U.S. Department of Transportation
Federal Railroad Administration

New Tank Car Standards for Crude Oil and Ethanol Rail Shipments

FRA Alaskan Outreach
May 3, 2016

- **HM-251 New Tank Car Standards and Operational Controls for High-Hazard Flammable Trains**

  Published May 8, 2015

- **Fixing America's Surface Transportation Act (FAST Act)**

  Signed by President Obama on Dec. 4, 2015

Major Flammable Liquid Recent Derailments

Ethanol Derailment

Crude Derailment

11/06
New Brighton, PA

10/07
Plainesville, OH

8/08
Luther, OK

2/11
Arcadia, OH

200

200

200

201

201

6/09
Cherry Valley, IL

11/11
Tiskilwa, IL

December 2012

- Rail Accident Mitigation Project (RAMP)
  - Additional FRA Inspections
  - Conducted Safety Seminars
  - Highway-rail grade crossing safety and trespass prevention outreach
    - including public service announcements and advertisements at major truck stops

Major Flammable Liquid Recent Derailments

Ethanol Derailment

Crude Derailment

7/12
Columbus, OH

8/12
Plevna, MT

3/13
Parkers Prairie, MN

4/13
Bremner, OH

7/13
Lac-Megantic, QC

11/13-4/14
Aliceville, AL
Casselton, ND
Plaster Rock, ND
New Augusta, MS
Vandergrift, PA
Lynchburg, VA

2012

2013

2014

Accident Data from NTSB

Lac-Mégantic, Quebec

July 6, 2013


Reset
Homes destroyed
Dollarama
Burnt-out cars
Firefighters
Library
Crashed oil containers

DOT Actions

• ***August 2, 2013***	• FRA issued Emergency Order No. 28, requiring railroads to properly secure rolling equipment. FRA also published a Safety Advisory recommending additional actions.
• ***August 29, 2013***	• FRA and PHMSA launched Operation Classification in North Dakota's Bakken oil region to verify that crude oil is being properly classified
• ***January 16, 2014***	• Secretary Foxx meets with rail company CEOs and rail and energy association leadership as part of the Department's Call to Action to discuss how to maintain our safety record even as domestic crude oil production and movement has increased.

DOT Actions

- ***Feb. 12, 2014***

In response to the Secretary's *Call to Action*, the American Short Line and Regional Railroad Association (ASLRRA) identified five actions that it believes small railroads can voluntarily take to contribute to a safer national rail network:

1. Train Speed: Unit trains of crude oil will operate at a top speed of no more than 25 mph on all routes.

2. Emergency Response: Railroads will develop a program of best practices to ensure a seamless system of timely and effective emergency response to crude oil spills.

3. Recovery and Environmental Remediation: Railroads will sign master service agreements with qualified environmental cleanup providers to ensure prompt and effective remediation in all areas subjected to unintentional discharge of crude oil.

4. Tank Car Standards: ASLRRA will support and encourage the development of new tank car standards.

5. Risk Reduction Program: Contingent upon securing a 6-12-month pilot project grant from FRA, ASLRRA plans to create the Short Line Safety Institute.

Major Flammable Liquid Recent Derailments

5/14
Evans, CO

2015

2/15
Dubuque, IA
Timmons, ONT
Mount Carbon, WV

3/15
Galena, IL
Gogama, ONT

5/15
Heimdal, ND

Ethanol Derailment

Crude Derailment

DOT Actions

Feb. 25, 2014	• USDOT issues Emergency Order requiring stricter standards to transport crude oil by rail
May 7, 2014	• PHMSA and FRA issued a Safety Advisory requesting companies to take all possible steps to avoid the use of DOT 111 tank cars when transporting Bakken crude oil.
May 7, 2014	• USDOT issues Emergency Order requiring railroad carriers to inform first responders about crude oil being transported through their towns and communities.
April 17, 2015	• FRA issued an Emergency Order to require that trains transporting large amounts of Class 3 flammable liquid through certain highly populated areas adhere to a maximum authorized operating speed of 40 mph. FRA issued a Safety Advisory recommending that railroads use highly qualified individuals to conduct the brake and mechanical inspections and recommends a reduction to the impact threshold levels the industry currently uses for wayside detectors that measure wheel impacts to ensure the wheel integrity of tank cars in those trains

HM-251

- **New Tank Car Standards and Operational Controls for High-Hazard Flammable Trains**
  - Scope of Rulemaking
    - A continuous block of 20 or more tank cars loaded with a flammable liquid or 35 or more tank cars loaded with a flammable liquid dispersed through a train.

Published May 1, 2015

HM-251

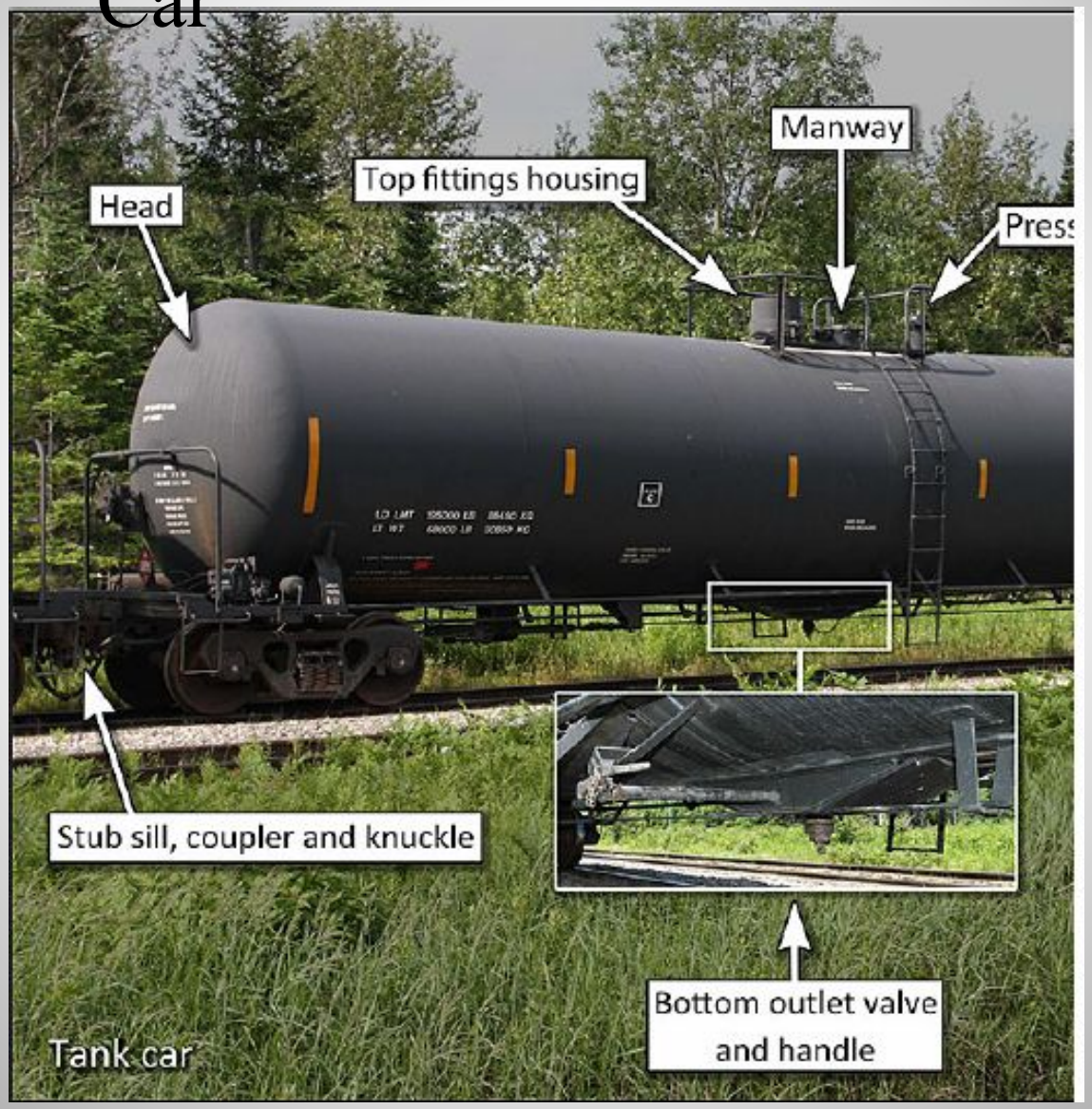
- Enhanced Braking
- Reduced Operating Speeds
- More Accurate Classification of Unrefined Petroleum-Based Products
- Rail routing - Risk Assessment
- Rail routing – Information Access
- Enhanced Standards for New and Existing Tank Cars Used in HHFT

New Tank Car Specs

- DOT 117
- DOT 117R (Retrofit)
- DOT 117P (Performance)

Older DOT 111's

Legacy DOT 111 Tank Car



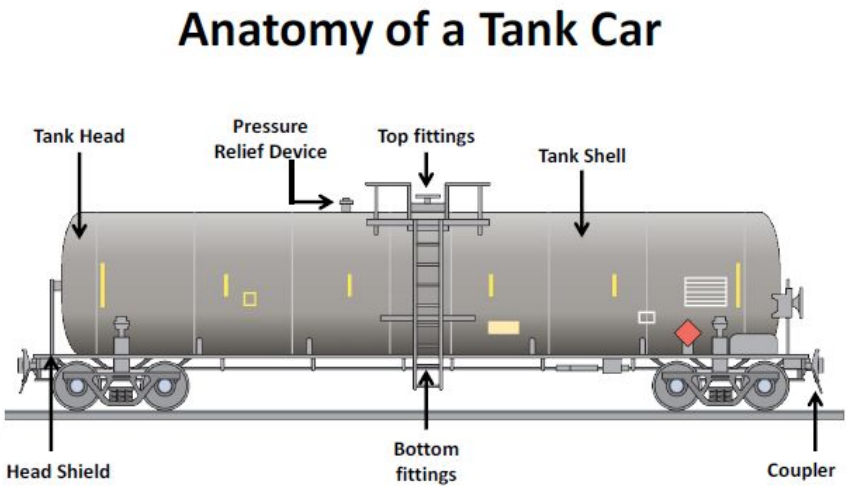
CPC-1232 Standard Tank Cars

DOT 111 in Fleet*

Tank Cars	*Total Cars*	*% of the Fleet*
Class 111 (including AAR 211)	272,102	100%
• Transporting a Material Subject to PHMSA's Hazardous Materials Regulations	172,147	63%
○ Flammable Liquid Service (Packing Group I, II, and III)	100,046	37%
▪ Flammable Liquid Service Without a Metal Jacket (Base Car)	68,660	25%
▪ Flammable Liquid Service With a Metal Jacket (Base Car)	31,386	12%
• Cars in Petroleum Crude Oil Service	38,835	14%
• Cars in Ethanol Service	29,602	11%
○ Industry Petition Cars with a Metal Jacket and Without a Metal Jacket (11,550 in Petroleum Crude Oil Service and 478 in Ethanol Service)	12,028	4%
○ Industry Petition Cars with a Metal Jacket and Without a Metal Jacket (all others)	2,615	0.9%

* As of January 1, 2014

Retrofit Requirements



- Upgrade PRV if needed
- Bottom valve protections against actuation

- DOT 117R
  - Allows 7/16” shell thickness with steel authorized by regulation at the time of construction.
    - Add 11-gauge steel jacket over thermal protection system
  - Add ½” Full Head Shield
  - Allows top and bottom fittings as equipped at time of construction
  - ECP Braking

Retrofit Cost

Estimated Cost of Modifications

Modification	*Cost to Existing Tank Car*
High Capacity Pressure Relief Device	$1,500
Head Protection[1]	$17,500
Top Fitting Protection (assuming removal of two nozzles and adding a larger nozzle, nozzle reinforcements, protective housing, post-weld stress relief, and hydrostatic testing to proof-test the final welds)[2]	$25,000
Welded Metal Jacket (includes Removal of Safety Appliances, Applying Metal Jacket Stand-Offs, Post-Weld Stress Relief, Extension of Air Brake System Supports, Reapplying Safety Appliances, and Applying an Interior Metal Jacket Protective Coating and Exterior Paint)[1]	$23,000
Insulation/Thermal Protection	$4,000
Bottom Outlet Valve Handle	$1,200
Truck Upgrade to Support the Additional Weight of the Head Protection, Metal Jacket, and Top Fittings Protection	$16,500
Total	$88,700.00

[1]Actual costs may be lower when installing head protection with a metal jacket.

[2]As an alternative, PHMSA could adopt a standard that allowed a reduction in fittings height (*i.e.*, lower nozzles) or some other degree of fittings protection, which may not comply with the current AAR standard. This approach would substantially reduce any modification cost. An estimate for grouping valves and fittings and reducing the valve and fitting profile is $6,500.

Retrofit Timeline

Timeline for the Retrofit of Affected Tank Cars for Use in North American HHFTs			
Tank Car Type / Service	**US Retrofit Deadline***	**Tank Car Type / Service**	**TC Retrofit Deadline**
Non Jacketed DOT-111 tank cars in PG I service	(January 1, 2017)[1] January 1, 2018	Non Jacketed DOT-111 tank cars in Crude Oil service	May 1, 2017
Jacketed DOT-111 tank cars in PG I	March 1, 2018	Jacketed DOT-111 tank cars in Crude Oil service	March 1, 2018
Non Jacketed CPC-1232 tank cars in PG I service	April 1, 2020	Non Jacketed CPC-1232 tank cars in Crude Oil service	April 1, 2020
Non Jacketed DOT-111 tank cars in PG II service	May 1, 2023	Non Jacketed DOT-111 tank cars in Ethanol service	May 1, 2023
Jacketed DOT-111 tank cars in PG II service	May 1, 2023	Jacketed DOT-111 tank cars in Ethanol service	May 1, 2023
Non Jacketed CPC-1232 tank cars in PG II service	July 1, 2023	Non Jacketed CPC-1232 tank cars in Ethanol service	July 1, 2023
Jacketed CPC-1232 tank cars in PG I and PG II service and all remaining tank cars carrying PG III materials in an HHFT (pressure relief valve and valve handles).	May 1, 2025	Jacketed CPC-1232 tank cars in Crude and Ethanol service and all remaining tank cars carrying PG III materials in an HHFT (pressure relief valve and valve handles).	May 1, 2025

[1] The January 1, 2017 date would trigger a reporting requirement, and shippers would have to report to DOT the number of tank cars that they own or lease that have been retrofitted, and the number that have not yet been retrofitted.

Retrofit Capacity*

- 8,400 – 19,600 cars/yr
- Unjacketed DOT 111's and CPC 1232's in crude oil service could all be retrofitted in 3.7 years
- Similar cars in Ethanol service could be retrofitted in 2.3 years

* Cambridge Systematics

DOT 117


MVTX 100407
LD LMT 192 100 LB 87 100 KG
LT WT 93 900 LB 42600 KG
MAIN 2

Comparison
111 / CPC-1232 / 117

TANK TYPE	PRE-PETITION	PETITION	FINAL RULE
Code	DOT-111	CPC-1232	DOT-117
Effective Date (new cars)	Nov-71	Oct-11	May-15
Max Gross Rail Load	263,000	286,000	286,000
Normalized Steel Heads & Shells	No	Yes	Yes
Half-Inch Head Shields	No	Half or Full Height	Full Height
Head & Shell Thickness	7/16 inch	7/16 to 1/2 inch*	9/16 inch*
Top Fittings Protection	No	Yes	Yes
Half-Inch Ceramic Insulation	No	No	Yes
Steel Jackets	Some	Some	Yes
High Flow Pressure Relief Valve	No	Some	Yes
Improved BOV Handle	No	No	Yes
ECP Brakes	No	No	Yes
		*Depends on jacketing	*7/16 inch for retrofitted — DOT-117R

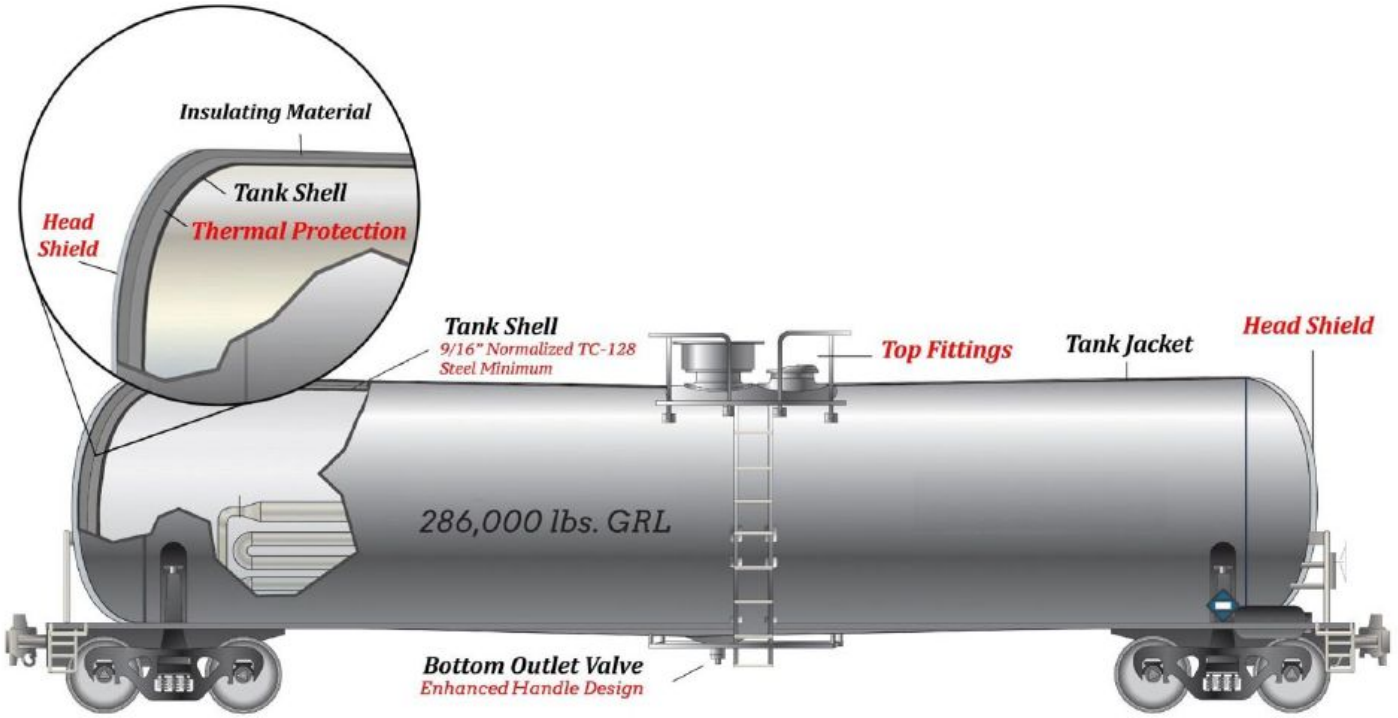
Pre-petition cars reflect the current government tank car standards (initially adopted in 1971).

Petition cars refer to the P-1577 standards that were adopted by AAR circular CPC-1232 for all cars ordered after October 1, 2011 (also known as "Good Faith" cars).

Post-petition cars reflect the new government standards released in May of 2015.

Source: GBX Internal

DOT 117 Specification Car



Safety enhancements of DOT Specification 117 Tank Car:

Full-height ½ inch thick head shield
Tank shell thickness increased to 9/16 inch minimum TC-128 Grade B, normalized steel
Thermal protection
Minimum 11-gauge jacket
Top fittings protection
Enhanced bottom outlet handle design to prevent unintended actuation during a train accident

* New tank cars built after 10/1/2015 must meet DOT 117 design or performance criteria

EVOLUTION OF RAIL INDUSTRY TANK CAR STANDARDS FOR CRUDE OIL

The railroad industry is proposing to increase the federal tank car design and construction standards for new tank cars used to transport crude oil. This proposal comes after a previous upgrade proposal which the industry voluntarily adopted and has been observing since October 2011. This graphic shows the additional tank car components included in the latest rail industry proposal.

HIGH CAPACITY PRESSURE RELIEF VALVE

Current Standard:
No requirement

Latest Rail Industry Proposal:
Requires a high capacity pressure relief device to protect against a rise in internal pressure resulting from fire. Provides for faster release of product.

TOP FITTINGS PROTECTION

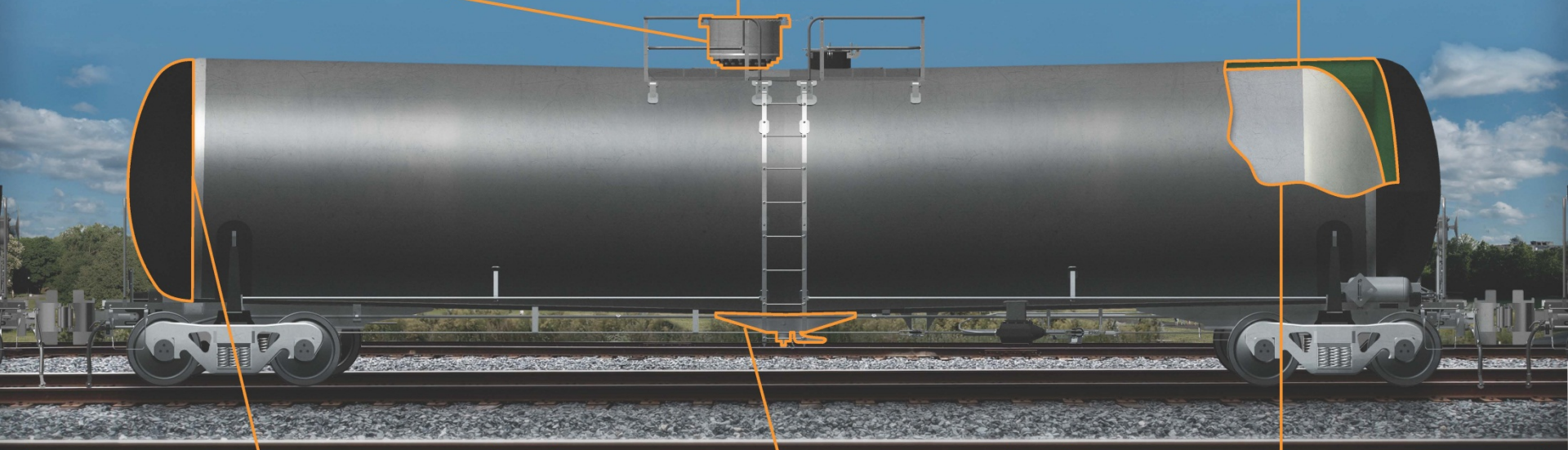
Current Standard:
Requires top fittings protection to protect the integrity of valves and fittings used to load product in the event of an accident.

Latest Rail Industry Proposal:
Contains the same requirement.

STEEL TANK

Current Standard:
Requires a minimum ½ inch thick steel tank for unjacketed cars and a minimum 7/16 inch thick steel tank for jacketed cars.

Latest Rail Industry Proposal:
Requires a minimum 9/16 inch thick steel tank.



HEAD SHIELDS

Current Standard:
Requires minimum ½ inch thick half height head shields at both ends of the tank car to improve puncture resistance.

Latest Rail Industry Proposal:
Requires ½ inch thick full-height head shields at both ends of the tank car.

BOTTOM OUTLET HANDLES

Current Standard:
No requirement

Latest Rail Industry Proposal:
Requires bottom outlet handle reconfiguration to prevent the handle from inadvertently opening the bottom outlets in the event of an accident.

JACKET AND THERMAL PROTECTION

Current Standard:
Requires a minimum ½ inch thick steel tank OR a ⅛ inch thick steel jacket.

Latest Rail Industry Proposal:
Requires the addition of both a ⅛ inch thick steel jacket around the tank car and thermal protection.

Source: Association of American Railroads, February 2014

New Car Manufacturing Capacity*

– Could reach 40,000 cars/yr

* Cambridge Systematics

Replacement vs Retrofit

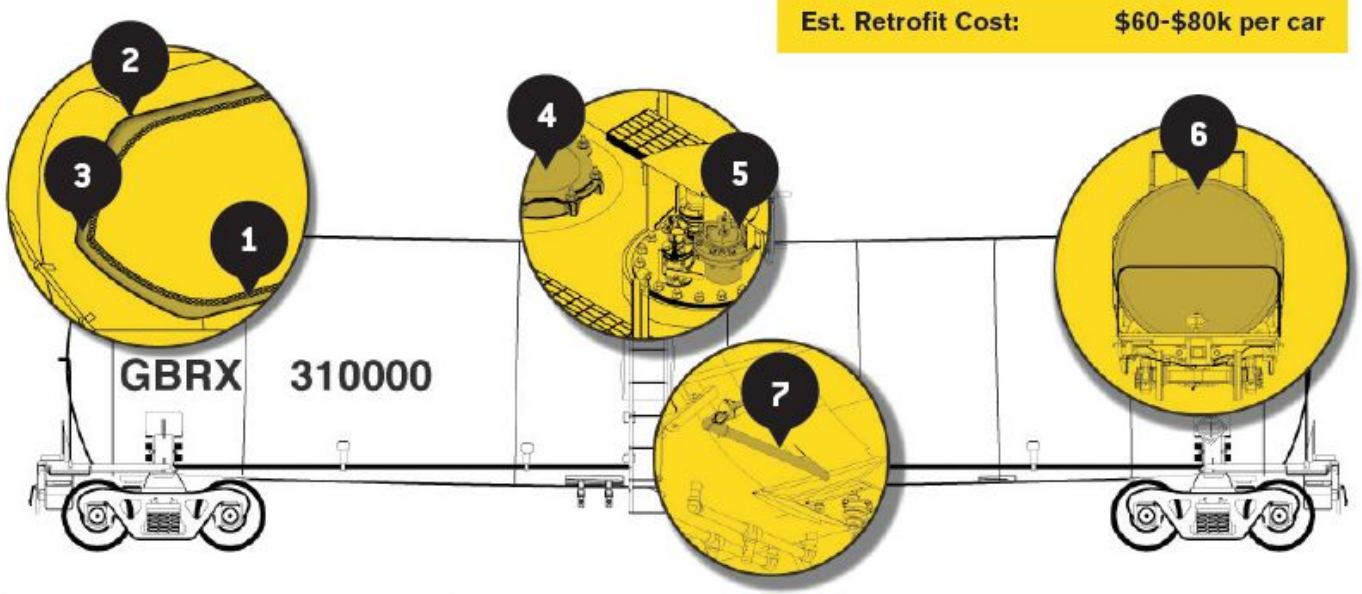
- Assuming an average purchase cost of $140,000 per tank car to conform to the industry standard, the replacement cost of the fleet of Class 111 cars is approximately $36 billion (257,459 * $140,000).

- Assuming an average modification cost of $88,700 per tank car, the modification cost of the fleet of Class 111 cars is approximately $22.8 billion (257,459 * $88,700), or approximately $8.9 billion (100,046*$88,700) for those cars in flammable liquid service alone.

DOT 117

All new HHFT cars built after **October 1, 2015** are required to meet **DOT-117 specification** (below), while older cars are required to meet **DOT-117R (Retrofit) specification** (same as DOT-117 except but 7/16" tank shell permitted) on a prescribed 2-10 year schedule.

Est. New Car Cost:	**$160-$180k per car**
Est. Retrofit Cost:	**$60-$80k per car**



GBX and GBW Railcar Services support this option

1. 9/16 inch steel tank shell
2. Minimum 11-gauge steel jacket
3. Ceramic Insulation
4. Top Fittings Protection
5. High-Flow Pressure Relief Valve
6. Full height ½-inch-thick head shields on both ends
7. Detachable bottom outlet valve handle

DOT 117P

- Same as the DOT 117 except:
  - Shell and jacket thickness could be less provided that it incorporates some type of protection or energy absorption systems on the shell and heads.
  - Must be capable of resisting a side impact of 12 mph and a head impact of 18 mph from a 12 x 12 inch impactor weight 286,000 pounds.

Impact Test

New Fleet of Tank Cars*

The entire tank car fleet could be replaced in less than five years with new cars that meet the new standards of safety!

* Cambridge Systematics

Enhanced Braking

- Two way End of Train device

- Distributed Power (DP)
- Electronically Controlled Pneumatic Brakes

Enhanced Braking

- Require HHFTs to have in place a functioning two-way End of Train (EOT) device or a Distributive Power (DP) braking system
- Require any HHFUT transporting at least one PG I flammable liquid be operated with an Electronically Controlled Pneumatic (ECP) braking system by January 1, 2021
- Require all other HHFUTs be operated with an ECP braking system by May 1, 2023

High Hazard Flammable Liquid Trains –
≥ 20 loaded cars in continuous block or
≥ 35 loaded cars within train

High Hazard Flammable Liquid Unit Trains –
≥ 70 loaded cars within train traveling more than 30 mph

Electronically Controlled Pneumatic (ECP) Braking Schedule

All HHFTs	Must have either EOT or DP braking functionality, speed restricted to 50 mph, 40 mph in HMTUA	Current
HFFUT with 1 or more loaded tank car containing a Class 3 PG I material	Must have ECP braking, or be restricted to 30 mph	Prior to Jan. 1, 2021
All HHFUTs (any Class 3 materials)	Must have ECP braking, or be restricted to 30 mph	Prior to May 1, 2023

High Hazard Flammable Liquid Trains –
≥ 20 loaded cars in continuous block or
≥ 35 loaded cars within train

High Hazard Flammable Liquid Unit Trains –
≥ 70 loaded cars within train traveling more than 30 mph

FAST Act

FAST Act

- Fixing
- America's
- Surface
- Transportation Act

- Signed by President Obama on Dec. 4, 2015
- Effective date: October 1, 2016

FAST Act
Transport of Flammable Liquids

Tank Car Type / Service	HM-251 Retrofit Deadline	Tank Car Type / Service (FAST Act)	FAST Act Retrofit Deadline
Non Jacketed DOT-111 tank cars in PG I service	(January 1, 2017) January 1, 2018	Non Jacketed DOT-111 tank cars in Unrefined Petroleum Products service	January 1, 2018
Jacketed DOT-111 tank cars in PG I	March 1, 2018	Jacketed DOT-111 tank cars in Unrefined Petroleum Products service	March 1, 2018
Non Jacketed CPC-1232 tank cars in PG I service	April 1, 2020	Non Jacketed CPC-1232 tank cars in Unrefined Petroleum Products service	April, 2020
Jacketed DOT-111 tank cars in PG II service	May 1, 2023	Jacketed and Non Jacketed DOT-111 tank cars in Ethanol Service	May 1, 2023
Non Jacketed CPC-1232 tank cars in PG II service	July 1, 2023	Non-Jacketed CPC-1232 tank cars in Ethanol Service	July 1, 2023
Jacketed CPC-1232 tank cars in PG I and PG II service and all remaining tank cars carrying PG III materials in an HHFT (pressure relief valve and valve handles).	May 1, 2025	Jacketed CPC-1232 tank cars in Unrefined Petroleum Products and Ethanol service	May 1, 2025
		All other Class 3 flammable liquids in PG I*	May 1, 2025
		All other Class 3 flammable liquids in PG II and III*	May 1, 2029

* Eventually all tank cars carrying a Class 3 flammable liquid will be required to be in DOT-117 tank cars whether in HHFT service or not.

FAST Act

- Requires Thermal Protection on Tank Cars Carrying Class 3 Flammable Liquids
  - All cars built to (or non-jacketed cars retrofitted to) the DOT117 standard must be equipped with ½" ceramic fiber blanket
  - Requires cars meet the 100 minute pool fire or 30 minute torch fire standards

FAST Act

- Top Fitting Protection
  - All cars retrofit to the DOT117 standards must be equipped with top fittings protection meeting the specified design criteria
  - No more than one PRV may be located outside of the protective housing

FAST Act

- Reporting of Modifications
  - Requirement to report retrofitted tank cars
  - Survey of tank car facilities retrofitting tank cars
  - Requires rulemaking

FAST Act

- ECP Braking
  - Requires a Government Accountability Office audit of the data and analysis related to ECP brakes and the justification made for in HM-251 final rule.
  - Requires at least one test of a 70 car unit trains consisting of DOT117 tank cars.
  - Very tight timeline for audit, test and evaluations.
    - 18 months for test and report
    - 90 days to update Regulatory Impact analysis (RIA)
    - Publish RIA for 30 days
    - Publish final RIA 60 days later
    - Overall the Department has 2 years to determine whether ECP brakes are cost beneficial
    - **If secretary does not publish this determination, the requirement for ECP Brakes are to be repealed.**

FAST Act

- Other Topic in FAST Act
  - Crude oil characteristic study
  - Hazmat by Rail Liability study
  - Oil spill response plans

Thank You !!!

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