings are marked on tank, if applicable.
- 13) Perform security check of the container and report any unusual conditions to site supervisors / management before proceeding. Examples include missing or broke security seals, valves open / unsecure upon arrival, suspicious packages on and around tank car.
- 14) Graffiti - note and report as applicable



- ✓ Tank capacity, placards, and required markings are present and legible





B-End
(Note Hand
Brake)

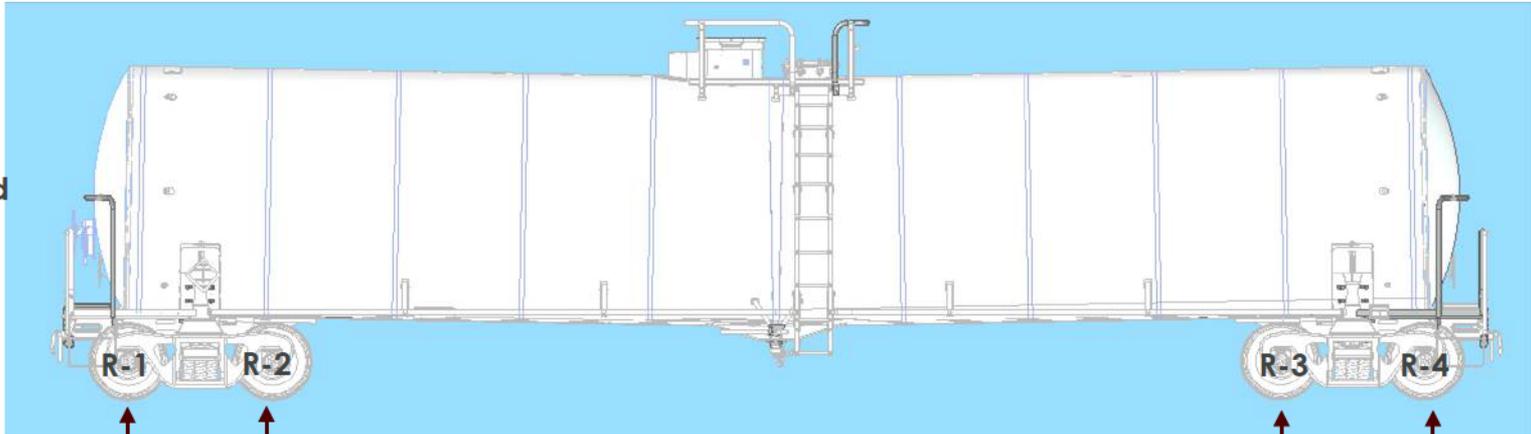
Left Side

Wheel
Set
4

Wheel
Set
3

Wheel
Set
2

Wheel
Set
1



B-End
(Note Hand
Brake)

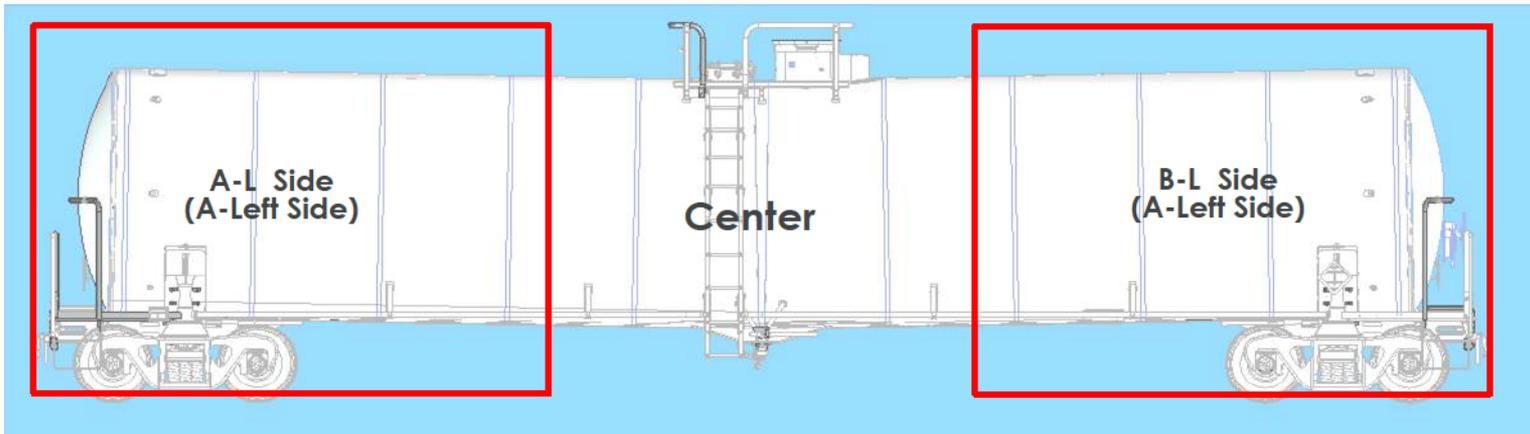
Right Side

Wheel
Set
1

Wheel
Set
2

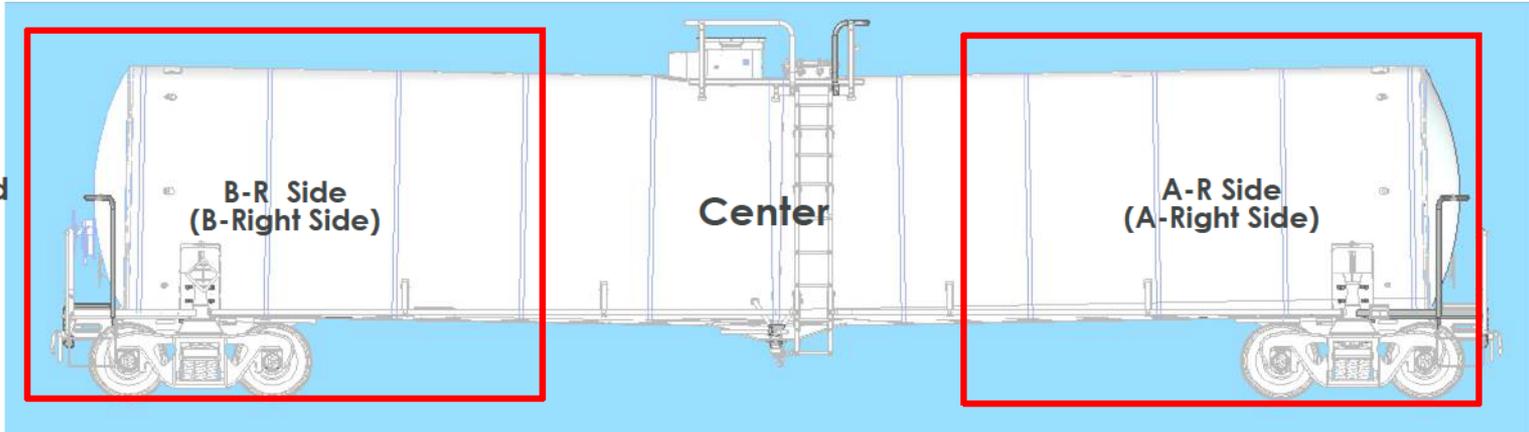
Wheel
Set
3

Wheel
Set
4



Left Side

**B-End
(Note Hand
Brake)**



Right Side

**B-End
(Note Hand
Brake)**

A-END / B-END TANK CAR INSPECTION

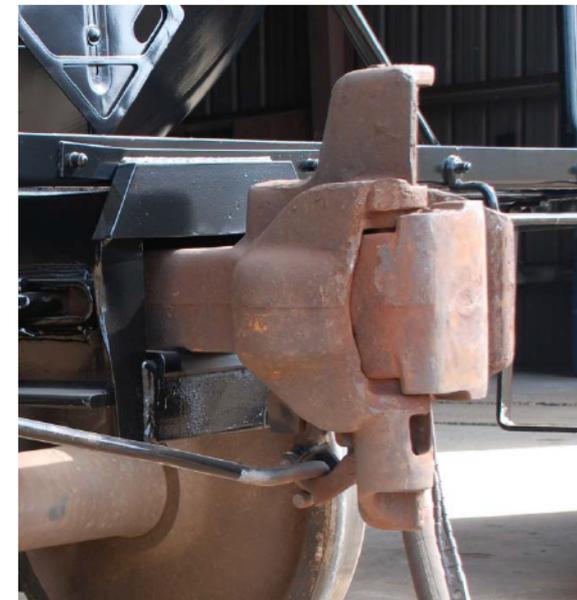
- 15) Verify car reporting marks and number are legible
- 16) Verify tank car capacity is legible and matches the loading ticket
- 17) Check that placards and identification numbers on both ends are present and free of visible defects
- 18) If applicable, confirm end ladders, running board grating and end handrails are free of visible defects.
- 19) Verify sill steps and handholds are free of visible defects.
- 20) Inspect the tank / jacket heads are free of visible defects.
- 21) If required, inspect the head protection (e.g., head shields) for visible defects.
- 22) Confirm tank car is equipped with double shelf couplers and that there are no visible defects present.



- ✓ Verify double shelf Couplers are present and free of visible defects



- ✓ Inspect head shields for visible damage



- ✓ Inspect safety appliances, such as sill steps and handholds

RIGHT AND LEFT SIDES

- 23) Verify car reporting marks are legible
- 24) Ensure placards and identification numbers on each side are in place and free of defects
- 25) Inspect AEI tags (two – one on each side) are in place and free of visible defects.
- 26) Verify all tank inspection and test dates are current and legible.
- 27) Verify that reflective sheeting, per 49 CFR 224, is applied.
- 28) Verify the coating or lining applicator, type of coating or lining, and the application year is marked on the tank or jacket, if applicable.
- 29) Visibly inspect the tank shell or jacket to ensure no visible defects exist.
- 30) Verify roller bearing adapters are in place and not broken. Cap screws must be present with locking plate
- 31) Check side ladders and handholds for visible defects
- 32) Ensure brake shoes and keys are in place
- 33) Ensure truck springs are present, seated and free of visible defects
- 34) Inspect the side frames, bolsters, and friction castings for visible defects
- 35) Check all axels and wheels are free of visible defects



DOT 105J500W			
	Station Stencil	Qualified	Due
TANK QUALIFICATION	GNGM	2016	2026
THICKNESS TEST	GNGM	2016	2026
SERVICE EQUIPMENT	GNGM	2016	2026
PRD VALVE: 300 PSI	GNGM	2016	2026
LINING TYPE	GNGM	2016	2026
RULE 88.B.2 INSPECTION	GNGM	2016	2026
STUB SILL INSPECTION	GNGM	2016	2026

Top of Tank Car

- 36) Inspect top platform grating and handrails for visible defects
- 37) If equipped, ensure side platform openings are equipped with chains
- 38) Ensure the tank car is free of all "WARNING," "DO NOT LOAD," "HOME SHOP," "BAD ORDER," or similar tags
- 39) If open top loading is performed, inspect tank interior for debris
- 40) Inspect all top valves and fittings for required fasteners, nuts, and securement chains
- 41) Verify all piping, valves, fittings, and threaded fasteners are free of damage including corrosion or signs of leakage
- 42) Ensure all exposed gaskets (e.g., Manway lid gasket), are free of visible defects. If gasket is replaced, record the gasket type and material specification on checklist



- ✓ Bolts, nuts, flanges and washers acceptable



- ✓ Piping, valves and fittings are free of damage and signs of leakage



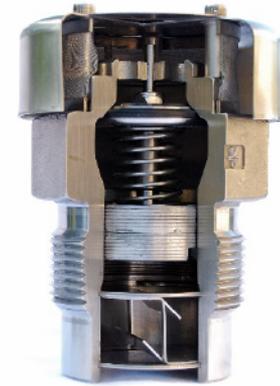
- ✓ All service equipment acceptable

Top of Tank Car

- 43) Ensure manway cover eyebolts and safety eyebolts are present and correct for the manway style, with proper nuts and washers, and that assembly is free of visible defects. Washer must seat flat against the manway cover
- 44) If equipped, inspect the vacuum relief valve is free of visible defects
- 45) Inspect the re-closing pressure relief device for visible defects
- 46) If equipped, inspect the non-reclosing pressure relief device for visible defects. When replacing the rupture disc, record the replacement
- 47) When inspecting or replacing the rupture disc ensure the discharge channel is free of visible obstructions



✓ Eyebolts and safety eyebolts



✓ Vacuum relief device



✓ Pressure relief device



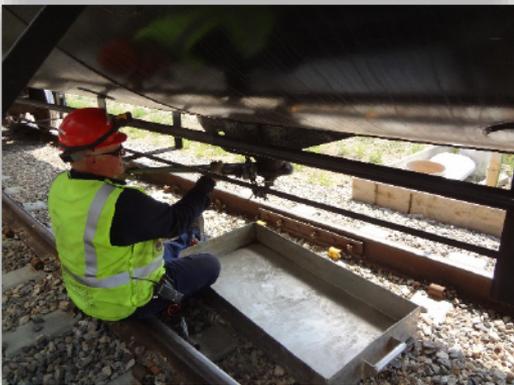
✓ Rupture disc

Bottom of Tank Car

- 48) If required, ensure bottom discontinuity protection is present and free of visible defects
- 49) Remove bottom outlet cap during loading
- 50) During loading, observe bottom outlet valve to ensure visible leaks are not present
- 51) If applicable, ensure bottom sump has proper fasteners and nuts applied and the flanged joint is free of visible defects including leakage
- 52) Remove interior heat coil caps during loading if applicable



- ✓ Bottom discontinuity protection free of visible defects



- ✓ Observe bottom outlet valve for visible signs of leakage
- ✓ Remove bottom outlet cap prior to loading



- ✓ Bottom sump/ washout acceptable

Outbound / Post Tank Car Loading Checklist

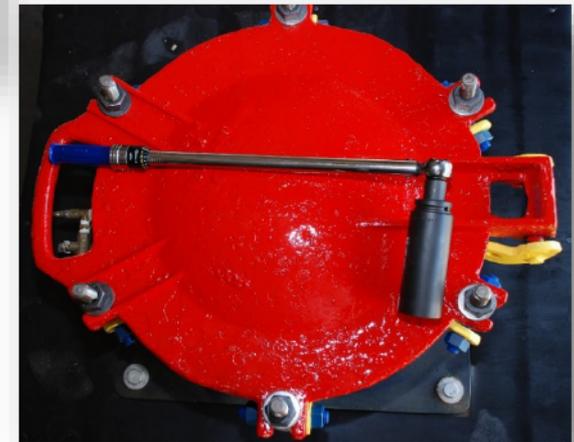
- 53) Close each top valve and fitting, install closures (e.g., pipe plugs) and tighten with a suitable tool. *This includes any valve or fitting that was not used during loading / unloading process. All gaskets on valves and flanges shall be in good condition and chains for valve plugs properly secured.
- 54) If equipped with a combination pressure relief valve, verify the rupture disc / breaking pin is functional by opening the tell-tale indicator
- 55) Close the manway lid, verify proper seating, install eyebolts and safety eyebolts by tightening with a suitable tool using a star pattern sequence. (Impact wrench must have torque limiter)
- 56) If equipped, close auxiliary valve and install closure (e.g., pipe plug) and tighten with appropriate tool
- 57) Verify protective housing cover is in proper condition with hinge and chained seal pin secured
- 58) Close bottom outlet valve and verify that the bottom outlet caps and gasket are free of visible defects. If replacing gasket, record gasket specification (material & dimension) on checklist



- ✓ All valves, fittings, closures, plugs, caps and fasteners are tool tight



- ✓ Inspect tell-tale indicator



- ✓ Manway secured and tightened using star pattern

Outbound / Post Tank Car Loading Checklist

- 53) Close bottom outlet valve and verify that the bottom outlet caps and gasket are free of visible defects. If replacing gasket, record gasket specification (material & dimension) on checklist
- 54) Install and tighten bottom outlet cap
- 55) Install and tighten plug in bottom outlet cap
- 56) If applicable, install interior heater coil caps with chains
- 57) Verify that the tank is free of visible leaks including odors or sounds of non-securement of tank
- 58) Verify placards, product identification numbers and required markings are applied and legible.
- 59) If applicable, install seal pin or seal hook
- 60) Apply seals to tank car and record security seal numbers
- 61) If defects were found and repaired, note repairs on the checklist.
- 62) IF ANY OF THE ABOVE ITEMS ARE FOUND DEFECTIVE, DO NOT LOAD OR OFFER THE TANK CAR FOR SHIPMENT UNTIL CORRECTED AND APPROVED BY MANAGEMENT. Detailed explanations of defects should be written legible on the checklist.
- 63) Sign & date the checklist report.



- ✓ Check bottom outlet cap gasket



- ✓ Install bottom outlet cap and verify that it is tool tight.



- ✓ Verify placards, product identification numbers and required markings



Leak Testing for Loaders

Paul Conner ASNT LT III
Performance Assurance Engineer
Greenbrier Management Services



Discussion Scope

- ◆ Leak Testing Method and Technique for employees not requiring certification to a code or standard.

Leak Testing Methods

- ◆ Divided into three main categories by American Society of Non-Destructive Testing.
 - Leak Detection,
 - Leak Location,
 - Leak Measurement
- ◆ Bubble Leak Testing is an example of both Leak Detection, and Leak Location

Three Techniques of LT

- ◆ Two common LT techniques for tank car inspection:
 - Bubble leak testing – liquid film (BLT)
 - Chemical Reactivity (CRLT)

Leak Testing

- ◆ LT is a form of NDT that uses either a pressurized or evacuated system to detect the location of leak and possibly measure the leakage through the leak.

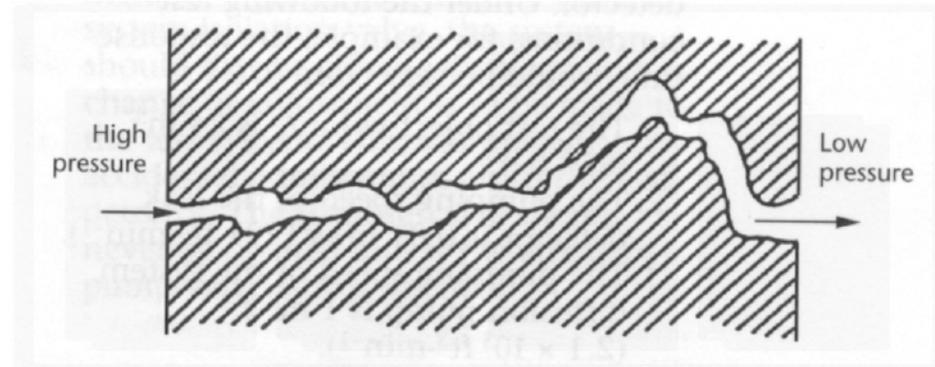
Leak Testing Definitions

- ◆ Leak:
 - Physical hole that exists and not the quantity of fluid passing through.
- ◆ Leakage:
 - The flow of fluid through a leak without regard to physical size of the hole through which flow occurs.

Leak Tight

- ◆ Term *leak tight* is relative. Nothing is truly *leak tight* and different terms should be used.
- ◆ Terms *no detectable leakage*, *no leakage*, or *zero leakage* truly represent the desired condition before shipping a tank car.
- ◆ Everything leaks, absolute tightness is only theoretical in practice. Nothing made by humans can truly be absolute leak tight.

Leak Path



Leak Rates/Sensitivity

- ◆ LT techniques are measured in leak rates. The smaller the leak rate detected, the higher the sensitivity.
- ◆ Examples of minimum detectable leak rates:

Leakage Rate	Time required for 1cc of helium loss
1×10^{-1}	10 seconds
1×10^{-3}	17 minutes
1×10^{-5}	28 hours
1×10^{-7}	4 months
1×10^{-9}	32 years

1 std cm³ per second

- ◆ Quantity (mass) of a gas leaking in one second.
 - Volume equal to three dimes stacked vertically.

Reasons for Leak Testing

- ◆ (Economic) To prevent material loss that interferes with system operation.
- ◆ (Safety) Prevent fire, explosion, and environmental contamination.
- ◆ (Reliability) Detect unreliable components, and those with leakage rates that exceed standards

System Reliability

- ◆ LT is an important process to the measure the reliability of the system under test.
- ◆ LT can show a fundamental fault of the system. High leakage rates in specific areas may determine:
 - Gasket improperly aligned
 - Valve connections misaligned or improperly threaded

System Reliability

- ◆ LT is not a direct measurement of continuing system reliability, only a measurement of the reliability at the time of testing.
- ◆ Primary use of LT for railroad tank car industry is to detect installation errors

LT Operator Training

- ◆ LT sensitivity depends heavily on the skill level and alertness of the LT operator.
- ◆ LT operators must be trained in the fundamentals of LT to ensure they are performing a LT correctly each time.
- ◆ Common errors:
 - Operators do not look at test joint for an acceptable period of time
 - not identify all possible leak paths

LT Operator Training

- ◆ Training plans for LT operator personnel should include:
 - Disadvantages and advantages of LT methods
 - Identify hazards with LT
 - Enhancing testing environments
 - Techniques for improving inspection skills
 - Factors affecting LT measurement accuracy
 - Proper ways to carry out and conduct LT methods

Bubble Leak Testing

- ◆ Leak Testing technique must be of proper sensitivity for scope of test, and also be economical value for the technique to be desirable for application.
- ◆ Bubble Leak testing accomplishes both of these criteria, and represents most of the LT performed in the RR Tank Car Tank industry.

Bubble Leak Testing

- ◆ Three techniques classified by the how the liquid used for detection is applied:
 - Liquid Immersion
 - Liquid Film
 - Foam application

BLT Advantages

- ◆ Simple to use, rapid application, and inexpensive
- ◆ Sensitivity is acceptable for use with tank car tanks
- ◆ Enables the observer to locate the exit point of leaks very accurately (compared to Pressure Change Test)
- ◆ Very large leaks and small leaks can be detected, offers a wide range of detection unlike some other techniques

BLT Advantages

- ◆ BLT allows observer to distinguish real leaks from “virtual” leaks.
- ◆ “Virtual” Leaks are those in which trapped gases are escaped during a test and are observed.
- ◆ Safe to apply BLT with proper inert gases, and testing liquids, in combustible areas.

BLT Limitations

- ◆ When performing BLT, or any LT technique beyond its limitations, it renders the test inaccurate and the results **dangerously** false.

BLT Limitations

- ◆ Certain conditions interfere with BLT, and must be corrected prior to testing.
 - Contamination of test specimen
 - Improper test temperatures
 - Contaminated Leak Test solutions
 - Prior contaminates that clog leaks or leak paths
 - Air dissolved in test liquids, or out gassing from connections. “Virtual Leaks”

BLT Limitations – Surface Cleaning

- ◆ Importance of cleaning test surface
- ◆ Cleaning a tank car connection prior to performing a LT should include as a guideline:
 - Remove by safe means any signs of rust, grease, oxide films, or other visible surface contaminants.

Commercial vs “Homemade” BLT Solutions

- ◆ Non-technical applications of LT can cause ordinary soap and water combination to be used.
- ◆ While economical, these testing solutions diminish the sensitivity of the test, possibly causing them to be lower than 10^1 std cm³ per second.
- ◆ Example: Dishwashing soap and water

Commercial vs “Homemade” BLT Solutions

- ◆ Limitations of Common Soap for BLT
 - Soaps form sticky, gummy deposits that can clog leaks. “Bath tub ring”
 - Soaps are alkaline; pH values of 10.5 to 11.5. Can cause severe corrosion to Aluminum Alloys.
 - Soaps contain chlorides and borates. These can cause stress corrosion cracking on stainless steels or titanium alloys. Many valves are SS or $_{22}\text{Ti}$.

Commercial vs “Homemade” BLT Solutions

- ◆ Commercial BLT solutions are favorable over “soap and water” when compared:
 - Have pH between 6-8
 - Do not form deposits when mixed with “hard water”
 - Viscosity allows low surface tension, allows BLT solution to spread over surface
 - Stabilized solutions are resistant to bacteria and maintain sensitivity over long periods of time
 - Allow BLT solution to dry to a clean state
 - Temperature range -30°F to over 150°F

Commercial vs “Homemade” BLT Solutions



Commercial vs “Homemade” BLT Solutions



Commercial vs “Homemade” BLT Solutions



Process Steps for BLT

- ◆ First and foremost, safety is key in working with loaded tank cars or any pressurized vessel.
- ◆ Along with tank car shipping location safety standards, LT safety briefings should include these topics:
 - Working with pressurized vessels
 - Hazards with going on top of, or below tank car.

Process Steps for BLT

- ◆ Clean areas of interest to BLT. Remove dirt, slag, rust, or any foreign debris.
- ◆ Consideration of the cleaning chemical must be taken in consideration for compatibility with BLT solution

Process Steps for BLT

- ◆ Create pressure differential. Creating a high pressure side, and lower pressure side will start leakage to flow.
- ◆ General guidelines state that a minimum of 15 psig (210 kpa) be used as a starting pressure.

Process Steps for BLT

- ◆ Temperature should be checked prior to applying the BLT solution.
- ◆ Use IR or contact thermometers. Must be between temp limits of BLT solution

Process Steps for BLT

- ◆ Apply BLT solution.
 - Flow solution over test area, not creating bubbles in the process
 - Do not brush or spray unless LT solution is designed for such application!
 - Gently flowing solution over area will allow complete coverage. Care should be taken to observe the solution as it is applied.

Process Steps for BLT

- ◆ Allow BLT solution to Dwell on the test area for a specific amount of time.
 - Usual Dwell times are 5min -10min
- ◆ After Dwell time has elapsed, inspect area for bubble formation

Process Steps for BLT

- ◆ Inspection should be done in a adequate environment to get the best results for the test.
- ◆ Improve the environment to increase the sensitivity of the test:
 - Increase lighting
 - Better position to keep view angle at 0°-15°
 - If possible, improve temperature, wind, humidity
 - Use BLT solutions that have higher visibility

Inspection

- ◆ Test joint must show no bubble formation to be considered to pass the leak test
- ◆ BLT will show bubbles collapsing and reforming to indicate a leak

LT Procedure

- ◆ LT procedure should be written by an ASNT Level III
- ◆ Allows for uniform application by all LT operators
- ◆ Specifies the minimum requirements for conducting a test
- ◆ A procedure should list all aspects of the LT that are essential to be met
- ◆ Can provide reasonable certainty that a specific sensitivity is being met

LT Procedures

- ◆ Procedures should include:
 - Cleaning requirements
 - LT solution
 - Temperature limits
 - Test Pressure
 - Acceptable leak rates (Acceptance Criteria)
 - Reporting of a leak
 - Cleaning practice

THANK YOU!

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