



2021

# BEST PRACTICES FOR RAIL TRANSPORT OF ETHANOL



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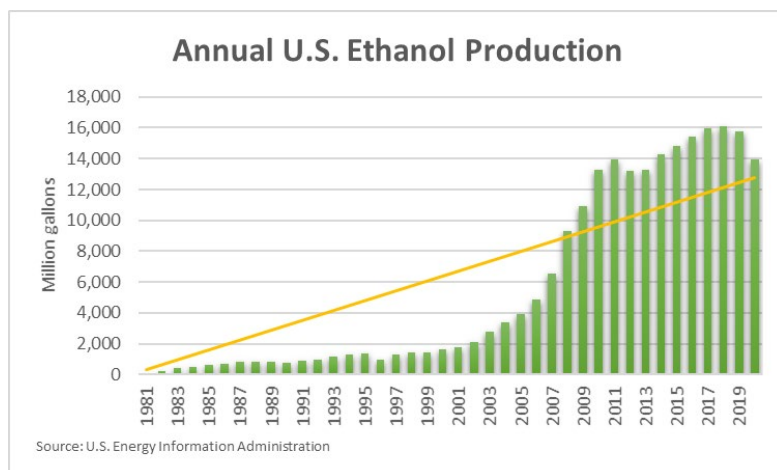
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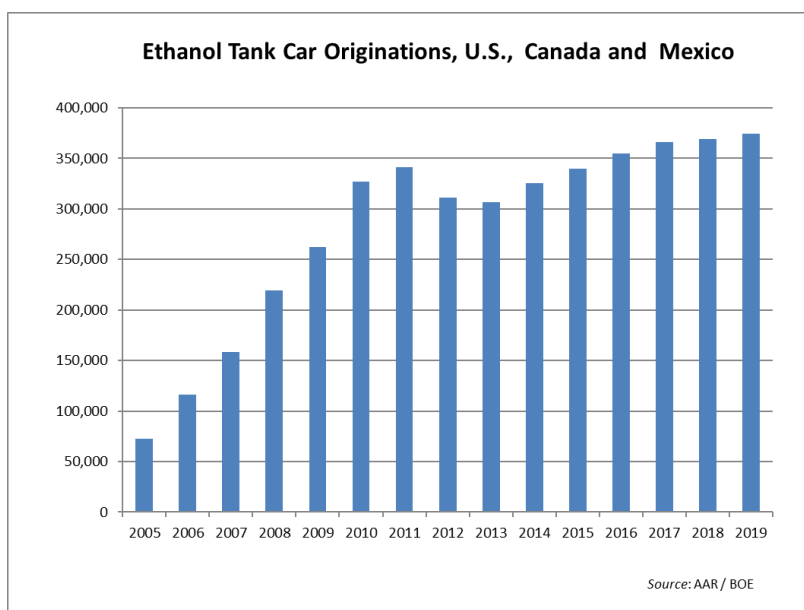
## THE FUEL ETHANOL MARKETPLACE

The U.S. ethanol industry has undergone a dramatic expansion over the last four decades. Since 1980 the U.S. has used Ethanol in its transportation fuel mix. Today, E10 (10% ethanol / 90% gasoline) is a common fuel found at most retail stations across the nation with E15 and E85 growing in the marketplace.

Production capacity is over 17 billion gallons annually with over 200 installed facilities across the United States. Ethanol production typically uses field corn and sorghum as feedstocks. Ethanol is also being exported, driven by global demand for the higher-octane value and lower greenhouse gas (GHG) emissions for more climate friendly fuels for the transportation sector.



Rail transport plays a significant role in the everyday operations of many ethanol production facilities. For example, a 100-million-gallon plant situated on a rail line can easily expect to receive and ship an average of 36 railcars per day. This includes the reception of raw materials and process aides and the output of fuel ethanol and other co-products to customers. From a production cost perspective, rail transport can represent the third highest internal cost for a facility, following only raw material procurement and direct energy costs.



It is estimated that 70% of ethanol travels to the marketplace by rail. Rail transport of fuel ethanol has proven to be safe and efficient. The ethanol industry refers to rail transport as the “virtual pipeline”. The number of ethanol shipments by rail has paralleled the overall growth seen in the industry. Since 2010 annual carload originations have held steady at 320,000 – 375,000 per year. Except for crude oil shipments in 2013-2015 ethanol is the number one hazardous material shipped by rail in North America.

There are many regulatory and general safety aspects associated with ethanol transport via rail.

Department of Transportation (DOT) Code of Federal Regulations (CFR) Title 49 specifically requires that each person who offers a hazardous material for transportation in commerce must comply with all applicable requirements. No person may offer or accept a hazardous material for transportation in commerce or transport a hazardous material in commerce unless that person is registered in conformance with subpart G of 49 CFR §107. There may be more than one offeror of a shipment of hazardous materials. Each offeror is responsible for complying with the requirements.

As indicated in 49 CFR §174, no person may offer, accept, or transport a hazardous material in commerce unless that material is properly classed, described, packaged, marked, labeled, and placarded and is in proper condition for transportation according to DOT and International regulations.

This document presents general guidelines for the ethanol industry to promote improved regulatory compliance and to communicate industry best practices for the continued safe transport of ethanol via rail. The information, though believed to be accurate at the time of publication, should not be considered as legal advice or a substitute for developing specific company operating guidelines or reviewing the pertinent regulations individually.

### **RAIL TANK CAR 101 VIDEO**

As an introductory training tool RFA helped to produce a Railcar 101 video. The video is a walk around of the tank car describing the general and safety features. This is a great introduction or refresher for all employees to learn rail tank car awareness. The video is found here <https://youtu.be/9YCD79pe22g>



## TRAINING REQUIREMENTS

As per regulation 49 CFR §172.704 Employees who work with Hazardous Materials must have training to include the following:

- **General Awareness Training.** Each hazmat employee shall be provided general awareness training designed to provide familiarity with the requirements and to enable the employee to recognize and identify hazardous materials consistent with the hazard communication standards.
- **Function-Specific Training.** Each hazmat employee must be provided function-specific training concerning requirements of the job. This training is specifically applicable to the functions the employee performs.
- **Safety Training.** Each hazmat employee shall receive safety training concerning emergency response information, how to protect employees from hazards exposure.
- **Security Awareness Training.** Each hazmat employee must receive training that provides an awareness of security risks associated with hazardous materials transportation and methods designed to enhance transportation security. This training must also include a component covering how to recognize and respond to possible security threats.

Initial training should take place before a new employee starts the job. A new hazmat employee, or a hazmat employee who changes job functions may perform those functions prior to the completion of training provided the employee performs those functions under the direct supervision of a properly trained and knowledgeable hazmat employee; and the required training is completed within 90 days after employment or a change in job function.

A hazmat employee must receive the training at least once every three years. Relevant training received from a previous employer or other source may be used to satisfy the requirements provided a current record of training is obtained from hazmat employees' previous employer.

### RECORDKEEPING

Each hazmat employer must create and retain a record of current training of each hazmat employee, inclusive of the preceding three years, for as long as that employee is employed by that employer as a hazmat employee and for 90 days thereafter. A hazmat employer must make a hazmat employee's record of current training available upon request, at a reasonable time and location, to an authorized official of the DOT or of an entity explicitly granted authority to enforce the Hazardous Materials Response (HMR). The record must include:

- ✓ The hazmat employee's name
- ✓ The most recent training completion date of the hazmat employee's training
- ✓ A description, copy, or the location of the training materials used and the name and address of the person providing the training
- ✓ Certification that the hazmat employee has been trained and tested

## IMPORTANCE OF REGULATORY COMPLIANCE: FINES & PENALTIES

Federal law governs the preparation, usage, and reception of tank car equipment before shipping, during transit, and upon arrival. Department of Transportation 49 CFR details these requirements for the rail supply chain. Understanding the implications of non-compliance is a key part of adhering to best practices policies for all tank car shippers, especially the ethanol industry. The table below lists commonly witnessed violations taking place at the shipper facility, and subsequent fines.

Most common regulatory violations at shipper facilities	
<b>Loaded car</b> Failure to inspect the tank car, service equipment, or markings prior to offering the car for transportation. If the failure to inspect resulted in a release of product, the appropriate penalty amount below applies.  With actual leak of product.	<b>Penalties</b>  \$5,000  \$10,000
<b>Residue car</b> Offering residue tank car for transportation when openings are not tightly closed. Guidelines vary with the type of commodity involved.	\$2,000
<b>Whether loaded or residue</b>	
Unloading a tank car without securing access to the track to prevent entry by other rail equipment. Derails, lined and blocked switches, or other equipment that provides equivalent level of security is acceptable.	\$4,000
Unloading a tank car without caution signs properly displayed.	\$2,000
Unloading without brakes set and/or wheels blocked;	
<i>No brakes set, no wheels blocked, or fewer brakes set/wheels blocked than facility's operating plan.</i>	\$5,000
<i>No brakes set, but wheels blocked.</i>	\$3,000
<i>Brakes set, but no wheels blocked.</i>	\$4,000
<b>Failure to placard; affixing or displaying wrong placard</b>	
Complete failure to placard (per car).	\$7,500
One placard missing (up to 3) (per car).	\$1,000
Offering hazardous material for rail transportation without affixing placards.	\$7,500
One placard missing (up to 3) (per car).	\$1,000
Accepting hazardous material for rail transportation without placards affixed.	\$5,000
Placard not readily visible, improperly located or displayed, or deteriorated. Placard is the unit of violation.	\$1,000

It is important for all individuals operating in the ethanol supply chain to recognize that responsibility does not only fall on the company providing ethanol products for rail transport. In some cases, liability may fall on the individual handling the car while in the facility during loading or unloading processes. Willful negligence of federal regulation may even be viewed as a criminal offense, which can carry prison sentencing alongside hefty fines. Ethanol shippers should take great care to implement strict operational procedures and set high standards, while aiding all company employees in understanding the severe implication of non-compliance from both a cost and liability perspective.

## DOT REGISTRATION REQUIREMENT

The Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) has an annual registration requirement for persons “who offer or transport hazardous materials in commerce”. The registration process includes a nominal annual fee, prior year registration (if applicable), identification of hazardous waste generation, and site security plan requirements as per 49 CFR §172.704. Registration calendar year starts July 1 and multiple year registration is allowed. The annual fee associated with this registration provides necessary funding to train first responders in emergency response planning associated with the transport of hazardous materials. This funding also supports the publication of the Emergency Response Guidebook, a critical tool for emergency personnel to identify and respond to placarded shipments involved in an accident.

The registration requirements and program information can be found in the Code of Federal Regulations, Title 49 Part 107, Subpart G (107.601 - 109.620). Offerors and transporters of hazardous materials are required to file an annual registration statement with the U.S. Department of Transportation and to pay a fee. The fee provides funds for grants distributed to States and Indian tribes for hazardous materials emergency response planning and training and to certain professional organizations for training purposes. This program began in 1992 and is administered by the Associate Administrator for Hazardous Materials Safety, Pipeline and Hazardous Materials Safety Administration (PHMSA).

More information and a link to online registration or register by mail instructions can be found here:

<https://www.phmsa.dot.gov/hazmat/registration>

Ethanol plants, ethanol transporters, and ethanol storage facilities are covered by this registration requirement. Modes of transport that are included in this registration are highway, rail, water, and air.

## CONTINUOUS IMPROVEMENT

### Non-Accidental Releases (NAR)



Safety is a priority of the ethanol industry, especially when it comes to ethanol transportation on the rail ways. RFA is an active voting member of the American Association of Railroads Tank Car Committee.

The RFA is continuously looking for improvements to the tank car design, loading and unloading actions as well as employee education and knowledge about tank cars.

As the numbers of cars moving ethanol on the rails picked up, ethanol also became the number one commodity flagged in the non-accidental release (NAR) program.

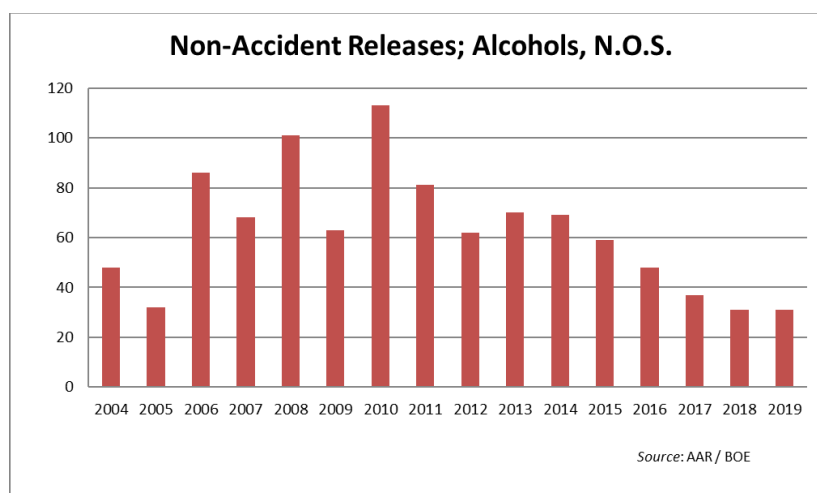
The RFA set out to decrease and eliminate NARs through awareness and education. RFA partnered with rail industry experts and the Federal Railroad Administration (FRA) to develop the engineering standard and educational information on the proper closing of a tank car manway. RFA published the **Guidelines for Hinged and Bolted Manway Assembly**.

This document provides industry personnel with procedures and standards for the inspection, maintenance, and securement of a hinged and bolted manway to ensure leak-free performance.

The RFA also developed a condensed version titled **How to Properly Close a Tank Car Manway**. Both available at this link; <http://www.ethanolrfa.org/producers/safety/railroad-tank-car-information/>

#### Top Specific Causes for NAR for Alcohols, n.o.s.

- **Manway**; loose bolts, gasket deteriorated, misaligned, or missing
- **BOV**; cap loose, valve stem loose
- **Liquid line**; threaded valve loose
- **VRV**; cap O-ring deteriorated or misaligned





## Improving the Safe Transportation of Flammable Liquids by Rail; New Tank Car DOT-117 - Required for Ethanol

Rail transportation of hazardous materials is a safe method for moving large quantities of products over long distances. Most hazardous materials shipped by railroad tank car each year arrive at their destinations safely and without incident. In fact, recent data shows greater than 99.99% of all hazardous shipments arrive safely at their destination. The statistics of safe shipping are constantly improving as all



stakeholders share a commitment to safety as a top priority. Ethanol a flammable liquid is transported using a standard DOT-111A non-pressure railcar, a workhorse of the liquid transportation industry. After a few fiery accidents moving flammable liquids there has been a variety of methods to address the risks of the bulk transport of flammable liquids by rail. These efforts include issuing guidance, conducting rulemakings, participating in rail

safety committees, holding public meetings, enhancing enforcement efforts, and reaching out to the public. All these efforts are consistent with the system-wide approach.

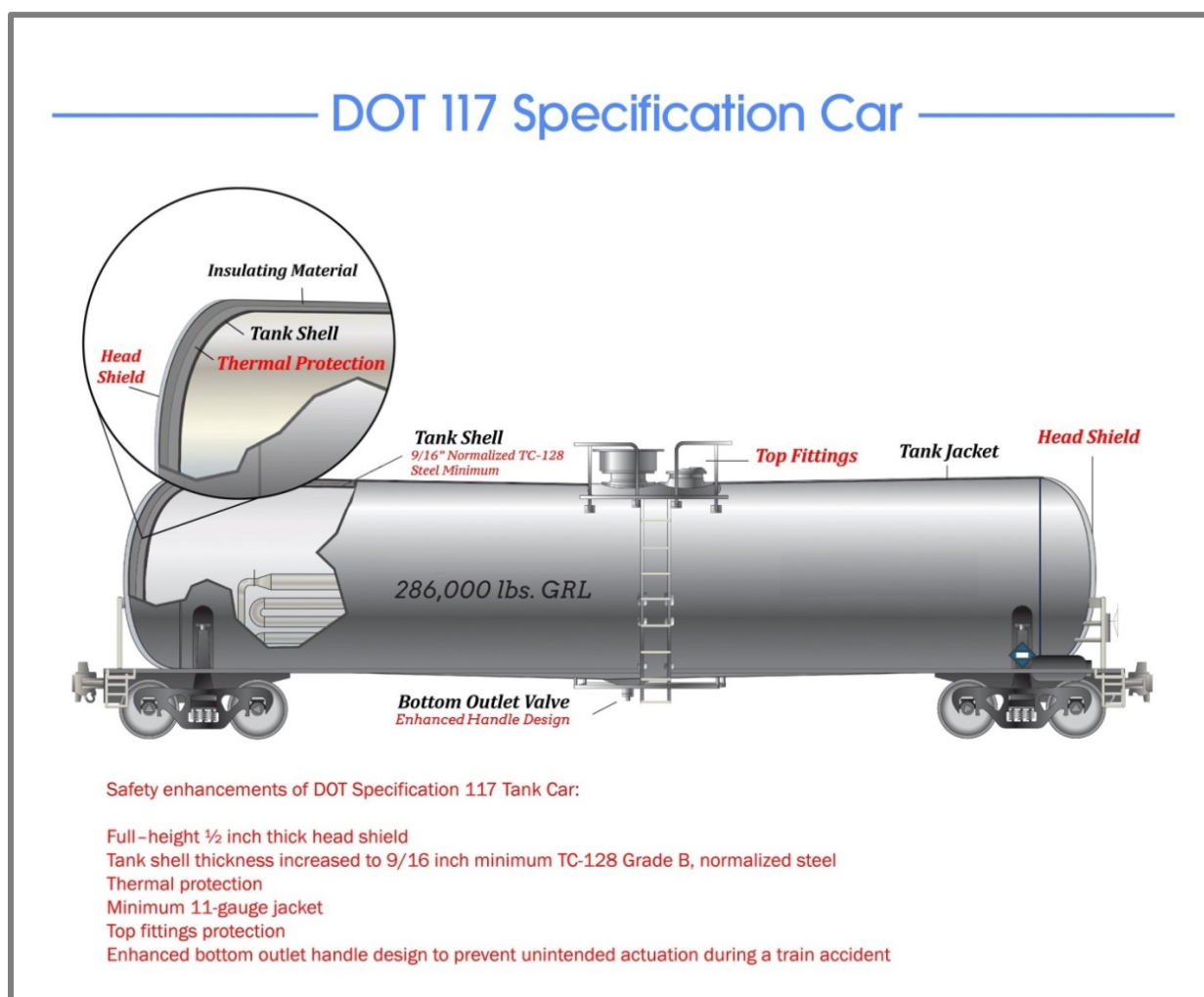
The DOT-111A tank cars are prone to puncture and release product during an accident. The *FAST* Act requires that all tank cars used to transport ethanol, crude oil and other hazardous flammable liquids meet the new, safer tank car specifications outlined in DOT's Final Rule (HM-251) published May 1, 2015 "Enhanced Tank Car Standards and Operational Controls for High Hazard Flammable Trains (HHFT)". The Act requires that all tank cars moving flammable liquids be retrofitted to meet the new DOT-117, DOT-117P or DOT-117R specifications outlined in the final rule and establishes a timeline to phase-out tank cars that do not met the new specifications, with prioritization of crude oil, followed by ethanol and then remaining flammables.

### Phase Out of DOT-111 Tank Cars Schedule (post FAST Act)

<b>Crude Oil</b>	DOT-111 non-jacketed	Jan 1, 2018
	DOT-111 jacketed	March 1, 2018
	CPC-1232 non-jacketed	April 1, 2020
	CPC-1232 jacketed	May 1, 2025
<b>Ethanol</b>	<b>DOT-111 non-jacketed and jacketed</b>	<b>May 1, 2023</b>
	CPC-1232 non-jacketed	July 1, 2023
	CPC-1232 jacketed	May 1, 2025
<b>Other Class 3, PG I</b>	DOT-111, CPC-1232	May 1, 2025
<b>PG II, III</b>	DOT-111, CPC-1232	May 1, 2029

## Best Practices for Rail Transport of Ethanol

These design enhancements will reduce the consequences of accidents involving an HHFT. These enhancements will improve puncture resistance and thermal survivability when exposed to fire. There will also be fewer releases from the service equipment (top and bottom fittings). The requirements are to use the enhanced tank car for shipping all flammable liquids, regardless of the length of the train. It also requires that all new tank cars be equipped with a thermal protection blanket, and that older tank cars retrofitted to the new design standard be equipped with top fittings protection and a thermal protection blanket. The DOT final rules on tank cars in conjunction with Transport Canada have requirements for both existing ethanol cars and new build cars. All 30,000+ tank cars currently in ethanol service will need to be the new DOT-117 or retrofitted to meet standard.



Source: AAR/BOE

## **Placements of DOT-111 and DOT-117 in Train Consist**

The National Transportation Safety Board (NTSB) issued safety recommendations to the Renewable Fuels Association, the Association of American Railroads and the American Short Line and Regional Railroad Association urging our groups to work together to develop and adopt guidelines and recommended practices for the systematic placement of the most vulnerable tank cars in high hazard flammable trains, such as unmodified DOT-111 tank cars, in positions of trains where they are least likely to derail or to sustain mechanical damage from the effects of trailing tonnage or collision in an accident. NTSB issued Safety Recommendation R-20-27 following investigations into derailments involving DOT-111 tank cars transporting denatured ethanol. The report RSR-20/01 is found here:

<https://www.nts.gov/investigations/AccidentReports/Reports/RSR2001.pdf>

The RFA Environmental Health & Safety Committee remains focused on actions that can improve tank car design, enhance the safety of loading and unloading practices, and increase our workforce's education and knowledge about the safe handling and transportation of ethanol by rail. After discussion, the RFA EH&S Committee is updating this *Best Practices for Rail Transport of Ethanol* and communicate the revisions to the industry. Specifically;

**Encourage the continuing rapid pace of the replacement of the DOT-111 fleet with DOT-117 cars to eliminate the need to sort and arrange cars.**

**Encourage tank car lessors to help expedite the move to DOT-117s due to normal business aspect of protecting the DOT-111 assets.**

**When possible, place DOT-117s at the front of the unit train, especially near the locomotives, and place DOT-111s toward the rear where they are less likely to derail or to sustain accident damage.**

**If shipping a 20-car block or unit train with a mixture of DOT-111 and DOT-117 tank cars for facilities that can arrange cars it is recommended DOT-111s placed in the back one third of the train.**

Research has not been done on the optimal placement in the train of tank cars with differing performance standards, but researchers generally agree that cars positioned at the rear of a train have a lower probability of being derailed and, therefore, a lower probability of sustaining mechanical breaching damages. The best practice placement of DOT-111 tank cars is based on data presented by Battelle Memorial Institute published in a Federal Railroad Administration (FRA) found here.

[https://railroads.dot.gov/sites/fra.dot.gov/files/fra\\_net/2066/safe\\_placement\\_report\\_june1605.pdf](https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/2066/safe_placement_report_june1605.pdf)

## ETHANOL AS A HAZARDOUS MATERIAL

Department of Transportation (DOT), Pipeline and Hazardous Materials Safety Administration (PHMSA) govern the requirements of classification, labeling and packaging of hazardous material transported in commerce. DOT defines the chemical and physical characteristics of flammable liquids in 49 CFR §173.120. Ethanol (undenatured) and fuel ethanol meeting ASTM D4806 Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for use as an Automotive Spark-Ignition Engine Fuel are Class 3 Flammable Liquids per DOT regulations.

Class 3 Definitions (per 49 CFR §173.120)	
Flammable Liquid	“For the purpose of this subchapter, a flammable liquid (Class 3) means a liquid having a flash point of not more than 60°C (140°F), or any material in a liquid phase with a flash point at or above 37.8°C (100°F) that is intentionally heated and offered for transportation or transported at or above its flash point in a bulk packaging...”
Combustible Liquid	“For the purpose of this subchapter, a combustible liquid means any liquid that does not meet the definition of any other hazard class specified in this subchapter and has a flash point above 60°C (140°F) and below 93°C (200°F).”
Flash Point	“Flash point means the minimum temperature at which a liquid gives off vapors within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid...”

Also, within the Class 3 designation there is a requirement to assign a packing group (§173.121). This packing group is assigned using the initial boiling point and its flash point of the flammable liquid.

Class 3 Packing Groups		
Packing Group	Flash Point (Closed Cup)	Initial Boiling Point
I		≤35°C (95°F)
II	<23°C (73°F)	>35°C (95°F)
III	≥23°C, ≤60°C (140°F)	>35°C (95°F)

### For Denatured Fuel Ethanol:

Initial Boiling Point (ASTM D86)

162.5°F (72.5°C) @ 760 mm Hg

Flash Point (ASTM D3278, Closed Cup)

19.4 °F (- 7°C)

### For Ethanol (Undenatured):

Initial Boiling Point (ASTM D86)

173°F (78°C) @ 760 mm Hg

Flash Point (ASTM D3278, Closed Cup)

57 °F (14°C)

**Ethanol** typically is Packing Group II.

**Flex Fuel or E85**, should have a known initial boiling point determined to assure PGII prior to transport.



For additional safety information refer to **Safety Data Sheets** for Ethanol and Denatured Fuel Ethanol;

[http://www.ethanolrfa.org/wp-content/uploads/2016/02/SDS-Example\\_Ethanol.pdf](http://www.ethanolrfa.org/wp-content/uploads/2016/02/SDS-Example_Ethanol.pdf)

[http://www.ethanolrfa.org/wp-content/uploads/2016/02/SDS-Example\\_DFE.pdf](http://www.ethanolrfa.org/wp-content/uploads/2016/02/SDS-Example_DFE.pdf)



## PLACARDING RECOMMENDATIONS

The RFA Plant and Employee Safety Committee previously provided this safety information to raise awareness of ethanol related transport and provide the industry guidance for proper shipping names and placarding for various ethanol blended fuels. Consistent labeling and marking of ethanol while in transit will help to improve the first response community's ability to recognize ethanol shipments.

As discussed in the violations and penalties section presented earlier in this document, improper placarding can result in serious fines and penalties that quickly stack up when occurring on multiple cars.

The following table lists the commonly used placards by members of the RFA.

Ethanol Volume % Content in Blend (Exx)	Commodity	Identification Numbers
<b>E100</b> (undenatured)	Ethanol or Ethyl alcohol or Ethanol solutions or Ethyl alcohol solutions	<b>UN1170</b>
<b>E95 – E98</b> (ASTM D4806 denatured fuel ethanol)	Alcohols, n.o.s.	<b>UN1987</b>
<b>E95 – E98</b> (Canadian transport)	Denatured alcohol	<b>NA1987</b>
<b>E16 – E83</b> (ethanol fuel blends)	Ethanol and gasoline mixture or Ethanol and motor spirit mixture or Ethanol and petrol mixture with more than 10% ethanol	<b>UN3475</b>
<b>E1 – E15</b> (retail fuels)	Gasoline	<b>UN1203</b>

## RAIL LOADING BEST PRACTICES

The following best practices are based on ethanol rail tank car loading experience and comments from inspector's observations in the field. The following practices have been developed and are being recommended to the industry to improve the safe handling and transport of ethanol.

For additional information the Association of American Railroads (AAR) issued *Pamphlet 34 Recommended Methods for the Safe Loading and Unloading of Non-Pressure (General Service) and Pressure Tank Cars* found at this link; [http://www.ethanolrfa.org/wpcontent/uploads/2015/10/9c7cce142dea5c27c5\\_p5m6bffy.pdf](http://www.ethanolrfa.org/wpcontent/uploads/2015/10/9c7cce142dea5c27c5_p5m6bffy.pdf)

### 1. Selection of Tank cars

- Tank cars chosen for ethanol transport must be suitable for use. The standard car for ethanol rail transport is the DOT-111A and beginning in the year 2023 only the DOT-117J and DOT-117R type of railcars. Phase out of DOT-111A for flammable service is currently underway.
- These railcars typically have a 286,000 lb. total weight restriction with a nominal liquid capacity of 30,000 gallons.
- These railcars are limited to non-pressure service.
- The service life of this type of railcar is expected to be 40-50 years.

### 2. Selection and Inspection of Gaskets & O-Rings

- Gaskets must be suitable for use with fuel grade ethanol. The materials of construction of the gasket must be compatible with the product being shipped, fuel ethanol may contain up to 5% denaturant, most likely a nominal 2% denaturant (hydrocarbon product.)
- Gaskets should be inspected upon each load and unload operation. Any noticeable deterioration of the gasket should prompt replacement. A preventative maintenance program could be established for the regular change-out of tank car gaskets.
- Testing should be done to determine which type of gasket material provides the best seal between the manway cover lid and the bottom outlet valve cap. It is important to use a durable and compatible gasket.
- The universal lip-type gaskets should only be used on manway nozzles where the gasket will not be pinched by a grooved manway lid or by a spring-aided manway hinge.

O-Rings must be suitable for use with fuel grade ethanol. The materials of construction of the O-Rings must be compatible with the product being shipped. Fuel ethanol may contain up to 5% denaturant, most likely a nominal 2% denaturant (hydrocarbon product). O-Ring selection and inspection may occur infrequently; therefore, selection when the opportunity arises is important. If any evidence is present indicating O-Ring failure, corrective action should be taken immediately.

### 3. Pre & Post Load Inspection Checklist

A pre and post load inspection checklist should be completed for every load activity, in the field, as the tank car is physically being inspected. Please see the example checklist included at the end of this

document. The example checklist contains numerous important and necessary regulatory and safety items to be performed that are not specifically listed in this best practice area, such as the requirement to post blue flag.

To load and maintain cars and locomotives, workers must get underneath, in between and climb up on the car. The workers are in a hazardous environment and any unexpected movement of the rolling stock could lead to personal injury or death. In recognition of this danger, the railroads have adopted blue flag/blue signal protection rules for employees.

### Types of blue flags and placement

Blue flag protection may consist of a blue-painted metal sign, generally has the word "stop" or a safety slogan painted on it in white. Also used a steady burning or flashing blue light, or switch and derailment locks that can be opened only by keys assigned to designated employees.

A blue flag or signal displayed on or in front of a piece of rolling stock means that that piece of equipment may not be moved or coupled to. When placed on a car, the blue flag is positioned so it is at right angles to the track and extended for its full size beyond the edge of the car, making it plainly visible.

A blue flag or signal located between the rails signifies that no rolling stock may move past that point. In fact, no equipment may come within 150 feet of the flag or signal. In yards or service areas where speed is restricted to 10 mph, equipment may come within 50 feet of a blue flag.

Violation of blue flag protection is one of the most serious rule infractions a railroad employee can commit. Blue flag protection exists to give employees the confidence to put themselves in vulnerable situations while working on rolling stock with the knowledge that no one will move the equipment.





## 4. Standard Operating Procedures (SOP)

An SOP should be established and written for the tank car loading process. The SOP should include sufficient detail for tightening manway lids that provide a uniform compression on the gasket /nozzle interface.

The procedures should recommend the tightening of the manway securing bolts using the operating procedure recommended at the facility. It is the shipper's responsibility to ensure the tank car is not leaking from the manway or any other area of the tank car before shipped. Tighten the bolts with a spark proof tool to relieve any tension on the bolt and then retighten, keeping in line with company policy, up to 100% of the final recommend securement.

Use a lubricant on the bolt threads and nut bearing surface to reduce the friction between the nut and bolt allowing for easier tightening and loosening. This also promotes a more uniform torque reading.

A listing of proper tools should be included. Using the proper wrench or tool with an extension onto a spark-proof socket will provide adequate leverage for the tightening operation. The SOP should define the proper tools for the operation and appropriate technique for securing the manway bolts.

Always check each of the fittings on the tank car, even the fittings for corrosion and damage, and fittings that may not have been used. Any defect found should be appropriately addressed.

## 5. Hinged and Bolted Manway Procedures

Eliminating leaks around a hinged and bolted manway requires a high-level process of assembly to ensure leak-free performance over a broad range of temperatures and pressures.

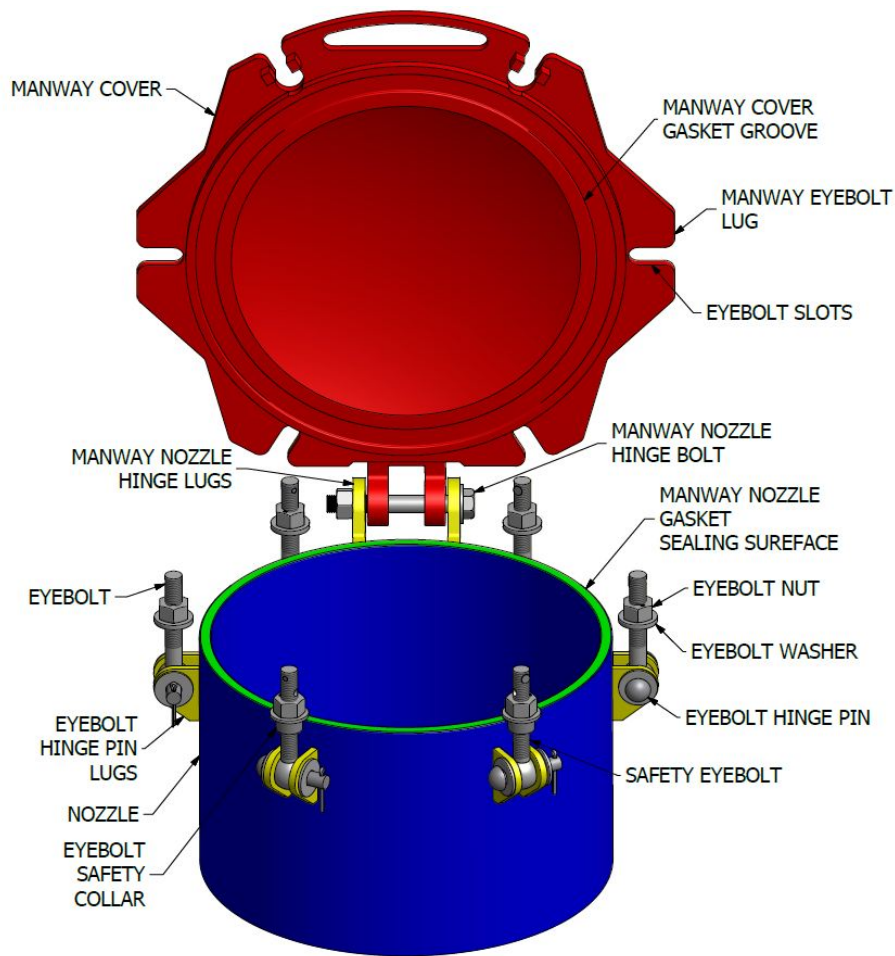
### **Common elements to consider when assembling a Hinged and Bolted Manway include:**

- ✓ Gasket-contact surface finish without unacceptable imperfections
- ✓ Suitable gasket
- ✓ Maintaining sufficient contact pressure on the manway cover, manway nozzle, and gasket surfaces (i.e., gasket stress)
- ✓ Condition of the eyebolt
- ✓ Maintaining sufficient contact pressure must consider the maximum and minimum temperature range and the internal pressure the joint may experience in service
- ✓ Bolt stretch, or relaxation, or gasket relaxation, or flow may result because of changes in temperature and pressure
- ✓ Mechanical failure of an eyebolt may result from corrosion, fatigue, galling, self-loosening, stress corrosion cracking and wear



RFA published the **Guidelines for Hinged and Bolted Manway Assembly engineering** document and a condensed version titled **How to Properly Close a Tank Car Manway**. Both available at this link; <http://www.ethanolrfa.org/producers/safety/railroad-tank-car-information/>

### HINGED AND BOLTED MANWAY DIAGRAM



By following the steps below, an operator can achieve a consistent, high level, process of assembling a hinged and bolted manway:

#### Inspect the Manway Area

- Examine the bolted manway cover for imperfections, bent and broken lugs, damaged gasket grooves and detrimental residue on gasket sealing surfaces
- Inspect the manway nozzle for imperfections

### Clean, Examine and Install New Gaskets

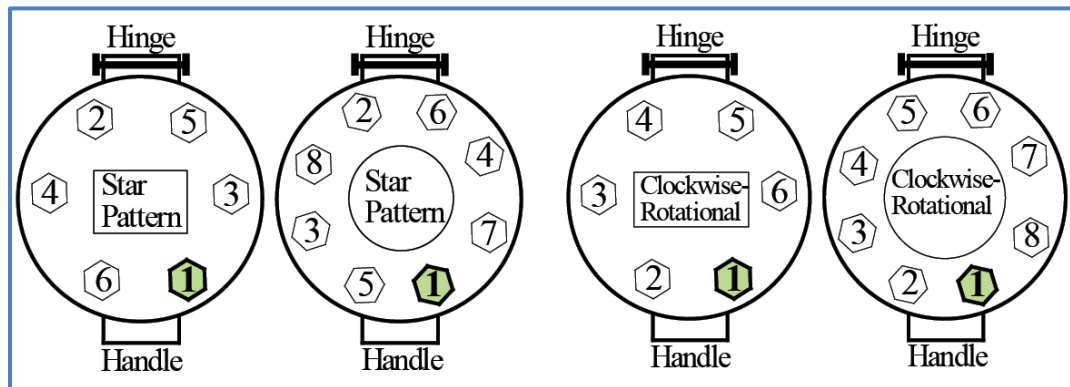
- Clean as necessary to observe imperfections
- Replace gaskets that have indications of abrasions, cuts, tears, or other damage that may affect its ability to seal properly
- When necessary, replace gasket by removing from the manway cover and inspecting the gasket contact sealing surface on the manway cover
- Replace with gasket suitable for service

### Inspect and Lubricate the Eyebolts

- Examine eyebolt threads and hinge pins
- Examine each nut to ensure same design and replace nuts that are broken, cracked, missing, or rounded
- Use proper lubricant on the eyebolts, safety eyebolts and bearing surface of the nuts, making sure lubricant is compatible with the product

### Identify Eyebolt Number and Tightening Sequence

- Recognize the numbering of the eyebolts beginning with the safety eyebolt near the right side of the lifting handle
- Follow the numbered sequence in a star pattern when tightening each eyebolt on the manway
- Select the proper tool with appropriate torque setting



### Preferred Torque Sequence and Value

- **Always** use approved fastener lubrication on threads and nut bearing surface
- **Always** start with #1 eyebolt
- **Do not use a pipe wrench**, this will under torque, resulting in leak
- **Do not use a cheater bar**, this will over torque, bend the manway cover and result in a leak



	VSP CYCLETIGHT®, or Hard Gasket		Elastomeric Gasket	
Sequence	6 Bolt	8 Bolt	6 Bolt	8 Bolt
Snug Pass (Star Pattern)	Snug	Snug	Snug	Snug
1 <sup>ST</sup> Pass (Star Pattern)	75 ft-lbs	70 ft-lbs	50 ft-lbs	45 ft-lbs
2 <sup>ND</sup> Pass (Star Pattern)	160 ft-lbs	140 ft-lbs	80 ft-lbs	70 ft-lbs
3 <sup>RD</sup> Pass (Star Pattern)	250 ft-lbs	200 ft-lbs	115 ft-lbs	90 ft-lbs
4 <sup>TH</sup> Pass (Clockwise/Rotational)	250 ft-lbs	200 ft-lbs	115 ft-lbs	90 ft-lbs

## 6. Bottom Outlet

- During inspection of the tank car, no matter under load or empty, verification of the bottom outlet valve position must be made.
- While loading a tank car equipped with a bottom outlet valve, the following should be considered:
  - ✓ Bottom outlet valve must be verified for proper operation. Once proper operation has been verified, the valve should be closed and secured as appropriate.
  - ✓ Bottom outlet cap and/ or outlet plug must be removed during the entire time the car is being loaded. Continuous monitoring of the bottom valve area ensures the valve does not leak.
  - ✓ Ensure that any auxiliary valve(s), if tank is so equipped, is open during the entire loading process. The operator has no visible way to indicate if the ball valve attached to the arm that controls the position of the valve is in the correct position. If there is any sign of leaking, while the process is taking place, the loading must be halted.
  - ✓ Post loading must ensure there is no sign of any liquid being released from the bottom outlet cap.
  - ✓ The gasket which is seated in the bottom outlet cap must be checked for integrity.
- While unloading a tank car equipped with a bottom outlet valve, the following should be considered:
  - ✓ Confirm the bottom outlet valve is closed before loosening the bottom outlet cap or plug. If it cannot be confirmed that the bottom outlet valve is closed, the tank car should be unloaded through the fittings on top of the car.
  - ✓ Ensure that during the unloading process, if leakage shows upon starting the removal of the bottom outlet cap or plug, the cap or plug should not be entirely unscrewed. Sufficient threads should be left engaged to permit controlled escape of any accumulation of liquid.
- Any leakage from the bottom valve area must prompt an investigation prior to release from the facility.

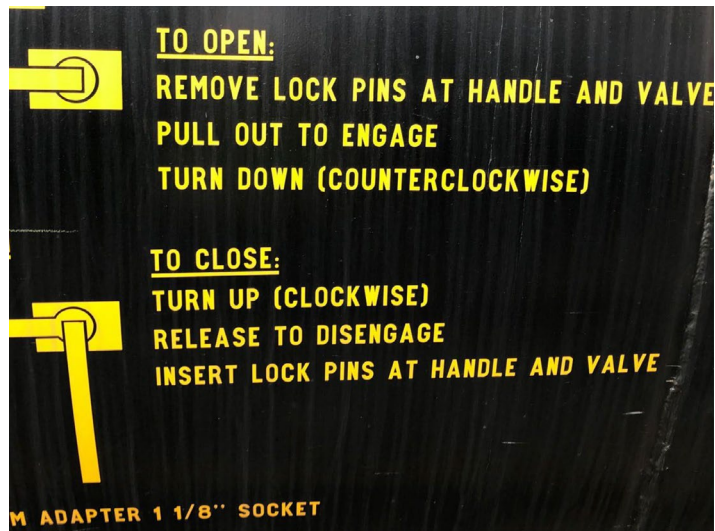
## 7. Bottom Outlet Valve Disengaging Handle Type (DOT-117)

The DOT-117 has a disengaging type of handle designed to prevent unintended actuation during a derailment situation. FRA is reporting several instances where disengaging BOV handles appear in the closed and secured position, but the valve is not fully closed. There have been releases from this condition. Majority of failures have broken, missing, or bent tabs at the BOV where the locking pin is secured. Other failures related to handle bracket not properly positioned at time of build or modification.

Operational misuse and resulting leaks have been directly related to not properly following the operating instructions. There are two locking pins that require removal before operation of the valve. Observations of damaged tabs reveal that the locking pin at the valve is mistakenly left in place and attempt to open the valve consequently causes damage to the valve function as damaged tab will not allow for full closure of the valve.

Corrective Actions have taken place for repair shops and industry for awareness of proper installation and operation. Multiple forms of media (video & animation) and instructions are available that explains the proper operation and key indicators for fully closed conditions. Please contact RFA for these media instructions.

**BOV Operation instructions are located on side of tank car.**



## 8. Vacuum Relief Devices

Vacuum Relief Devices should be inspected prior to every loaded shipment. The new configuration of vacuum relief devices is part of the qualification of the tank car and cannot be checked for correct operation. But older style vacuum devices can be inspected for correct operations; with the manway lid open, gently depress the valve and check the spring tension. If the valve does not fully return to its normal position, then the device would warrant further inspection.

## 9. Grounding and Bonding

All ethanol shipping vessels and containers must be electrically grounded to prevent the possibility of sparks from static electricity or stray electrical currents.

## 10. Shipping Papers

A quarterly review of the shipping papers associated with the transport of ethanol should be conducted for thoroughness and accuracy. The required information for shipping papers for rail transport are located within the BOE Tariff 6000 DOT Hazardous Materials Manual which is currently update every quarter.

## 11. Outage, Headspace

A procedure should be developed to determine the proper outage for the tank car contents. (See *section; How Full Can an Ethanol Car Be Loaded?*) Tank cars may need to sit idle for 24 hours, then have the manway and bottom outlet closures re-checked to ensure continued securement. Double checking the manway securement bolts with a proper wrench will verify that bolts were not loosened due to stretching. It is always good measure to re-check the vacuum relief valve for no leakage.

## ADDITIONAL SAFETY AND REGULATORY INFORMATION

Fuel ethanol customers and certain facility security plans for the transport of a hazardous material may require the use of tamper evident or tamper resistant seals.

All transport mode personnel should be issued a Safety Data Sheet (SDS) on fuel ethanol. Transport companies should also be advised of all safety and firefighting guidelines.

At times, tank cars need to be washed or cleaned for maintenance or inspection. It is imperative to incorporate these cars into ethanol service as quickly as possible post wash to prevent the “rust bloom” from occurring. A rust bloom is the formation of iron oxide on the unlined carbon steel surface and can cause both fine and larger flakes of rust to migrate into the product.



**All tank car repairs must be completed by a DOT Certified or Registered Tank Car facility.**

**Car Owners need to prepare Quality Management Plans (QMP) for their Tank Cars and update, when necessary, in the Umler® system, which is an electronic resource that contains critical data for North American transportation equipment.**

**Lessors of Tank Cars need to be aware and follow of the Tank Car Owners qualification and maintenance schedules within the QMP**

## **How Do Recommendations for Industry Best Practices for Ethanol Fit with Regulatory Requirements?**

Short answer, the Federal government continues to push the envelope as to what additional items will be governed by regulation in the future. For example, the FRA is currently pushing a regulation that would demand shipper facilities to implement a Standard Operating Procedure (SOP). Currently, shippers of hazardous materials are utilizing checklists to ensure that their cars are fit to be released for transport. There is no set deadline for when SOPs will become a governed requirement, but it is currently in the evaluation phase. The best practice for a shipper of fuel ethanol is to take measures to implement a SOP to defend against pending regulatory requirements and remain risk averse.

Shippers looking to begin developing a SOP in the interest of defensibility against future regulation should look to 49 CFR §173.31(d). This subsection addresses the examination of a hazardous materials tank car before shipping, and includes measures for car inspection, shipment securement, and proper marking of the car. Each item listed in this section is likely to become future requirements that will need to be spelled out in a company's SOP.

## **How Is the FRA Combatting NARs?**

In line with the future development of requirements for SOPs, the FRA plans to implement a requirement for the use of procedures to tighten manway eyebolts so there are proper instructions for loaders to follow, and that there be consistency from person to person when securing a load for shipment. This will help prevent NARs for General Purpose cars. The tentative verbiage for this regulation follows as such...

*"The offeror must have and follow a procedure for closing and securing all openings on a tank car prior to shipment. The person responsible for developing or updating the procedure must consider available best practices and guidance from each package and component supplier, such as service equipment manufacturer, gasket manufacturer, tank car owner or other product-specific closure manufacturer. The procedure must be reviewed and updated to reflect changes or modifications of the equipment design, but not later than 2 years from the previous update."*

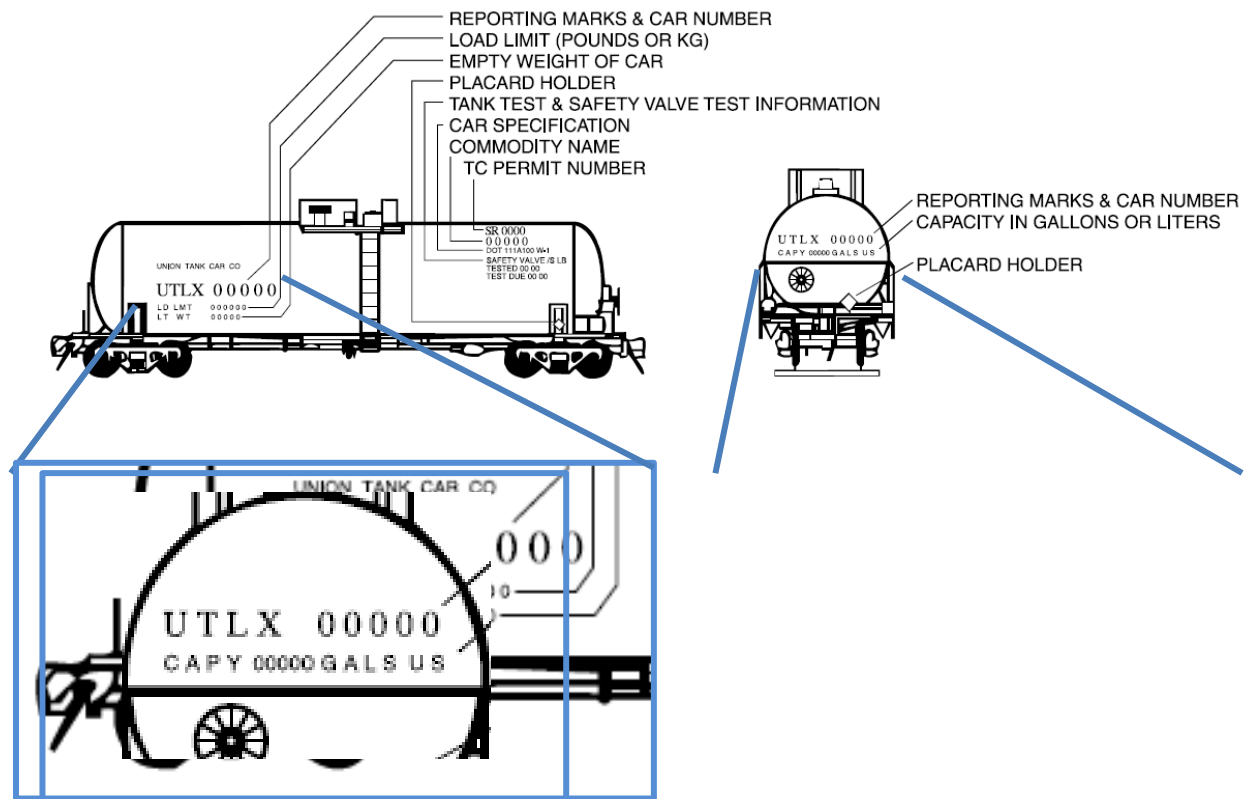
This will also address the usage of "tool tight" as the primary means of shipment security. Currently, tool tight is too loosely defined in the eyes of the FRA. The term "tool-tight" is used in 49 CFR §173.31(d)(2) and indicates the level of securement for a closure (i.e., manway cover), and §173.31(d)(1)(iv) requires closures to be secured with a bar, wrench, or another suitable tool. This requirement for securing a closure has led to a wide variety of tightness values that depend on the physical attributes of the person and the type of tool used. One person may consider manway eyebolts loose, while another person may consider the same eyebolts unreasonably tight. The move towards measured torque values will provide consistent requirements for securing manways and other closures.

## HOW FULL CAN AN ETHANOL CAR BE LOADED?

49 CFR §173.24(b) describes the regulation for outage and filling limits. Ethanol requires at least 1% outage of the total capacity of the tank car at the following reference temperatures;

- 46 °C (115 °F) for a non-insulated tank (such as DOT-111)
- 43 °C (110 °F) for a tank car having a thermal protection system, incorporating a metal jacket that provides an overall thermal conductance (such as a DOT-117)

Reports indicate that shippers of ethanol and fuel products are loading railcars to a 2% volume outage as a standard. While this certainly gives the shipper a little bit of breathing room with respect to legal loading limits, ethanol is permitted to load at 1% outage temperatures listed above. This section is meant to illustrate the process used to gain maximum shipment volume efficiency.



The first thing every shipper should do when loading a tank car is to check the stenciled capacity on the side of the tank car. The **load limit weight (LD LMT)** can be found directly below the reporting marks on the side of the car. The **gallonge capacity** can be found on the rear B end of the car above the handbrake.

➤ **Example: DOT-111 Large General Purpose Tank Car, non-insulated**

Stenciled: 30,120 gallon capacity, LD LMT is 218,900 pounds (lbs), car tare weight is 67,100 lbs

1. **Use coefficient of expansion, initial temperature, and final temperature to calculate the change in density.** The volumetric coefficient of expansion (CoE) for ethanol is 0.00063. The initial temperature will be 60 °F ( $T_0$ ), and the final temperature will be **115 °F ( $T_1$ )**. Assume the specific gravity (60 °F/60 °F) of the ethanol is 0.7935 (at 60 °F water weighs 8.328 lbs/gallon; so weight of product at 60 °F is  $8.328 \times 0.7935 = 6.61$  lbs/gallon)  
Follow the red highlighted portion to track the process, leading to the final density result.

$$\begin{aligned}\text{Density @ 115 °F} &= \text{Initial Density} / [1 + (\text{CoE} \times (T_1 - T_0))] \\ \text{Density @ 115 °F} &= \text{Initial Density} / [1 + (\text{CoE} \times (115-60))] \\ \text{Density @ 115 °F} &= \text{Initial Density} / [1 + (\text{CoE} \times (55))] \\ \text{Density @ 115 °F} &= \text{Initial Density} / [1 + (0.00063 \times 55)] \\ \text{Density @ 115 °F} &= \text{Initial Density} / (1 + 0.03465) \\ \text{Density @ 115 °F} &= \text{Initial Density} / (1.03465) \\ \text{Density @ 115 °F} &= 6.61 / 1.03465 \\ \text{Density @ 115 °F} &= 6.39 \text{ lbs/gallon}\end{aligned}$$

*Note: this calculation is purely illustrative for a typical initial specific gravity /relative density of denatured fuel ethanol. Initial specific gravity /relative density may vary based on individual specifications of different shipper products.*

2. **Using the gallonage capacity listed, calculate loading capacity for the car at 1% outage.**  
**Multiply the loading capacity (99%) by the density of ethanol at 115 degrees F. This gives the loading capacity of ethanol at 115 °F, per regulation in 49 CFR.**

$$\begin{aligned}\text{Capacity gallons} \times 99\% &= \text{LOADING CAPACITY (99\%)} \\ 30,120 \text{ gallons} \times 0.99 &= 29,819 \text{ gallons} \\ \text{LOADING CAPACITY (99\%)} \times 6.39 \text{ lbs/gallon} &= \text{weight of total product} \\ 29,819 \text{ gallons} \times 6.39 \text{ lbs/gallon} &= 190,543 \text{ lbs} \\ \text{Pounds approved to be loaded into the railcar} &= \text{LD LMT}\end{aligned}$$

3. **If weight of total product is greater than the LD LMT of the car, then the shipper must only load to LD LMT as the limiting weight (this means the outage is higher than 1%).**
4. **If the LD LMT of the car is greater than the weight of total product, calculate according to density of ethanol at net loading temperature (60 °F). This will be more typical as ethanol is a light liquid.**

$$[\text{LOADING CAPACITY (99\%)} \times 6.39 \text{ lbs/gallon}] \div 6.61 \text{ lbs/gallon} = \text{Max loading gallons (outage included)}$$

$$[190,543 \text{ lbs}] \div 6.61 \text{ lbs/gallon} = 28,827 \text{ gallons}$$

*If ethanol heats up to 115 °F when filled to the gallonage calculation above, the car will be 99% full, per regulation in 49 CFR.*



➤ **Example: DOT-117 Tank Car, jacketed with thermal protection**

Stenciled: 30,320 gallon capacity, LD LMT is 194,500 pounds (lbs), car tare weight is 91,500 lbs

5. **Use coefficient of expansion, initial temperature, and final temperature to calculate the change in density.** The volumetric coefficient of expansion (CoE) for ethanol is 0.00063. The initial temperature will be 60 °F ( $T_0$ ), and the final temperature will be **110 °F ( $T_1$ )**. Assume the specific gravity (60 °F/60 °F) of the ethanol is 0.7935 (water weighs 8.328 lbs/gallon; so weight of product at 60 °F is  $8.328 \times 0.7935 = 6.61$  lbs/gallon)  
Follow the red highlighted portion to track the process, leading to the final density result.

$$\begin{aligned}\text{Density @ 110 °F} &= \text{Initial Density} / [1 + (\text{CoE} \times (T_1 - T_0))] \\ \text{Density @ 110 °F} &= \text{Initial Density} / [1 + (\text{CoE} \times (110-60))] \\ \text{Density @ 110 °F} &= \text{Initial Density} / [1 + (\text{CoE} \times (50))] \\ \text{Density @ 110 °F} &= \text{Initial Density} / [1 + (0.00063 \times 50)] \\ \text{Density @ 110 °F} &= \text{Initial Density} / (1 + 0.0315) \\ \text{Density @ 110 °F} &= \text{Initial Density} / (1.0315) \\ \text{Density @ 110 °F} &= 6.61 / 1.0315 \\ \text{Density @ 110 °F} &= 6.41 \text{ lbs/gallon}\end{aligned}$$

*Note: this calculation is purely illustrative for a typical initial specific gravity /relative density of denatured fuel ethanol. Initial specific gravity /relative density may vary based on individual specifications of different shipper products.*

1. **Using the gallonage capacity listed, calculate loading capacity for the car at 1% outage.**  
**Multiply the loading capacity (99%) by the density of ethanol at 110 °F. This gives the loading capacity of ethanol at 110 °F, per regulation in 49 CFR.**

$$\begin{aligned}\text{Capacity gallons} \times 99\% &= \text{LOADING CAPACITY (99\%)} \\ 30,320 \text{ gallons} \times 0.99 &= 30,017 \text{ gallons} \\ \text{LOADING CAPACITY (99\%)} \times 6.41 \text{ lbs/gallon} &= \text{weight of total product} \\ 30,017 \text{ gallons} \times 6.41 \text{ lbs/gallon} &= 192,409 \text{ lbs} \\ \text{Pounds approved to be loaded into the railcar} &= \text{LD LMT}\end{aligned}$$

2. **If weight of total product is greater than the LD LMT of the car, then the shipper must only load to LD LMT as the limiting weight (this means the outage is higher than 1%).**
3. **If the LD LMT of the car is greater than the weight of total product, calculate according to density of ethanol at net loading temperature (60 °F). This will be more typical as ethanol is a light liquid.**

$$[\text{LOADING CAPACITY (99\%)} \times 6.41 \text{ lbs/gallon}] \div 6.61 \text{ lbs/gallon} = \text{Max loading gallons (outage included)}$$

$$[192,409 \text{ lbs}] \div 6.61 \text{ lbs/gallon} = 29,109 \text{ gallons}$$

***If ethanol heats up to 110 °F when filled to the gallonage calculation above, the car will be 99% full, per regulation in 49 CFR.***

## HOW TO APPLY FOR A ONE TIME MOVEMENT AUTHORIZATION

The Federal Railroad Administration (FRA) has guidelines to seek approval to move non-conforming cars transporting regulated commodities and non-conforming DOT class cars transporting non-regulated commodities. Using the table below, identify the type of One Time Movement Authorization (OTMA) needed to find the most expedient way to move the damaged car. The process flow at the end of this page illustrates the activities needed to be completed to have an OTMA approved.

### OTMA-1

- **Traditional Approval**
- Needed when OTMA-2 or OTMA-3 don't apply

### OTMA-2

- **Overloaded by Weight**, Greater than 1,000lbs of the GRL.
- Calculations must indicate that car is not shell full or will become shell full during transport.

### OTMA-3

- **Automatic Approval or Standing Approval** if the following are true:
  - Must not be a PIH (Poison Inhalation Hazard)
  - Must not have been involved in a NAR (Non-Accident Release)
  - The nonconforming conditions meets the criteria shown under the Defect Numbers and Descriptions listed in HMG-127 (Issue 10/7/14) **EXACTLY**

Determine  
the type of  
OTMA

Gather  
information

Complete  
the online  
application

Secure the  
car and  
apply home  
shop decals

Wait for  
approval

To apply for an OTMA, the eOTMA application can be found here <https://safetydata.fra.dot.gov/otma/>

## MORE INFORMATION ON ETHANOL SAFETY AND EMERGENCY RESPONSE

The RFA recommends ethanol plants put a strong company emphasis on facility, employee, and transportation safety.

The ethanol industry is one of the largest shippers of hazardous material on the rail. It is important that the emergency response community throughout the country is well prepared and trained for ethanol and ethanol-blended fuel-related emergencies.

The U.S. ethanol industry takes the safety of its employees, community neighbors, and the first responders tasked with confronting ethanol incidents very seriously. To ensure the continued safety of those who encounter ethanol, the RFA is pleased to offer resources for ethanol facilities and first responders to help mitigate the impacts of ethanol incidents.

RFA supports the [www.EthanolResponse.com](http://www.EthanolResponse.com) website as a “one-stop shop” of ethanol safety and emergency information.



RFA would like to thank AllTranstek for helpful guidance on the preparation of this document.

Alltranstek is a services provider creating customized solutions for rail transport sector having the flexibility to tailor services to the customer's individual needs, from large-scale facility management to specific assignments. Their expertise and technological know-how can help navigate the complex path from fleet maintenance management to compliance.

<http://www.alltranstek.com/>

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## RAILCAR INSPECTION REPORT

<b>Railcar Number</b>	<b>Date Loaded</b>	<b>Product Tank</b>
-----------------------	--------------------	---------------------

Place your **INITIALS** in **YES** or **NO** column when more than one loader. (**Any NO means Do Not Ship**)

BEFORE LOADING: INBOUND INSPECTION (Pre Load/Unload):					Acceptable?	
Per 49 CFR 173.31(d),(g) & BOE Pamphlet 34				LOADER initials for this section →		
CAR PREPARATION: (Check YES or NO column after loader initials are entered)					YES	NO
1	DERAIL set? (BEFORE getting on top of a railcar!)					
2	BLUE FLAG SIGNS: "DERAIL" & "STOP" set? (BEFORE getting on top of a railcar!)					
3	WHEELS CHOCKED? (Is Tank Car properly chocked?)					
4	HAND BRAKE set? (Brake chain taught? Bell crank housing in upright position?)					
TRACKMOBILE; Secured as per Company Standard Operating Procedures?						
5	Inspect car for INTEGRITY, VISIBLE DAMAGE, &/or LEAKAGE? (Checks done, then YES)					
6	Inspect TANK SHELL/HEADS for obvious abrasions, corrosion, cracks, dents, distortions, defects, including stub sill welds, or any other unsafe conditions (if any defects, BAD ORDER the car) (Checks done, then YES)					
7	PAINT on tank/jacket in good condition? (with No Graffiti or No bare metal over large area)					
8	Is the rail car properly GROUNDED before loading?					
9	Are all VALVES securely CLOSED and in the proper LOADING position?					
10	Is car defect free? (No DEFECT/BAD ORDER cards present)					
11	DOT Specification Number circle one:		<b>DOT-111</b> <b>DOT-117</b>			
12	TANK QUALIFICATION in test?	<b>YEAR TESTED:</b>		<b>YEAR DUE:</b>		
13	TANK SHELL THICKNESS in test?	<b>YEAR TESTED:</b>		<b>YEAR DUE:</b>		
14	SERVICE EQUIPMENT in test?	<b>YEAR TESTED:</b>		<b>YEAR DUE:</b>		
15	VACUUM RELIEF VALVE in test?	<b>YEAR TESTED:</b>		<b>YEAR DUE:</b>		
16	PLACARD HOLDERS (with like new/un-faded PLACARDS) in place? (TOP stencils optional)		4 – PLACARDS?	Circle one: <b>1987</b> <b>1170</b> <b>3475</b>		
			4 - Orange PANELS?	Circle one: <b>1987</b> <b>1170</b> <b>3475</b>		
TANK CAR INSPECTION:					YES	NO
17	HAND BRAKE free of obvious defects? (Brake chain/rod not constantly rubbing against axle?)					
18	DOUBLE SHELF COUPLERS on both ends? (DSC in place on both A & B end?)					
19	AEI TAGS present on both sides of the railcar? (AEI tags HORIZONTAL?)					
20	ROLLER BEARING END PLATE TABS in place on all wheels? (On all 8 wheels?)					
21	SAFETY APPLIANCES (EQUIPMENT) free of all defects? (NO MISSING or LOOSE BOLTS or NUTS?, Ladders, Running Board Gratings, Handrails, Platforms, Steps, in good order?)					
22	STENCILS & REPORTING MARKS legible, In place? MUST have ALL 4 placards or orange panel's					
23	All FITTINGS, VALVES, GASKETS, and FASTENERS (chains) in proper condition?					
24	DOME GASKET and all BOLTS and NUTS present and in good working order?					
25	DOT-SPECIAL PERMIT NUMBER in place? Number: <b>XXXXXXXX</b> (leave blank if not applicable)					
26	<b>LOAD COMPLETED BY:</b>					
27	<b>MANWAY SWING BOLTS - Name :</b>					
28	<b>BOTTOM OUTLET CAP - Name:</b>					

UPDATED 04/25/2017 by AllTranstek, LLC, HazMat Compliance Specialist

## RAILCAR INSPECTION REPORT **continued**

Railcar Number	Date Loaded	Product Tank
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CHECK ONE:

☐

OK TO SHIP

☐

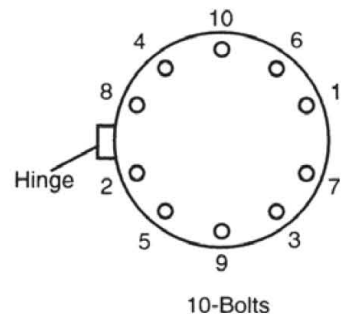
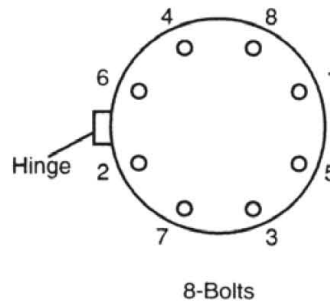
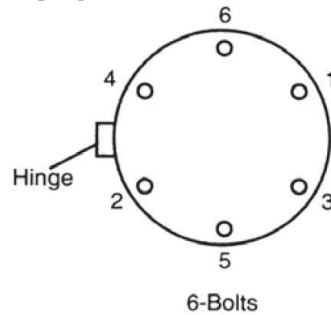
BAD ORDER-unloaded?

**Refer to and follow Company SOPs if railcar needs REPAIR**

**IMPORTANT:** Explain defect below

COMMENTS:

Manway tightening sequence is to be as follows:



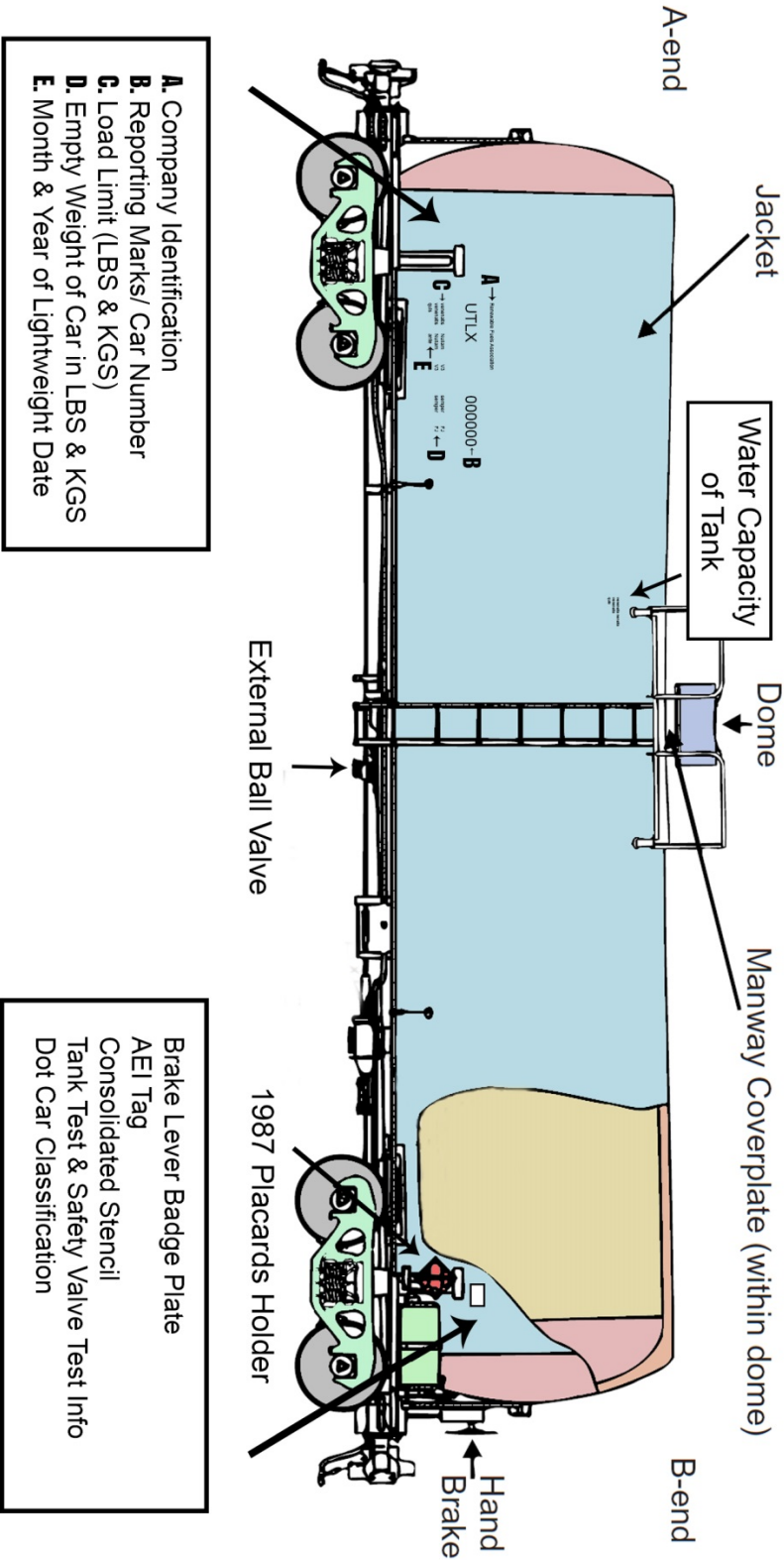
**SIGNATURE(S) of Inspection Personnel (INITIALS NOT ACCEPTABLE)**

SIGN	PRINT NAME
SIGN	PRINT NAME

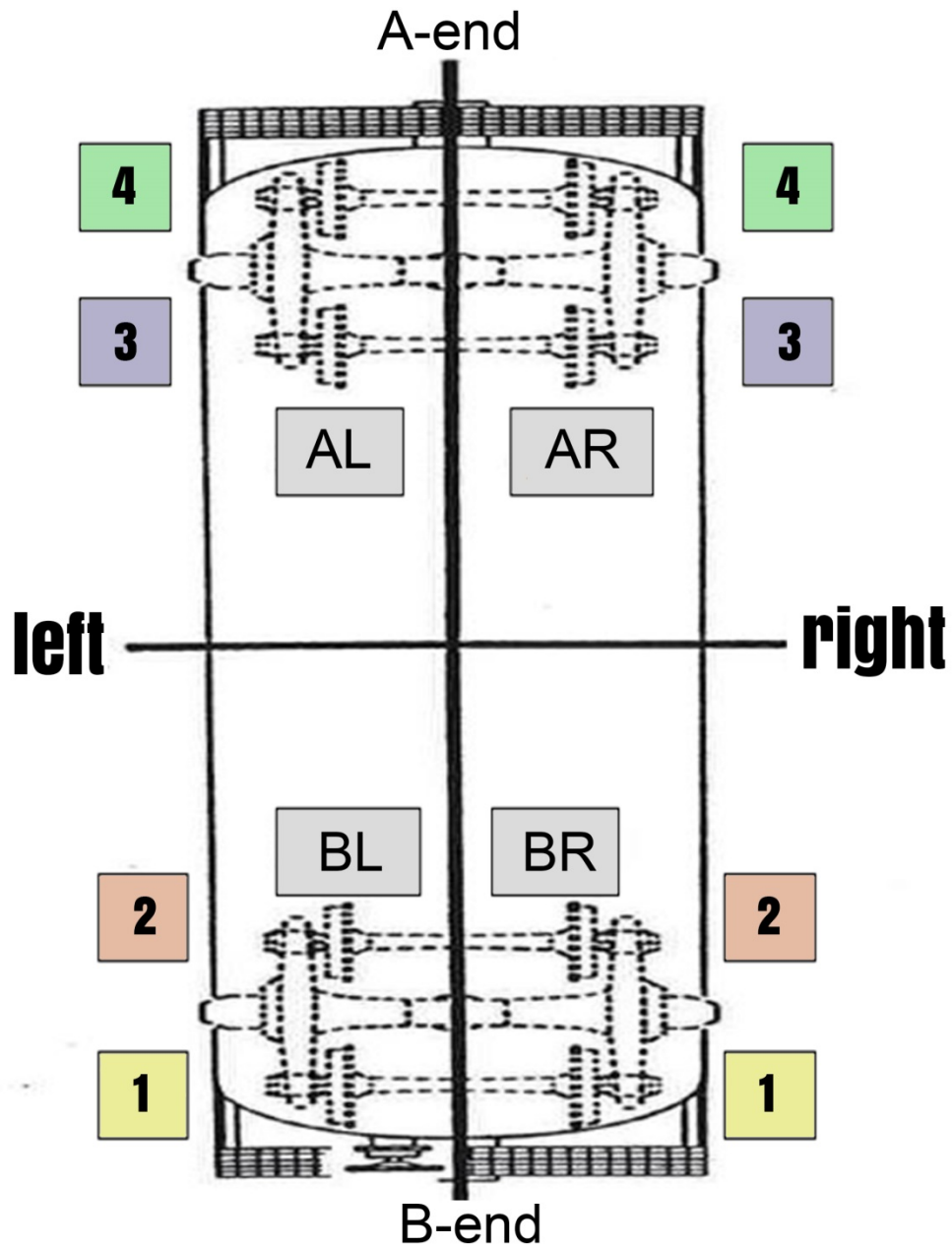
**SIGNATURE(S) of FINAL Inspection Personnel**

SIGN	PRINT NAME
SIGN	PRINT NAME

# RAIL CAR STENCILING

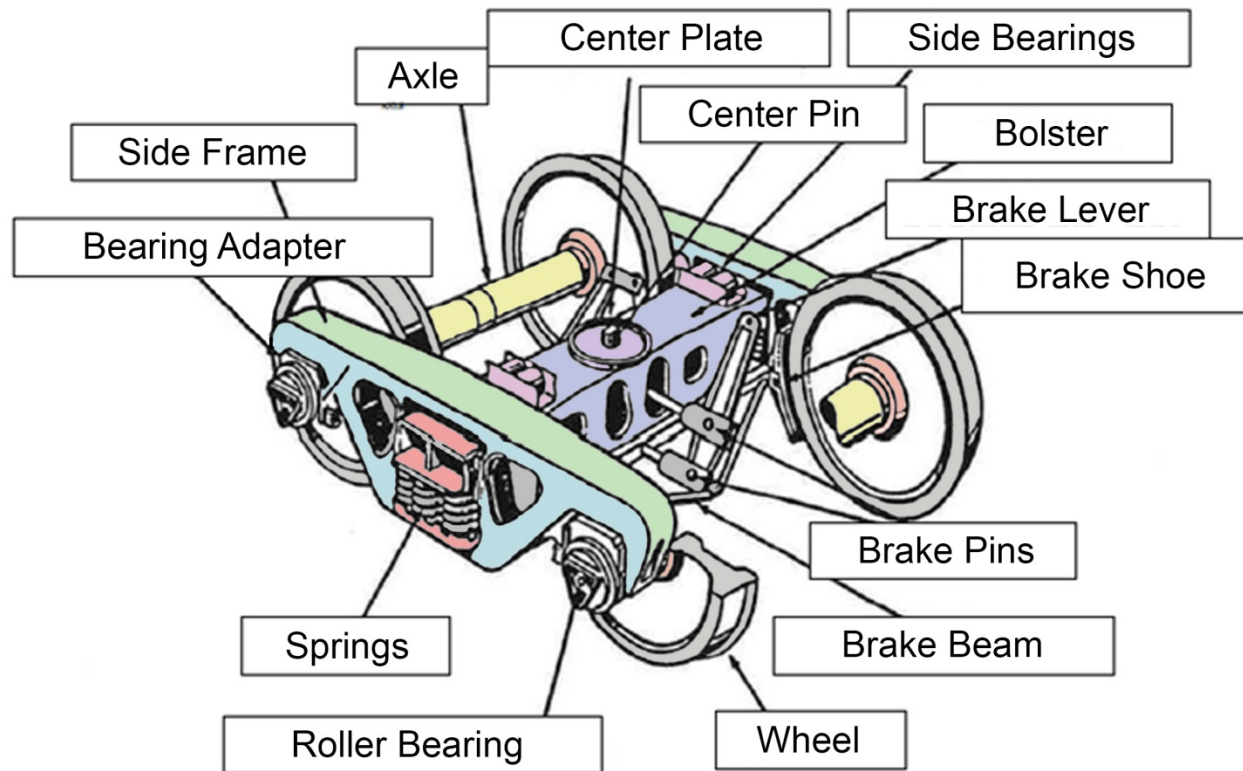


## RAIL SIDE CAR & END IDENTIFICATION





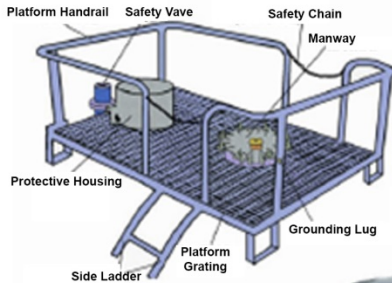
## TRUCKS



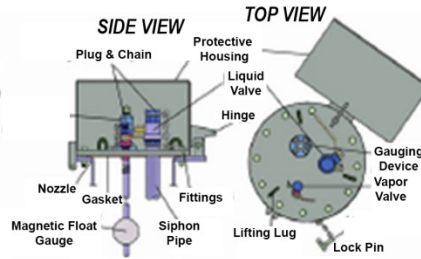


# GENERAL PURPOSE TANK CAR

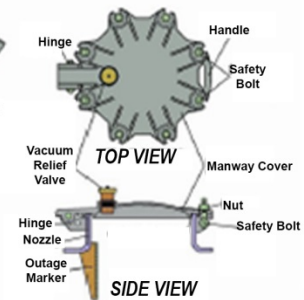
## OPERATING PLATFORM



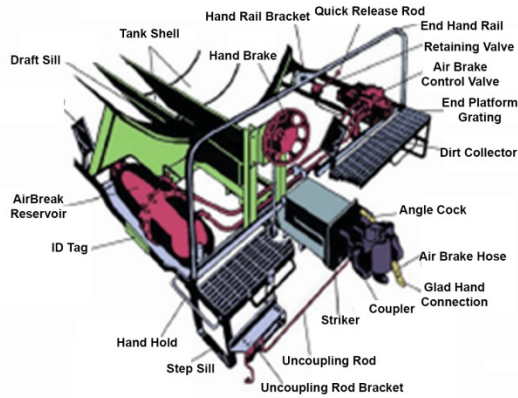
## TOP VALVES & FITTINGS



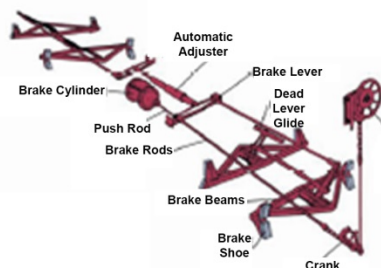
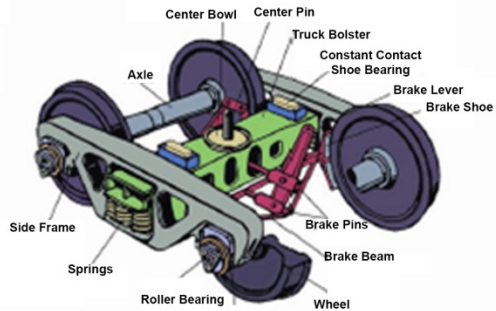
## HINGED & BOLTED MANWAY



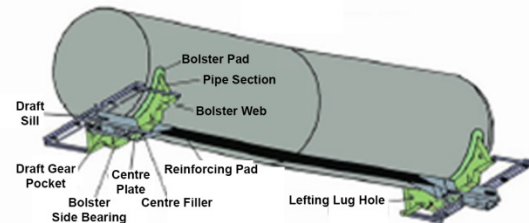
## DRAFT SILL & "B" END ARRANGEMENT



## TRUCK ASSEMBLY



## BRAKES



## STUB SILL