



**ASSOCIATION
OF AMERICAN
RAILROADS**

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Executive Director - Tank Car Safety

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CPC-1232

Subject: Requirements for Cars Built for the Transportation of Packing Group I and II Materials with the Proper Shipping Names "Petroleum Crude Oil""Alcohols, n.o.s." and "Ethanol and Gasoline Mixture"

TO MEMBERS AND PRIVATE CAR OWNERS

This is the final action on revisions effecting requirements for cars built for the transportation of packing group I and II materials with the proper shipping names "Petroleum Crude Oil""Alcohols, n.o.s." and "Ethanol and Gasoline Mixture" The changes are shown in the attached pages and marked with change bars.

Comments received from CPC-1230 have been incorporated into this final action. Questions concerning applicability of changes to MSRP M-1002 Chapter 2 should be directed to the Executive Director of Tank Car Safety.

The revised proposal is included in this circular and is in effect as of the publication date of this circular. Under the provisions of Standard S-050, which may be found on the TTCI web site (AAR.com), this circular reflects the final action on this matter.

Sincerely,

K.B. Dorsey

CHAPTER 2

AAR SPECIAL REQUIREMENTS FOR DOT TANK CARS

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CHAPTER 2. AAR SPECIAL REQUIREMENTS FOR DOT TANK CARS

2.1 Special Commodity Requirements

2.1.1 Argon, Carbon Dioxide, Nitrogen, and Oxygen

2.1.1.1 Tank cars in argon, carbon dioxide, nitrogen, and oxygen service must be marked with the following stencils:

2.1.1.2 Stencil “REGULATING VALVE(S) (VENTING NORMAL),” “RELIEF VALVE,” or “RUP-TURE DISC” in 1-in. letters, minimum, over or under the discharge pipes from the respective devices.

2.1.1.3 Stencil “REGULATING VALVE(S) VENTING NORMAL,” in 3-in. letters, minimum, on each side of the insulation jacket in the REMARKS position as shown in Appendix C, Fig. C2.

2.1.2 Hydrogen Sulfide

2.1.2.1 DOT exemption required.

2.1.2.2 Tank cars used to transport hydrogen sulfide must comply with Specification DOT-105J600W or DOT-120J600W and with the following additional special requirements:

2.1.2.2.1 No welding or welding repairs are permitted on the tank shell, heads, or manway nozzle after the tank is postweld heat treated. When such welding is necessary, the tank must be post-weld heat treated as a unit after welding is completed. Welding after postweld heat treatment is permitted only to external pads that have been welded in place prior to postweld heat treatment.

2.1.2.2.2 Tank must be postweld heat treated at 1100 °F (593 °C) minimum; postweld heat treat-ment at the alternate lower temperatures in Appendix W is prohibited.

2.1.2.2.3 Plates for the tank shell, heads, and manway must comply with Specification ASTM A516 Grade 70 normalized or ASTM A537 Class 1.

2.1.2.2.4 Manway stud and nut material, including that material inside the protective housing, must comply with Appendix M, modified by heat treatment to the following properties:

Hardness	Rc 22 maximum
Tensile strength	90,000 psi (621MPa) minimum
Yield strength	75,000 psi (517 MPa) minimum

2.1.2.2.5 Valves, valve parts, fittings, and other appurtenances must comply with National Asso-ciation of Corrosion Engineers Publication MR-01-75. Ferritic stainless steels and free-machining stainless steels must not be used. Series 300 stainless steels, except for Type 303, must be used.

2.1.2.2.6 Vacant

2.1.2.2.7 Special tank material requirements:

2.1.2.2.7.1 Tank cars intended to be loaded at ambient temperatures must be constructed of steel listed above that has not less than 20 ft-lb (27.1 J) Charpy V-notch impact value at –20 °F (–28.9 °C). The jacket must be stenciled adjacent to water capacity stencil “MINUS 20 °F (or MINUS 20 °F OR MINUS 28.9 °C) MINIMUM LOADING TEMPERATURE.”

2.1.2.2.7.2 Tank cars intended to be loaded at lading temperatures below –20 °F (minus 28.9 °C) must be constructed of steel listed above that has not less than 15 ft-lb (20.3 J) Charpy V-notch transverse impact value at –50 °F (–45.6 °C). The jacket must be stenciled adjacent to water capacity stencil “MINUS 50 °F (or MINUS 50 °F OR MINUS 45.6 °C) MINIMUM LOADING TEMPERATURE.”

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2.1.2.2.7.3 Impact testing must conform to ASTM A370 and Appendix W, except that all test and retest specimens (not the average) must meet the requirements.

2.1.2.2.8 Tank anchor-to-tank shell fillet welds must be examined by a suitable nondestructive testing method to ensure that welds are free from cracks or other detrimental defects.

2.1.2.2.9 Lead-base paints and lead gaskets must not be used.

2.1.2.2.10 Tank jacket must be stenciled on both sides in letters not less than 4 in. (102 mm) high "HYDROGEN SULFIDE."

2.1.2.2.11 All loose mill scale must be removed from the interior of the tank using Steel Structures Painting Council Specifications SP7. Surface hardening of parent metal must be avoided.

2.1.3 Molten Sulphur

2.1.3.1 To ensure structural integrity, tank cars ordered after January 1, 1994, constructed for the transportation of molten sulphur must have a protective coating, lining, or corrosion-resistant material in areas of high heat flux to prevent wet elemental sulphur contact corrosion. The National Association of Corrosion Engineers (NACE) has published NACE Standard RP0302-2002, "Selection and Application of a Coating System to Interior Surfaces of New and Used Rail Tank Cars in Molten Sulfur Service," available from NACE International, 1440 South Creek Drive, Houston, TX 77084-4906.

2.1.3.2 To ensure structural integrity, existing tank cars used for the transportation of molten sulphur must have an inspection and test conducted every 10 years. After an inspection and test, the owner must ensure that the tank car has a protective coating, lining, liner, or corrosion-resistant material applied in areas of high heat flux to prevent wet elemental sulphur contact corrosion. First inspection must be completed before December 15, 2003.

2.1.4 Hydrogen Fluoride, Anhydrous

In addition to the DOT requirements, the following AAR requirements for tank cars used to transport anhydrous hydrogen fluoride must be met. See Appendix R, paragraph 5.1, for alteration of existing tank cars to hydrogen fluoride service. New construction must be Class 112 specification (DOT exemption required).

2.1.4.1 Bottom opening in tank is prohibited.

2.1.4.2 The steelmaking practice for new fabrication and plates for repairs to tank shell, heads, and manway nozzles shall provide resistance to hydrogen-induced cracking and blistering. The steel must meet the following requirements:

- Tensile strength is not to exceed 85 ksi.
- The steel shall have a specification of 0.006% maximum sulfur content and be calcium treated to obtain the minimum number of inclusions, inclusion shape control, and maximum resistance to hydrogen blistering.
- Steels with sulfur content above 0.003% shall be tested for hydrogen-induced cracking per National Association of Corrosion Engineers (NACE) Standard TM-02-84, or be ultrasonically scanned per ASTM A-578, Level C (using a 1-in. circle).

2.1.4.3 Tanks must be postweld heat treated between 1125 °F and 1225 °F. Postweld heat treatment at alternative lower temperatures referenced in Appendix W is prohibited.

2.1.4.4 If welding or welded repairs are required on the tank shell, heads, or manway nozzle after the tank is postweld heat treated, repairs must be made per Appendix R, paragraph 5.1.

2.1.4.5 The maximum hardness of the tank and welds after postweld heat treatment must be 20 HRC. If weld repairs are required, hardness measurements shall be made per Appendix R, paragraph 5.1.

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2.1.4.6 Valves, valve parts, and other appurtenances normally in contact with the lading must comply with National Association of Corrosion Engineers Publication MR-01-75 or be of the following materials:

- Gold
- Platinum
- Nickel (except electrolytic and electroless)
- Monel (except free-machining)
- PTFE
- Fluoroelastomer copolymer/tripolymer
- Aluminum-silicon-bronze

2.1.4.7 Pressure relief valves must be in combination with either a breaking pin device or a rupture disc. See DOT 179.15 (e). If the pressure relief valve is in combination with a rupture disc, the tank must be 112A400W, stenciled -200W and equipped with a combination device set for -200W requirements, having the disc rated at 150 psig (1034 kPa) and the valve start-to-discharge at 142 psig (979.1 kPa). The space between the rupture disc and valve must be vented and the vent must be closed in transportation.

The vent must be checked at each loading to ensure that the rupture disc is not leaking. If the rupture disc is defective, it must be replaced and the pressure relief valve tested for proper operation.

2.1.4.8 Studs and bolts used to fasten any valves or fittings to the cover plate or the cover plate to the manway ring must meet one of the following specifications:

- ASTM A193-B7M including Supplement S3 requiring 100% hardness testing
- ASTM A193-B7—Maximum hardness Brinell 237 (Rc 22)
- ASTM A320-L7—Maximum hardness Brinell 237 (Rc 22)
- ASTM A193-B8, Class 2, Type 304 stainless steel, carbide solution treated and strain hardened to Brinell 320 (Rc 35) maximum hardness

Rolled threads are required for all studs and bolts.

2.1.4.9 Nuts used to fasten any valves or fittings to the cover plate or the cover plate to the manway ring must meet one of the following specifications:

- ASTM A194-2HM including Supplement S7 requiring 100% hardness testing
- ASTM A194-2—Maximum hardness Brinell 237 (Rc 22)
- ASTM A194-8F, Type 303 stainless steel, carbide solution treated, machined from cold drawn bar, Brinell 300 (Rc 32) maximum hardness

2.1.4.10 Fasteners used in valve assemblies must conform to the National Association of Corrosion Engineers Publication MR-01-75 and must be approved for anhydrous hydrogen fluoride service. Ferritic stainless steels must not be used.

2.1.4.11 Each tank must be marked “HYDROGEN FLUORIDE” in accord with DOT 172.330.

2.1.4.12 Inspection and Repairs

See Appendix R, paragraph 5.1.

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2.1.5 Vinyl Chloride

All tank cars ordered after May 1, 2001, for vinyl chloride service must be equipped with cover plates as shown in Appendix E, Fig. E9 (20-in. diameter) or Fig. E11 (22-in. diameter). Refer to Fig. E10 (20-in.-diameter cover plate) or Fig. E12 (22-in.-diameter cover plate) for details on nozzle joints. For details on openings, see Figs. E19 through E19.25.

2.1.6 Aluminum Tank Car Tanks

The following commodities are not authorized in aluminum tank car tanks:

- Carbon tetrachloride
- Chloroform
- Ethylene dichloride
- Methylene chloride
- Propylene dichloride

2.1.7 Totally Contained Commodities (Shipped in Tank Cars not Equipped with Pressure Relief Devices)

2.1.7.1 The transportation of totally contained commodities in tank cars not equipped with pressure relief devices must be approved by the Tank Car Committee and be carried out in tank cars stenciled as AAR Specification tank cars. A DOT exemption is required for totally contained transportation in a DOT Specification tank car.

2.1.7.2 Proponents desiring to transport a product in a tank car without a pressure relief device must petition the Tank Car Committee by submitting an AAR Form 4-2 (see Fig. 1.1 on page C-III-28), requesting approval. Technical justification must be submitted with the application and must include calculations made with the AFFTAC simulation model or approved equivalent analysis, indicating that the car will survive at least 100 minutes in a pool fire before rupturing. Such calculations must consider the thermal properties of the commodity, including the coefficient of expansion, expected exothermic reactions, and other considerations specified by the Tank Car Committee.

2.1.7.3 Tank Cars must be marked with a commodity stencil as specified in Appendix C, paragraph 6.1.

2.1.8 Reserved

2.1.9 Reserved

2.2 General Requirements

2.2.1 Pressure Tank Car Tanks

2.2.1.1 All steel, single-unit pressure tank car tanks must be fabricated from fine-grain steels as described by ASTM A516, A537 or TC128. Heads and shells of pressure tank car tanks constructed of ASTM A516 or TC128 must be normalized, effective January 1, 1989. Tank car heads must be normalized after forming, unless specific approval is granted for a facility's equipment and controls.

2.2.1.2 Effective for cars ordered after August 1, 2005, each plate-as-rolled of ASTM A516, A302, A537, and AAR TC128 steel used for pressure tank car heads and shells must be Charpy impact tested transverse to the rolling direction in accordance with ASTM A20. The test coupons must simulate the in-service condition of the material and must meet the minimum requirement of 15 ft·lb average for three specimens, with no single value below 10 ft·lb and no two below 15 ft·lb at -30 °F. Plates for low-temperature service described in 49 CFR 179.102 that require longitudinal impact testing at -50 °F do not require transverse testing at -30 °F.

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2.2.2 Manway Covers

For dimensions and tolerances of manway covers for tanks covered by DOT 179.100, see Appendix E. For stud and bolt materials, see Appendix M. Carbon steel manway cover plates used for pressure cars must be fabricated from fine-grain practice, normalized material.

2.2.3 Fittings for Acid Cars

2.2.3.1 Lead gaskets are prohibited.

2.2.3.2 Fill openings, when used, must be designed as follows:

2.2.3.2.1 For 111A*W2/103AW tanks

- Minimum 6-in. (152.4-mm) nominal pipe size opening
- Minimum three-bolt or rim-clamping mechanism closure
- Cover to be hinged or otherwise attached to tank
- Safety feature to prevent removal of cover while tank is under pressure

2.2.3.2.2 For 111A*W5/103BW tanks, as an alternative to the one-bolt clamping arm type, the fill opening criteria above may be used.

2.2.3.3 The service equipment fitted on top of new nonpressure cars in sulfuric acid service, ordered built new after June 30, 2010, must meet the requirements of paragraph 10.2.1 of Appendix E. Subject to paragraph 2.2.3.4, the service equipment fitted on top of nonpressure cars in sulfuric acid service ordered new before July 1, 2010, and built after August 1, 2002, must meet the requirements of paragraph 10.2.1 of Appendix E or must be protected by one or more of the following methods:

2.2.3.3.1 By fitting a protective device mounted to the tank shell and/or manway cover plate. These protective structural items must meet all of the following criteria:

- Must be designed to effectively protect the service equipment and to meet the conditions listed in paragraph 2.2.3.5.
- Must be mounted to the shell through a pad or to the manway cover plate with a welded or bolted joint having no more than 70% of the strength of the pad-to-shell or manway cover plate-to-manway nozzle joint.
- Must not reduce the pressure relief device flow capacity below the minimum required.
- Must provide sufficient drainage and adequate access for personnel to load and unload and maintain and inspect the service equipment while wearing the appropriate protective gear.

2.2.3.3.2 By using the filling nozzle as a local protective device for the service equipment fitted on the manway cover plate, in which case, the following apply:

- The filling nozzle and its closure are designed to meet the conditions of paragraph 2.2.3.5.
- No service equipment or part thereof extend higher than the top surface of the filling nozzle cover structure, nor extend beyond the perimeter of the manway cover.
- Except for the following item, the service equipment is mounted to the manway cover plate or to a nozzle welded to the manway cover plate or fill opening through a welded or flanged connection.
- If an air connection is provided, the connection may be threaded, and pipe elements must be at least extra-strong (XS) in wall thickness and located where ample roll-over protection is afforded by the filling nozzle. This fitting may be mounted to the manway cover plate or to a nozzle through a threaded connection.

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2.2.3.4 The service equipment fitted on top of nonpressure tank cars built before August 1, 2002, in sulfuric acid service must meet the requirements of paragraph 10.2.1 of Appendix E or must be protected by one or more of the following methods by August 1, 2011:

2.2.3.4.1 By fitting a protective device as per paragraph 2.2.3.3.1.

2.2.3.4.2 In the case of service equipment fitted on the manway cover plate, by using the filling nozzle as a local protective device, where

- the service equipment is a non-reclosing pressure relief device mounted on the manway cover plate through a welded or flanged connection and the device or part thereof does not extend higher than 1 in. above the top surface of the filling nozzle cover structure, nor extend beyond the perimeter of the manway cover;
- the service equipment is an eduction pipe and its closure assembly made with minimum NPS 2 extra strong (XS) and the assembly or part thereof does not extend higher than 4 in. above the top surface of the filling nozzle cover structure, nor extend beyond the perimeter of the manway cover; and
- the service equipment is mounted as per paragraph 2.2.3.3.2 bullets 3 and 4.

2.2.3.4.3 In the case of a non-reclosing pressure relief device mounted on an existing nozzle but located outside of the manway cover plate, the device may not meet the conditions of paragraph 2.2.3.5 nor be fitted with a protective device meeting the conditions of paragraph 2.2.3.5 if

- the device is mounted to the nozzle through a welded or flanged connection; and
- the device or any part thereof extends no more than 8 in. above the top face of the nozzle's flange and no more than 20 in. above the outer longitudinal centerline of the tank shell as shown in Fig. E25.4.

2.2.3.5 The protective device or unprotected service equipment under consideration and tank must withstand, at a minimum, the following loads applied to the top fittings assembly and nozzle: 1/2W vertical in the downward direction, 1W horizontal in the longitudinal direction, and 1/2W horizontal in the lateral direction, with each load applied separately as a uniform load over the projected plane of the element(s) under consideration. For horizontal loads, the height of the projected plane is from the top of the tank at the centerline to the height of the item. 1W is the car's maximum gross weight on rail minus the weight of the trucks. The stress must not exceed the following:

- The minimum specified tensile strength of the material for the tank, nozzle(s), unprotected service equipment, and protective device (where applicable); and
- The critical buckling stresses of the assembly under consideration.

2.2.4 Eduction Pipes

The following applies to all pressure and nonpressure tank cars, with and without interior coatings or linings:

2.2.4.1 Eduction pipes and guides must be designed and installed to prevent contact of the eduction pipe with the tank shell, sump, or interior coating/lining material. Consideration must be given to manufacturing tolerances, wear of components, coating/lining thickness, and any deflection that may occur due to design loads as specified in paragraph 6.2.

2.2.4.2 Whenever an eduction pipe is removed from a car, a procedure must be in place to identify the eduction pipe to the car and to ensure proper orientation and fit when reinstalled or when replaced per the original design.

2.2.4.3 Bleed holes in eduction pipes closed with pipe caps are prohibited. Approved means must be provided to relieve pressure.

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2.2.5 Two-Bolt Swing Closures

When two-bolt swing closures are used as secondary closures on bottom outlets, their use must be limited to commodities that have a freezing point above 150 °F (65.5 °C) and that exhibit little or no vapor pressure at ambient temperatures.

2.2.6 Lead Rupture Discs

Lead rupture discs are prohibited.

2.2.7 Vacuum Relief Valves

Gravity-actuated vacuum relief valves must not be applied or replaced in kind.

2.2.8 Electrical Bonding

The car design must meet the electrical bonding requirements of AAR Specification M-1001, paragraph 4.3.6.

2.2.9 Internal Reinforcing Pads

Reinforcing pads are required for internal attachments, except gauging bars, pressure relief device baffle plates, shell stiffeners, and non-anchor-type pipe supports for internal coils. They must be not less than 1/4-in. thick, have each corner rounded to a 1-in. minimum radius, and be attached to the tank by continuous fillet weld. Pad venting provision must be considered and tank drainage must be provided.

2.2.10 Insulation

Tank car insulation systems, including foams, must not promote corrosion to steel when wet. Tank and jacket protective coatings are required. The tested pH of reacted foam-in-place insulation must be within the range of 5 to 9. The pH of the foam is tested when cured, and granulated foam is boiled for one hour in deionized water, in a ratio of one part foam to 40 parts water by weight.

2.2.11 Bottom Outlet Caps and Nozzles

The limiting wear dimensions for bottom outlet caps and nozzles are found in Appendix E, Figs. E18 through E18.5. Caps or nozzles worn to these limits must be removed from service. Suggested NOGO gauges are shown in Figs. E18.6 through E18.9. These gauges also may be used to verify the integrity of threads on hose connections used at loading and unloading sites.

2.2.12 Internal Heater Connections

Unused internal heater coil couplings in tank shells or heads must be closed only with a threaded and seal-welded plug.

2.2.13 Gas Purging Standards

2.2.13.1 Definitions.

The following definitions apply to this standard:

2.2.13.1.1 Purging. The replacement of air or other vapors in a tank car by introducing gaseous nitrogen or other cryogenic liquids under low pressure and venting the resulting gas mixture. Purging is generally used as part of the cleaning operation for tank cars or for cars being prepared for a change in commodity service.

2.2.13.1.2 Padding. The introduction of an inert gas under pressure into the vapor space of a tank car tank in order to create a nonflammable or moisture-free atmosphere.

2.2.13.2 Each facility that purges a tank car with nitrogen or other cryogenic liquid shall ensure against the introduction of liquid into the tank through a written procedure, training, supervision, and appropriate equipment.

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2.2.13.3 For recommended nitrogen purging procedures, see the latest edition of *Recommended Procedures for Nitrogen Purging of Tank Cars*, Compressed Gas Association, Pamphlet No. CGA P-16.

2.2.14 Pressure Relief Valves

Tank cars in regulated commodity service that are equipped with pressure relief valves incorporating a 35-psi start-to-discharge pressure must be upgraded to a 75-psi start-to-discharge pressure at the next shopping, not to exceed next valve qualification time.

2.2.15 Thermal Protection Systems

2.2.15.1 In addition to the requirements of the Federal Regulations, thermal protection systems, when required, must meet the provisions of this paragraph.

2.2.15.2 Each combination of tank car, pressure relief device, thermal protection system, and lading material must be capable of withstanding a full-immersion pool fire for 100 minutes and a torch fire for 30 minutes under the conditions described in paragraph 2.2.15.3 with no release of lading except through the pressure relief device. An analysis using the computer program AFF-TAC is the recommended means of verifying this.

2.2.15.3 Analyses must be performed with the tank car in both the upright position and overturned 120° about the longitudinal axis. In addition, the following conditions must be met:

2.2.15.3.1 Initial temperature of the lading material must be 46 °C (115 °F) for a noninsulated tank car, 43 °C (110 °F) for a tank car having a thermal protection system, or 41 °C (105 °F) for an insulated tank car.

2.2.15.3.2 The maximum allowable filling limit of the lading material as required by the Federal Regulations. The filling limits for the winter months must not be used.

2.2.15.3.3 Thermal properties of the lading material must be used. Default properties provided for the lading material in the analysis software may be used.

2.2.15.3.4 Surface emissivity of tank or metal jacket must be 0.8.

2.2.15.3.5 Discharge coefficients for the safety relief device shall be 0.8 for vapors and 0.6 for liquids. Other discharge coefficients may be used, provided they are justified by actual flow test data.

2.2.15.3.6 The pool fire analysis shall use a fire with a minimum temperature of 1,500 °F. The torch fire analysis shall use a fire with a minimum temperature of 2,200 °F.

2.2.15.3.7 The analysis must consider the heat flux through tank discontinuities, protective housings, underframes, metal jackets, insulation, and thermal protection.

2.2.15.4 The thermal conductivity of the thermal protection and insulation material, as a function of temperature, shall be based upon actual test data.

2.2.16 Re-Stenciling AAR Class Cars to DOT/TC Class

AAR-class tank cars may be re-stenciled to DOT/TC class provided the following conditions are met:

2.2.16.1 The original construction of the cars must be in accordance with the DOT/TC specification.

2.2.16.2 At the time of conversion, cars must be qualified to the DOT/TC specification in accordance with the applicable federal regulation.

2.2.16.3 Identification plates have been added or replaced in accordance with the applicable federal regulation and with Appendix C, paragraph 4.0.

2.2.16.4 The proponent must submit a Form R-1 to AAR.

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2.3 Special Requirements (Proposed Revisions to DOT Specifications)

2.3.1 AAR Special Requirements for DOT Tank Cars

2.3.1.1 Bottom Outlets and Bottom Washouts

Reference DOT 179.100-14(a)(3), 179.103-5(b)(4), 179.200-17(a)(7), 179.200-17(b)(3), 179.220-18(a)(6), and 179.220-18(b)(3):

2.3.1.1.1 If the outlet (or washout) nozzle and its closure extends, a) more than 1 in. beyond the shell envelope and is not provided with bottom discontinuity protection, or b) beyond the bottom discontinuity protection, or c) below the bottom surface of a continuous center sill, a machined breakage groove or bolted connection must be incorporated that is designed to fail without rupturing the tank when a horizontal load is applied. The breakage groove or bolted connection must be located, a) within 1 in. of the tank envelope, or b) within the envelope of a protective device, or c) above the bottom surface of a continuous center sill. In addition, except for special application, the breakage groove or the bolted connection must be designed to withstand a 1,000-ft-lb (1356-Nm) torque without exceeding the shearing yield strength. The bolted connection must have threads or a necked-down cross-section located in the shear plane. A breakage groove, if used, must be a V-groove, cut (not cast) to a depth that will leave the thickness of the nozzle at the base of the groove not over 1/4 in. (6.35 mm).

2.3.1.1.2 The strength of the breakage groove or breakage groove equivalent must not exceed 60% of the primary valve connection to the universal flange using the minimum published tensile strength of the nozzle material (for a V-groove) or of the nozzle bolting material, and the minimum published yield strength of the valve-to-universal flange bolting material. If the maximum tensile strength of the nozzle bolting is known and used, then this connection strength may be equal to the calculated valve-to-universal flange bolting strength based on minimum yield. Connection strength for two load applications must be analyzed—one with the load applied at the lowest point of the nozzle assembly and one with the load applied at the nozzle breakage groove or equivalent bolted connection or at the lowest point of the valve protective device. In both cases, the calculated loads must be based on the combined tensile and shear stress.

2.4 Shipper Requirements in Addition to DOT Requirements

2.4.1 Outage Requirements

Tank cars must be so loaded that sufficient outage is provided under conditions normal to transportation. Consideration must be given to the volumetric expansion characteristics of the liquid and the ambient temperatures to which it will be subjected in transit. Calculations must use the reference temperatures and outage limits listed in DOT 173.24b (a).

2.5 Requirements for DOT/TC Tank Cars Weighing Over 263,000 lb GRL

2.5.1 All Class DOT/TC Tank Cars

Paragraph 2.5 applies to all Class DOT and TC tank cars ordered after December 31, 2003, when the gross weight exceeds 263,000 lb.

2.5.1.1 Cars must comply with all requirements of the *Office Manual of the AAR Interchange Rules*, latest version.

2.5.1.2 Shippers are reminded that regulations limit the gross weight of Class DOT/TC tank cars to 263,000 lb and that a federal exemption is required to operate these cars at higher weights.

2.5.1.3 In addition to the design loads described in *MSRP S-286*, all REPOS loading, including horizontal and vertical coupler loads, used for fatigue calculations must be increased by a factor of 1.09 above the loading used for 263,000-lb cars.

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2.5.1.4 Car owner must identify appropriate areas of inspection for fatigue, corrosion, wear, etc., and must have a “life-cycle” maintenance plan for cars. This must identify inspection items, inspection methods, acceptance criteria, and inspection frequencies. The car owner or designee must have written procedures that ensure that work performed on cars conforms to federal and AAR requirements.

2.5.1.5 New cars may not be equipped with reconditioned truck components.

2.5.1.6 Class DOT/TC cars with tanks constructed of aluminum or nickel plate with gross weight over 263,000 lb are not authorized.

2.5.2 Class DOT/TC-111 Nonpressure Tank Cars

2.5.2.1 Class DOT/TC-111 cars must be equipped with top fittings protection in accordance with Appendix E, paragraph 10.2.

2.5.2.2 Class DOT/TC-111 cars must be equipped with reclosing pressure relief devices, except where the applicant can demonstrate that a non-reclosing device affords an equivalent level of safety.

2.5.2.3 Class DOT/TC-111 cars with carbon steel tanks must meet one of the following minimum criteria:

- Tanks are constructed of normalized TC128 steel at least 7/16 in. thick and equipped with steel jackets and 1/2-in.-thick steel jacket heads.
- Tanks are constructed of normalized TC128 steel at least 1/2 in. thick and equipped with 1/2-in.-thick steel half-head shields.
- Tanks are constructed of normalized ASTM A516 steel at least 1/2 in. thick and equipped with steel jackets and 1/2-in.-thick steel jacket heads.
- Tanks are constructed of normalized ASTM A516 steel at least 5/8 in. thick and equipped with 1/2-in.-thick steel half-head shields.

Tank car heads must be normalized after forming, unless specific approval is granted for a facility's equipment and controls.

2.5.2.4 Class DOT/TC-111 cars with high-alloy steel tanks (111****W6 and 111****W7) must have heads and shells at least 1/2 in. thick and be equipped with half-head shields if not jacketed. Jacketed tanks must be at least 7/16 in. thick and be equipped with 1/2-in.-thick jacket heads.

2.5.3 Class DOT/TC Pressure Cars

2.5.3.1 In addition to the requirements of paragraph 2.5.1, Class DOT/TC-105, 112, 114, and 120 tank cars having a gross weight on rail over 263,000 lb must conform to paragraph 2.5.1 and be equipped with a metal jacket and tank head protection.

2.5.3.2 Notwithstanding paragraph 2.5.3.1, if the federal regulations authorize the use of a tank car without a metal jacket, the AAR requirement for a metal jacket is waived, if not required by car specification, provided that the tank heads and shell are constructed from normalized AAR TC128 Grade B steel and the required thickness of the tank heads and shell is increased by at least 1/16-in. over minimum specification thickness. Tank head protection is required.

2.5.4 Class DOT/TC-113 Cryogenic Cars

Class DOT/TC-113 cryogenic cars with gross weight over 263,000 lb must meet the requirements of paragraph 2.5.1.

2.5.5 Class DOT/TC-115 Nonpressure Tank Cars (tank within a tank)

In addition to the requirements of paragraph 2.5.1, Class DOT/TC-115 cars with gross weight over 263,000 lb must meet the requirements of paragraphs 2.5.2.1 and 2.5.2.2.

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2.6 Top Fittings Protection Requirements for Nonpressure Cars

For protection of top fittings against rollovers and accidental horizontal loads, all new nonpressure Class DOT/TC tank cars ordered after July 1, 2010, used to transport Packing Group I (high hazard) and Packing Group II (medium hazard) materials must be equipped per paragraph 10.2.1 of Appendix E.

2.7 Requirements for Cars Built for the Transportation of Packing Group I and II Materials with the Proper Shipping Names “Petroleum Crude Oil,” “Alcohols, n.o.s.,” and “Ethanol and Gasoline Mixture”

2.7.1 Cars ordered after October 1, 2011, for the transportation of packing Group I and II materials with the proper shipping names “petroleum crude oil,” “alcohols, n.o.s.,” and “ethanol and gasoline mixture” must comply with the following requirements.

2.7.2 Top Fittings Protection

2.7.2.1 Class 111 tank cars used to transport packing Group I and II materials with the proper shipping names “petroleum crude oil,” “alcohols, n.o.s.,” and “ethanol and gasoline mixture” must be equipped per Appendix E, paragraph 10.2.1.

2.7.3 Pressure Relief Devices

Class 111 tank cars used to transport packing Group I and II materials with the proper shipping names “petroleum crude oil,” “alcohols, n.o.s.,” and “ethanol and gasoline mixture” must be equipped with reclosing pressure relief devices. Upon approval of Pipeline and Hazardous Safety Administration (PHMSA), a non-reclosing device can be used where the applicant demonstrates that a non-reclosing device is required and affords an equivalent level of safety.

2.7.4 Tank Material and Thickness

2.7.4.1 Class 111 tank cars used to transport packing Group I and II materials with the proper shipping names “petroleum crude oil,” “alcohols, n.o.s.,” and “ethanol and gasoline mixture” must have heads and shells constructed of normalized TC128 Grade B steel or normalized A516-70 steel. Tank car heads must be normalized after forming, unless approval is granted by the AAR Executive Director of Tank Car Safety on the basis that a facility has demonstrated that its equipment and controls provide an equivalent level of safety. For tanks constructed of normalized TC128 Grade B steel, non-jacketed tanks must be at least 1/2 in. thick and jacketed cars must be at least 7/16 in. thick. For tanks constructed of normalized A516-70 steel, non-jacketed cars must be at least 9/16 in. thick and jacketed cars must be at least 1/2 in. thick. In all cases the cars must be equipped with at least 1/2 in. half-head shields.

2.7.4.2 Class DOT-111 cars with high-alloy steel tanks (111 ****W6 and 111 ****W7) used to transport packing Group I and II materials with the proper shipping names “petroleum crude oil,” “alcohols, n.o.s.,” and “ethanol and gasoline mixture” must have heads and shells at least 1/2 in. thick and be equipped with at least 1/2 in. half-head shields if not jacketed. Jacketed tanks must be at least 7/16 in. thick and be equipped with 1/2 in. thick jacket heads at a minimum.

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