CAMBIOS EN LA ESPECIFICACION PARA MATERIALES PELIGROSOS EN CARROS TANQUE

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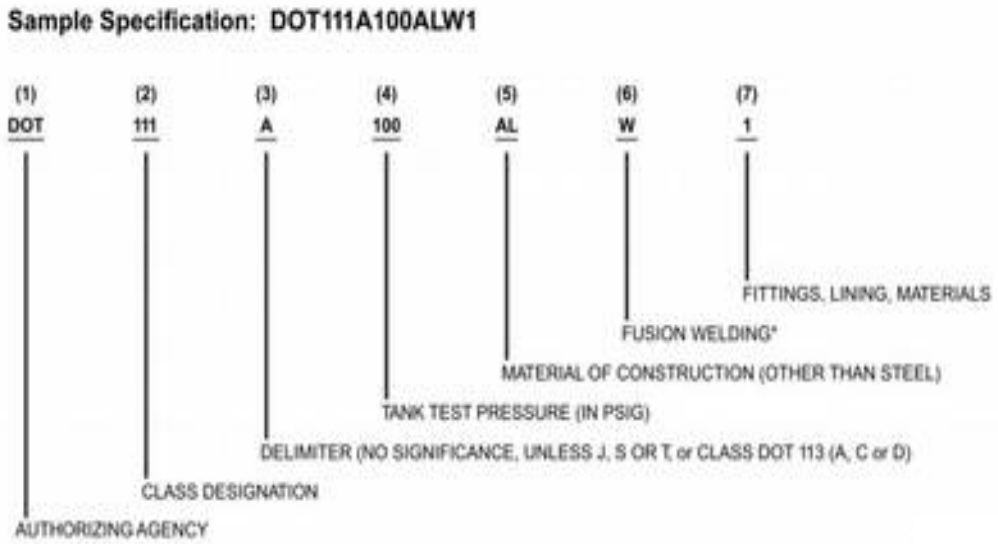
CLASIFICACION Y ESPECIFICACIONES

Clasificacion de Carro Tanque y Especificaciones. Explica los diferentes DOT, TC, y Clases de tanques AAR y especificaciones.

Sistemas de seguridad de Carros Tanque
Describe los diferentes tipos de valvulas de presion y otros sistemas de proteccion aplicados a proteger al tanque.

Estencilado y marcas en carros tanque
Informacion diferente en estencilado y marcas requeridas paracarros tanques por DOT, TC, y AAR



CLASIFICACION Y ESPECIFICACIONES

DOT 9 Classes of Hazardous Materials

DOT classifications include the following:

Class 1 Explosives
Class 2 Gases
Class 3 Flammable liquids
Class 4 Flammable solid
Class 5 Oxidizer
Class 6 Poison
Class 7 Radioactive
Class 8 Corrosive
Class 9 Miscellaneous

CLASIFICACION Y ESPECIFICACIONES

A estos límites se les denomina límite inferior de inflamabilidad (mezcla pobre) y límite superior de inflamabilidad (mezcla rica).

También pueden denominarse:

Límite superior e Inferior de combustibilidad o explosividad de un gas o vapor

Los límites de inflamabilidad de un gas o vapor combustible están directamente dados con la química de combustión de cada sustancia. Así pues, cada combustible tiene sus límites individuales, tal y como se muestra en la tabla siguiente:

Tabla Límites de inflamabilidad de algunos gases y vapores comunes (%)

GAS O LÍQUIDO INFLAMABLE	LÍMITES DE INFLAMABILIDAD	
Compuesto	Inferior	Superios
Acetona	2.6	12.8
Acetileno	2.5	81.0
Alcohol	4.3	19.0
Benceno	1.3	7.1
Butano (LPG)	1.9	8.5
Gasolina (Motor)	1.4	7.6
Hidrógeno	4.0	75.0
Jet Fuel	0.6	3.7
Kerosero	0.7	5.0
Metil Etil Cetona	1.8	10.0
Gas Natural	3.8	17.0
Propano (LPG)	2.2	9.5
Gases de alcantarilla	6.0	17.0

Principios de la Extinción

El proceso de combustión se efectúa de dos formas distintas:

Combustión con llama y

Combustión sin llama superficial.

El primer caso, en el que se incluyen las explosiones, está caracterizado por una velocidad de combustión

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CLASIFICACION Y ESPECIFICACIONES

Clasificación de Líquidos Combustibles e Inflamables

Los Códigos de NFPA. Clasificación de Underwriters Laboratories.

Clasificación de los Códigos Contra Incendios de NFPA El sistema más útil para indicar el grado de riesgo o de peligro de incendio de los líquidos capaces de entrar en ignición y sus clasificaciones y etiquetados, es el sistema desarrollado por los comités técnicos de líquidos inflamables de la Asociación Americana de Protección contra Incendios NFPA.

Este sistema se recoge con detalle en la Norma NFPA 321 "Standard sobre clasificación básica de líquidos combustibles e inflamables". A esta norma pertenecen las siguientes definiciones:

CLASIFICACION Y ESPECIFICACIONES

Class number: The term "class" is a three-digit number used to identify general groupings of tank cars. A "class designation" usually includes several specifications and is made up of the authorizing agency followed by the three-digit class number, such as Class DOT-111, Class TC-111, or Class AAR-211.

Note: In this document, the letters "TC" may be substituted for "DOT" when referring to a tank car's class or specification; and, in some cases, the authorizing agency may not be shown preceding the class number (e.g., "Class DOT-111", "Class TC-111" or "Class-111").

- **Nonpressure Tank Car Classes:**

  DOT-111: insulated or uninsulated, without an expansion dome.

  DOT-115: insulated with a carbon or alloy (stainless) steel or aluminum inner container (tank) and a carbon steel outer shell (tank, not jacket). Also referred to as a tank-within-a-tank.

  DOT-117: insulated or uninsulated carbon steel tank with jacketed thermal protection, full height head shields, and top fittings protection; a bottom outlet is optional. Additional information regarding Class-117 tank cars is contained in Section 4: Nonpressure Tank Cars.

  AAR-206: insulated with an inner container (tank) and carbon steel outer shell (tank, not jacket), similar to Class-115 tank cars. Also referred to as a tank-within-a-tank.

  AAR-211: insulated or uninsulated, without an expansion dome, similar to Class-111 tank cars.

CLASIFICACION Y ESPECIFICACIONES

- **Pressure Tank Car Classes:**

  DOT-105: insulated carbon or alloy (stainless) steel.

  DOT-109: insulated or uninsulated, carbon steel or aluminum.

  DOT-112: insulated or uninsulated, carbon or alloy steel.

  DOT-114: insulated or uninsulated, carbon or alloy steel.

  DOT-120: insulated carbon steel or aluminum.

- **Cryogenic Liquid* Car Classes:**

  DOT-113: vacuum insulated with an alloy (stainless) steel or nickel alloy inner container (tank) and carbon steel outer shell (tank, not jacket).

  AAR-204: vacuum insulated with an inner alloy (stainless) steel container (tank) and carbon steel outer shell (tank, not jacket). These tank cars are similar in concept to Class-113 tank cars.

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*Cryogenic liquid is defined by U.S. 49CFR as: "A refrigerated liquefied gas having a boiling point colder than -130°F (-90°C) at atmospheric pressure". Transport Canada TP 14877E defines it as: "A refrigerated liquefied gas that is handled or transported at a temperature equal to or less than -100°C (-148°F)".

CLASIFICACION Y ESPECIFICACIONES

Delimiter Letter: On pressure and nonpressure tank cars, the letter A separates the class from the tank test pressure and has no meaning. However, on pressure and some nonpressure tank cars, the delimiter letter is an indicator of tank head puncture resistance and/or thermal protection systems. On cryogenic liquid tank cars, the delimiter letter indicates the authorized lading loading temperature. On Class-117 tank cars, the delimiter letter corresponds to the tank car's as constructed (J), performance (P), or retrofitted (R) status.

- **Nonpressure or Pressure Tank Cars:**

  A – no significance.

  J – equipped with a thermal protection system that is covered by a jacket and tank head puncture-resistance system.

  S – equipped with tank head puncture-resistance system.

  T – equipped with a thermal protection system that is not covered by a jacket (the thermal protection material is sprayed directly onto the tank's surface) and tank head puncture-resistance system.

- **Cryogenic Liquid Tank Cars:**

  A – authorized for minus 423°F loading.

  C – authorized for minus 260°F loading.

  D – authorized for minus 155°F loading.

- **Class-117 Tank Cars:**

  J – constructed to Class-117A specification.

  P – existing nonpressure tank car that meets performance standards for a Class-117A.

  R – existing nonpressure tank car that has been retrofitted to conform to the prescribed retrofit or Class-117A performance standards.

CLASIFICACION Y ESPECIFICACIONES

Tank Test Pressure: The next set of digits is the tank test pressure in psig; typically, 20 to 40 percent of the tank's burst pressure.

For nonpressure tank cars, test pressures are specified as 60 or 100 psig; however, some manufacturers test 100-pound tanks to 165 psig, because they are equipped with 165 psig pressure relief devices (PRD), which equates to 33 percent of the tank's 500 psig burst pressure.

For pressure tank cars, test pressures range from 100 psig to 600 psig.

For cryogenic liquid tank cars, tank test pressures range from 60 psig to 120 psig.

Material of Construction (other than steel): The letters AL appearing after the tank test pressure indicate that the tank was constructed of aluminum. For other materials of construction, no letters or numerals are shown.

6. **Fusion Welding:** The letter W following the tank test pressure or the letters AL indicates that the tank was constructed using fusion welding. All tank cars are currently constructed using fusion welding. See "Note" below for PIH/TIH materials.

Note: Tank cars built after, March 16, 2009, used for the transportation of PIH/TIH materials may have the letter "I" stenciled in place of the letter W; e.g., Specification DOT-105J500I, Specification DOT-112J500I, or Specification DOT-105J600I. The letter I may be said to indicate interim design standards for a PIH/TIH tank car. More information on these requirements is found in Section 5, Pressure Tank Cars.

7. **Fittings, Linings, and Materials:** For nonpressure tank cars, the numeral following the W will indicate the tank's material of construction, requirements for insulation or interior lining, and options for a bottom outlet or bottom washout. For tank cars constructed of aluminum, the W will be prefaced by the letters AL. Class-117 tank cars do not have a numeral following the W.

CLASIFICACION Y ESPECIFICACIONES

Nonpressure Tank Car Designator Table

Designator	Tank Material	Bottom Outlet	Bottom Washout
ALW1	Aluminum	Optional	Optional
ALW2	Aluminum	No	Optional
W1	Carbon Steel	Optional	Optional
W2	Carbon Steel	No	Optional
W3	Carbon Steel (Insulated)	Optional	Optional
W4	Carbon Steel (Insulated)	No	No
W5	Carbon Steel (Elastomer Lined)	No	No
W6	Alloy (Stainless) Steel	Optional	Optional
W7	Alloy (Stainless) Steel	No	No

Age/Life Limits – There is no life limit on a tank car tank if it conforms to both the federal regulations and the AAR requirements. An underframe built prior to July 1, 1974, has an AAR life limit of 40 years, unless it has received extended service status. Underframes since July 1, 1974, have an AAR life limit of 50 years.

Note: Underframes may be "continuous" or "stub sill"; refer to "Center Sill" and "Stub Sill Tank Car" in Section 8 for additional information.

CLASIFICACION Y ESPECIFICACIONES

Identification Plate

Car builder's name:	Allied Tank Car Co
Builder's serial number:	2016 – 01110
Certificate of construction/exemption:	AO10209-1234
Tank specification:	DOT-117A100W
Tank shell material/head material:	TC128 GR B NORM
Insulation materials:	Ceramic Fiber/Fiberglass
Insulation thickness:	0.5 inch/3.0 inch
Underframe/Stub sill type:	RPM-101
Date built:	Dec 2016

Note: Tank cars built before July 25, 2012 may have the identification plates instead of, or in addition to, the head stamping.

When a modification (e.g., retrofitting a Class-111 tank car to a Class-117) changes any of the information on the ID plate, an additional variable ID plate must be installed that includes the "AAR Number" (AAR CERT NO) assigned to the modification, items that were modified, and the month and year of the modification.

Variable ID Plate

AAR Cert No:	AO11222-2345
Insulation Material:	1/2 inch Ceramic Fiber
Date of Mfg:	10/2016

Other information is required to be stenciled on both sides of the tank car near the specification marking on a "qualification stencil"; e.g., required periodic inspections and testing of the tank, PRDs, interior heater system, and interior lining/coating. The stencil will also include the due dates for next inspections and tests.

At the time of construction, tank car tanks are subject to an initial hydrostatic pressure test corresponding to its specification; e.g., the tank test pressure for a specification DOT-111A100W2 tank car is 100 psig. (Some tank car builders test nonpressure cars to 33 percent of the minimum burst pressure; i.e., 165 psig for a tank with a 500 psig minimum burst pressure.)

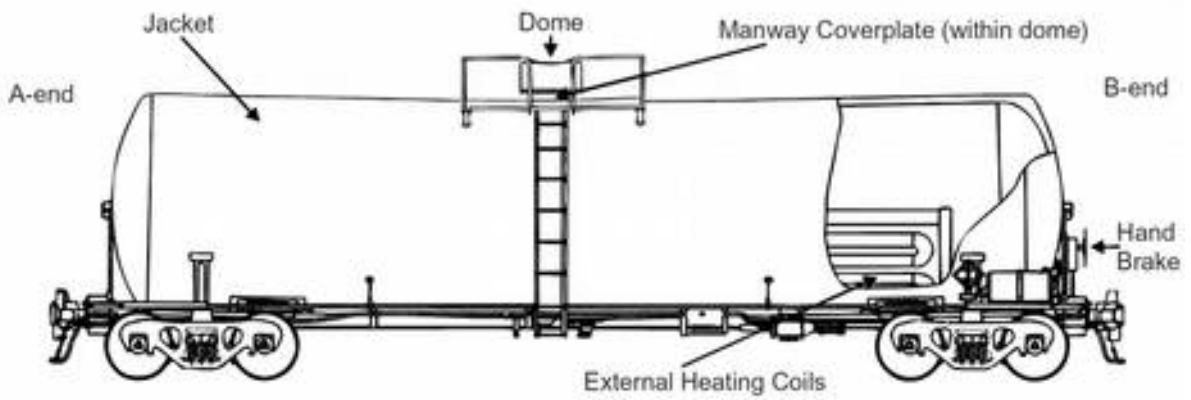
DIFERENCIAS EN LAS REGULACIONES

Tank car differences

Tank type	DOT-111	CPC-1232	DOT-117
Normalized steel heads and shells	No	Yes	Yes
Half-inch head shields	No	Half or full height	Full height
Head and 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	All
High flow pressure relief valve	No	Yes	Yes
Improved bottom outlet valve handle	No	No	Yes

* Depends on jacketing

SOURCES: The Columbian, Greenbrier Companies, NTSB, BNSF Railway — The Columbian



DIFERENCIAS EN LAS REGULACIONES

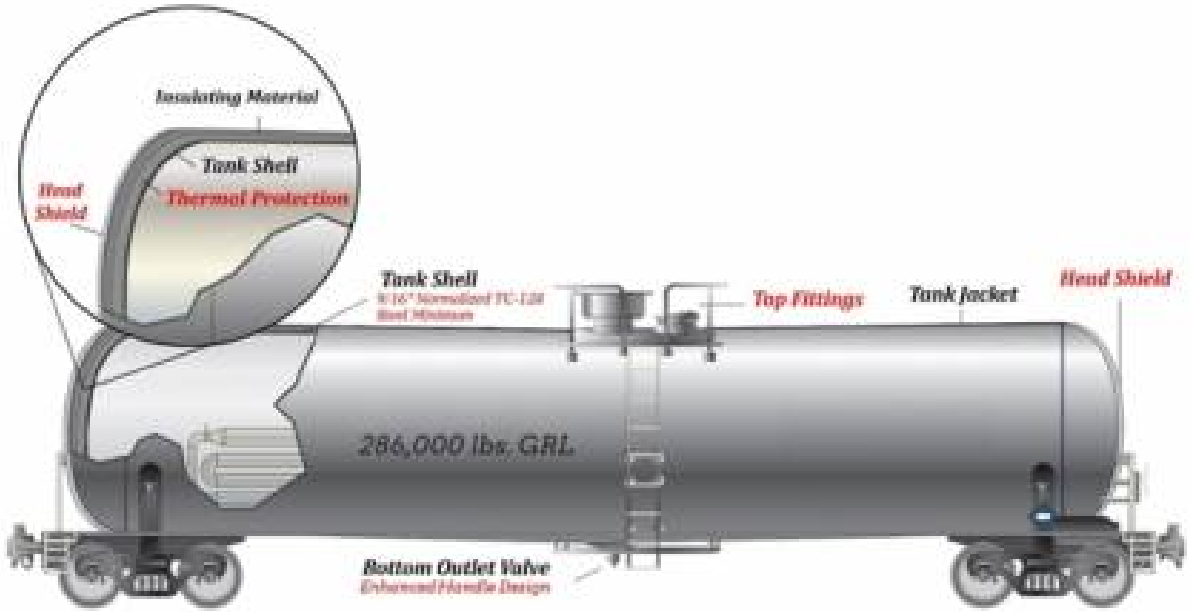
Class DOT/TC-111A "CPC 1232" Tank Car for Flammable Liquid Service
(Equipped with Top Fittings Protection and Headshields)

Courtesy of Railway Association of Canada.

Headshield Detail

ESPECIFICACION DOT 117

DOT 117 Specification Car

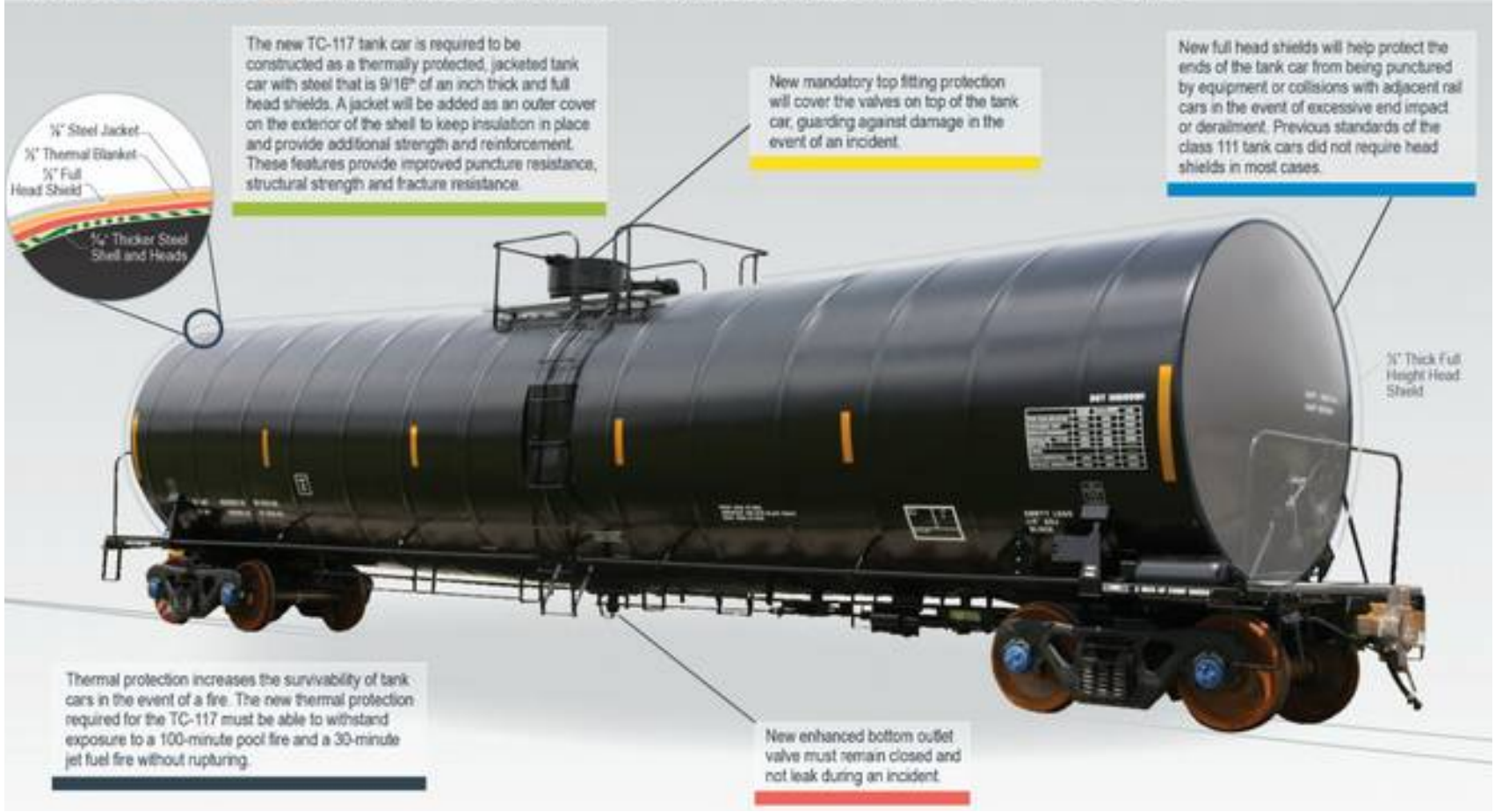


Safety enhancements of DOT Specification 117 Tank Car:

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

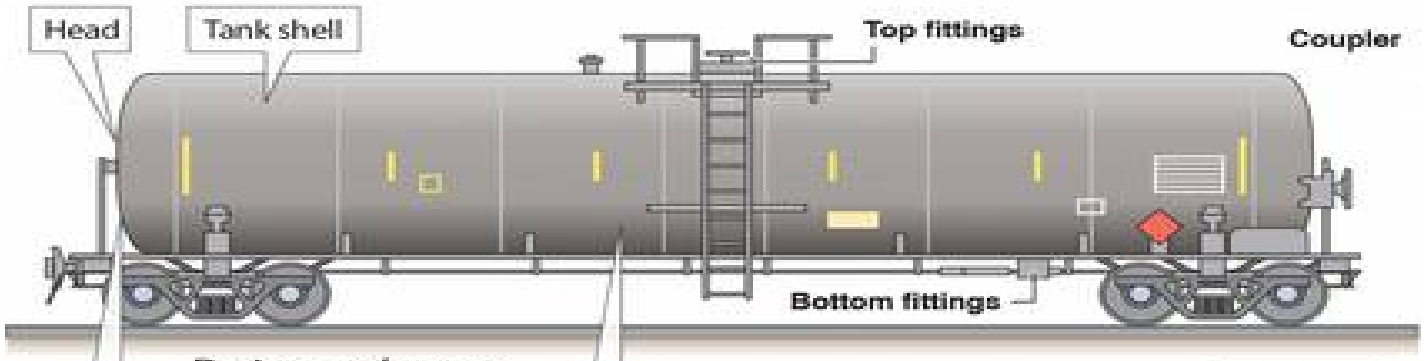
ENHANCED **SAFETY** FEATURES

The new **TC-117 TANK CAR** standard includes several enhanced safety features to protect communities along Canada's railways



EXISTING DESIGN: DOT-111 rail tank car used to transport flammable liquids

- About 92,000 DOT-111s are in use; these must be retrofitted or replaced within eight years
- Railroads generally don't own tank cars; most are leased by oil companies or other firms moving products by rail

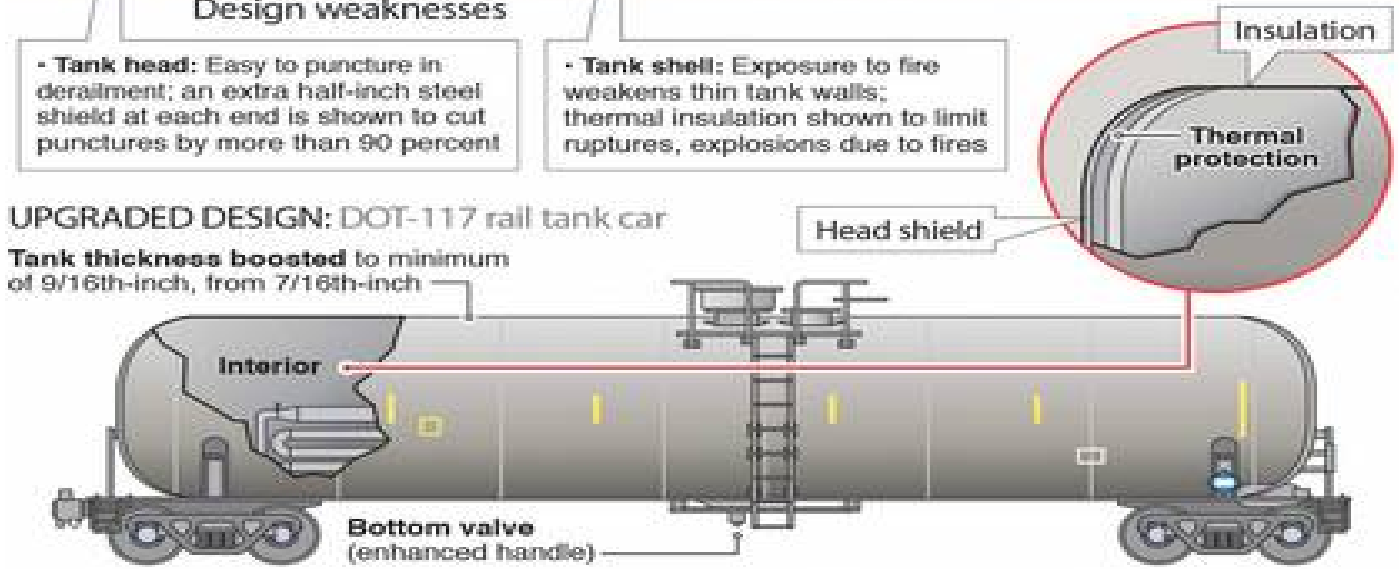


Design weaknesses

- **Tank head:** Easy to puncture in derailment; an extra half-inch steel shield at each end is shown to cut punctures by more than 90 percent
- **Tank shell:** Exposure to fire weakens thin tank walls; thermal insulation shown to limit ruptures, explosions due to fires

UPGRADED DESIGN: DOT-117 rail tank car

Tank thickness boosted to minimum of 9/16th-inch, from 7/16th-inch

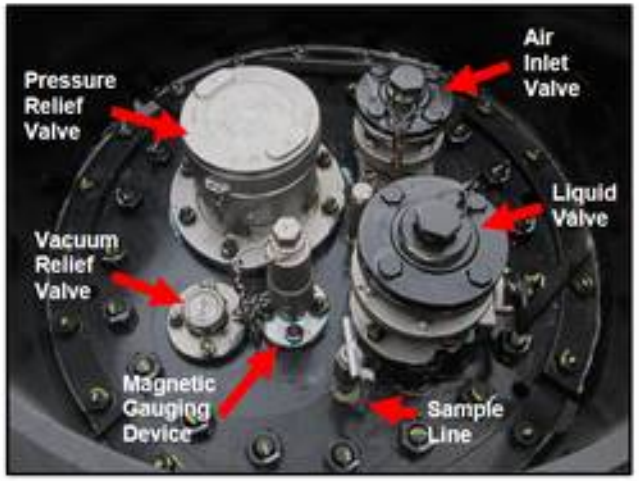


DOT/TC-117J100W Tank Car for Flammable Liquid Service

Courtesy of Railway Association of Canada.

Class DOT/TC-117 Manway and Top Fittings Protective Housing

Class DOT/TC-117 Fittings Arrangement Inside Protective Housing



Courtesy of Railway Association of Canada.

Class DOT/TC-117 Bottom Outlet Operating Mechanism

(Operating Handle Disengaged During Transportation)

Courtesy of Railway Association of Canada.

DOT/TC-117R100W Tank Car for Flammable Liquid Service

DOT-117R100W Specification and Qualification Stencil

DOT 117R100W

		STATION STENCIL	QUALIFIED	DUE
TANK QUALIFICATION		TIJA	2016	2026
THICKNESS TEST		TIJA	2016	2026
SERVICE EQUIPMENT		TIJA	2016	2026
PRD: VALVE	75 PSI	TIJA	2016	2026
LINING:				
88.B.2 INSPECTION		TIJA	2016	2026
STUB SILL INSPECTION		TIJA	2016	2026

DOT-117R100W Retrofit and Original ID Plates

Chlorine and Sulfur Dioxide:

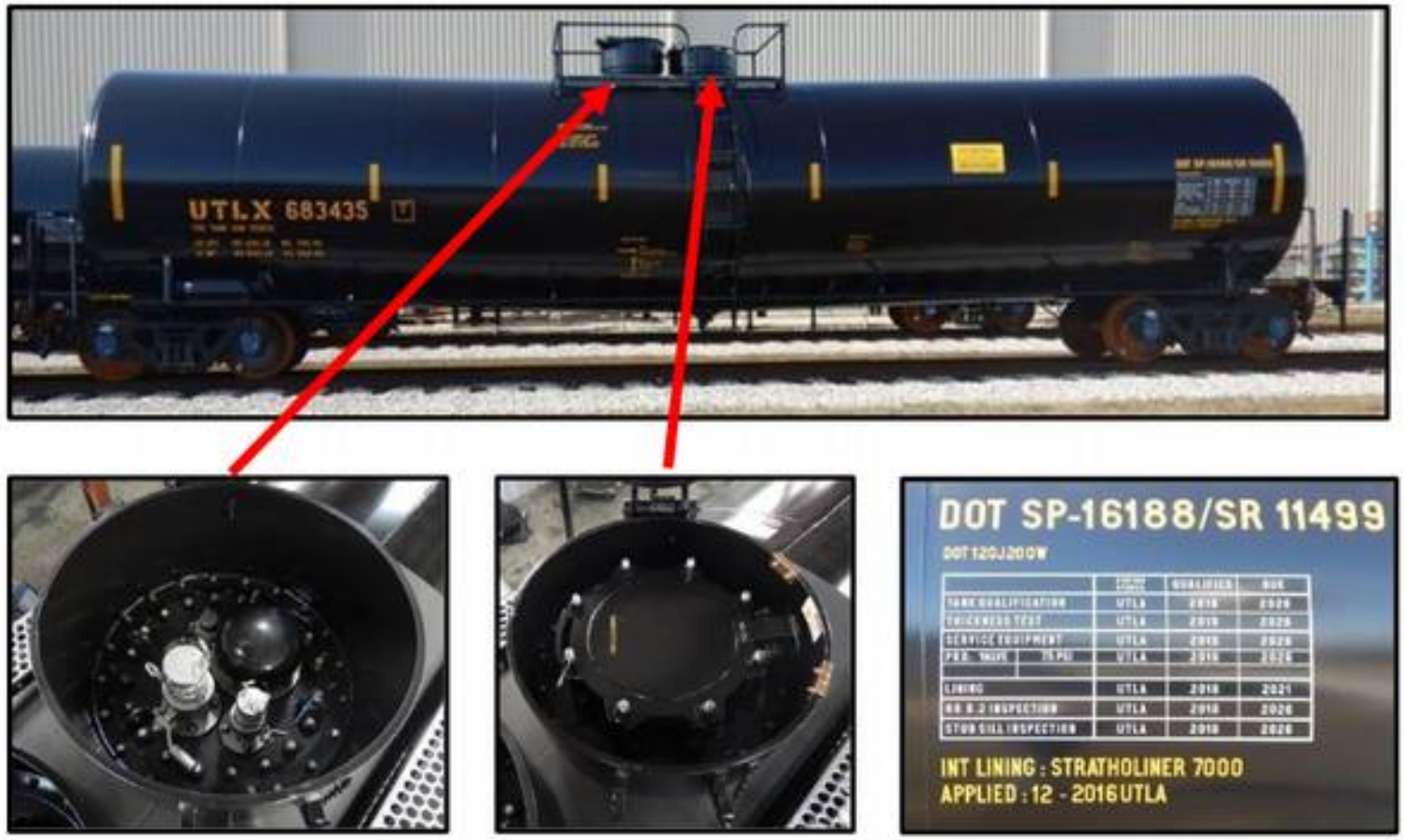
- Two liquid eduction lines along the centerline of the tank with the eduction valves pointing towards the ends of the car.
- Two vapor eduction lines with the eduction valves pointing to the sides of the car. Tank cars equipped with the enhanced fitting package (see page. 87) may be equipped with one instead of two vapor eduction lines.
- Combination PRD (breaking pin or rupture disc beneath a pressure relief valve).
- No gauging device, sample line, or thermometer well.

Carbon Dioxide and Nitrous Oxide:

- One liquid eduction line with an eduction valve and one vapor eduction line with an eduction valve along the centerline of the tank with the valves pointing towards opposite ends of the car. Typically, these eduction valves will be identified on a plate inside the protective housing or by the letters L (for liquid) and V (for vapor) applied to the interior wall of the protective housing.
- Two pressure regulating valves.
- Pressure relief valve.
- Safety vent/rupture disc device.
- Two or more fixed-length, telltale outage gauges.
- Thermometer well.

Note: Regulations require that the final discharge of the regulating valves, PRV, and rupture disc must be piped to the outside of the protective housing and identified by stenciling "REGULATING VALVES VENTING NORMAL", "RELIEF VALVE", "REGULATING VALVES", and/or "RUPTURE DISC", as appropriate, over or under the discharge pipes from the respective devices. Under no circumstances should these discharge pipes be plugged or otherwise blocked.

DOT/TC-120J200W for Flammable Liquid Service



Photographs courtesy of UTLX Manufacturing.

Fittings Arrangement for Carbon Dioxide and Nitrous Oxide Tank Cars

Tank cars transporting Carbon Dioxide and Nitrous Oxide will be stenciled "REGULATING VALVES VENTING NORMAL" on each side of the car.

The venting of vapor from the regulator valves is a normal function to reduce internal pressure through auto-refrigeration. DO NOT attempt to plug the discharge pipes of the pressure relief devices.

This design involves a "tank-within-a-tank" concept (referred to as a "sandwich car design") wherein the "outer tank" is only anchored to the "inner" commodity tank at the nozzle, and the bottom of the commodity tank rests on cradles within the outer tank.

The commodity tank has a lower test pressure (300 psi than a typical chlorine tank car. This tank car desig operates with the enhanced fittings package describ above.

Courtesy of UTLX Manufacturing.

Enhanced Fittings Arrangement for Chlorine Tank Cars with One Vapor Line

Illustration courtesy of Midland Manufacturing Company.

Cutaway View of Enhanced Fittings Arrangement for Chlorine Tank Cars

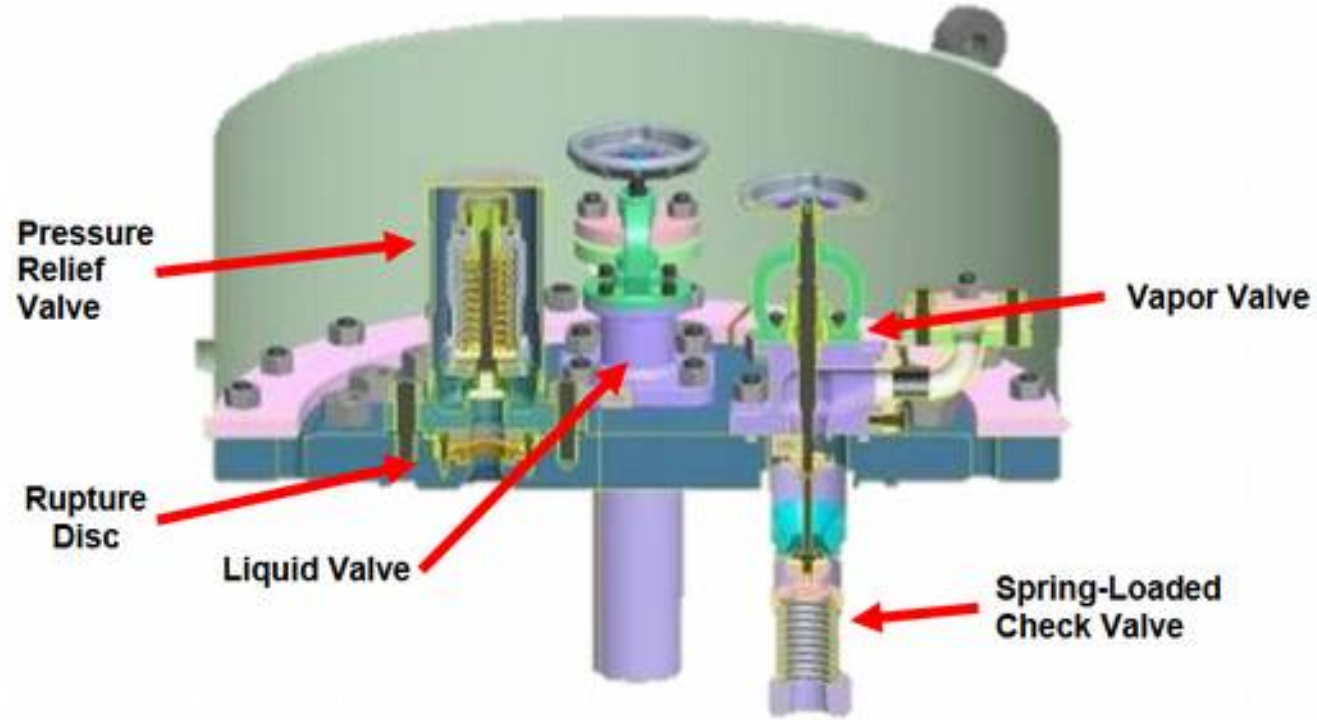


Illustration courtesy of Midland Manufacturing Company.

CRYOGENIC LIQUID TANK CARS

Cryogenic liquid tank cars, Class DOT/TC-113 and Class AAR-204, are vacuum-insulated cars having an inner container (tank) and outer shell (tank, not a jacket (although referred to as an "outer jacket" in 49CFR)). The inner tank is constructed of alloy (stainless) steel and the outer shell is constructed of carbon steel. Cryogenic tank cars are designed to transport refrigerated liquefied gases having a boiling point colder than minus 130°F at atmospheric pressure; e.g., liquid hydrogen, ethylene, oxygen, nitrogen, and argon.

The annular space between the inner and outer tanks has a vacuum drawn and is equipped with an insulation system using granular perlite or an alternating wrap of multiple layers of aluminum foil and paper. These tank cars are frequently referred to as Thermos® bottle tank cars.

The insulation system (designed for the commodity being transported and meeting specified performance standards) and vacuum controls the rate of heat input for normal transportation time periods.

Note: DOT regulations require the shipper to notify the Federal Railroad Administration whenever a tank car containing any flammable cryogenic liquid is not received by the consignee within 20 days from date of shipment. Typically, the insulation system will keep the commodity pressure from activating the PRDs for at least double this 20-day period.

Specification DOT/TC-113A60W tank cars have a design service temperature of minus 423°F, a minimum burst pressure of 240 psig, and a tank test pressure of 60 psig.

Specification DOT/TC-113C120W tank cars have a design service temperature of minus 260°F, a minimum burst pressure of 300 psig, and a tank test pressure of 120 psig.

Specification AAR-204W tank cars must meet the specification requirements for Class-113 tank cars, with some exceptions. The minimum required burst strength is 240 psig, with a 60 psig tank test pressure. Specification AAR-204W tank cars are not authorized for Division 2.1 (flammable gas) materials.

Cryogenic liquid tank cars are required to have two liquid-level gauges. One gauge measures the liquid level in the inner tank (this gauge may be a portable gauge that does not move with the car) and the other gauge, a fixed-length dip tube set, indicates the maximum allowable liquid level for the allowable filling density. In addition, the car must be equipped with a vapor-phase pressure gauge to indicate the pressure within the inner tank.

The cars must be equipped with various PRDs for the protection of the tank assembly and piping system. The discharge of the PRD must be directed away from operating personnel, the car structure, trucks, and safety appliances; e.g., steps, handholds/grab irons, and handrails.

The inner tank must be equipped with at least one PRV and at least one safety vent (rupture disc device), which may be replaced by an alternate PRV. The car may also be equipped with a pressure control device (regulator valve) and mixing device to control the routine release of vaporized lading during transportation. Tank cars in liquid hydrogen service must be equipped with a device that will instantly ignite any hydrogen that is discharged through the PRDs. The outer jacket/tank must be equipped with a system to prevent buildup of pressure within the annular space.

Typical Cryogenic Liquid Tank Car (Class DOT/TC-113)

Photo courtesy of Chart Industries.

FECHAS RETROFIT

FAST Act Phase-Out Schedule

Commodity	Tank Car	Phase-out /Retrofit
Crude Oil		
	DOT-111 Non-jacketed	January 1, 2018
	DOT-111 Jacketed	March 1, 2018
	CPC-1232 Non-Jacketed	April 1, 2020
	CPC-1232 Jacketed	May 1, 2025
Ethanol		
	DOT-111 Jacketed & Non-Jacketed	May 1, 2023
	CPC-1232 Non-jacketed	July 1, 2023
	CPC-1232 Jacketed	May 1, 2025
Other Class 3, PG I		
	DOT-111, CPC-1232	May 1, 2025
Other Class 3, PG II & III		
	DOT-111, CPC-1232	May 1, 2029

Muchas Gracias!