

SECTION 15

RAIL TANK CARS

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15.1 GENERAL DESCRIPTION AND REQUIREMENTS

15.1.1 SCOPE

15.1.1.1 This section specifies requirements for the design, construction and maintenance of rail tank cars. Underframes, draft gear and attachments, bogies, couplers, brakes, hand rails, steps and other components shall be in accordance with the provisions of relevant sections of this ROA Manual and with the requirements of the rail System concerned. The following standards and codes shall be used in conjunction with this Section:

- (a) Australian Standards (see Appendix B)
- (b) Current issue of the Association of American Railroads Specification for Tank Cars M-1002
- (c) Codes of Practice, prepared by the Australian Institute of Petroleum Ltd (AIP)
- (d) Codes of Practice, prepared by the Australian Liquefied Petroleum Gas Association
- (e) ROA Code of Practices and Conditions for the Carriage of Dangerous Goods

15.1.1.2 The standards of design and construction embodied in the AAR Manual of Standards and Recommended Practices satisfy the requirements of this Section.

15.1.2 DEFINITIONS

AAR:

Unless otherwise stated shall mean the latest issue of the Association of American Railroad's Manual of Standards and Recommended Practices Section C Part III; Specification for Tank Cars, Specification M-1002, including the United States Code of Federal Regulations Title 49 sections 173.314, 173.319, 173.320 and Part 179.

Approved (Components):

Unless otherwise specified, shall mean components approved in accordance with the requirements of the AAR or approved by another independent organisation which has tested the component in question and found it to have adequate function and capacity for its intended duty. Typical independent organisations include:

- (a) National Association of Testing Authorities
- (b) Australian Institute of Petroleum Ltd
- (c) Australian Liquefied Petroleum Gas Association
- (d) Standards Australia

Approved (Construction):

Unless otherwise specified, shall mean approved by the rail systems or rail authorities concerned with the transport of the tank car.

Bolster:

A casting or fabrication used to support the tank.

Bottom Wash-out:

A plugged and flanged opening in the bottom of a tank to facilitate cleaning of a car which does not have a bottom outlet valve.

Excess Flow Valve:

A safety device placed in a fluid line and designed to close when the normal flow rate of that line is exceeded due to breakage or damage.

Filling Density:

Used to determine the filling level when transporting gases and liquefied gases, and is the percentage ratio of the mass of gas or liquid in the tank to the mass of water the tank will hold at 15°C.

Insulation:

Tank covering designed to minimise heat transfer through the tank shell. Insulation may or may not contribute to a tank's thermal protection.

Non-Pressure Tank Car:

A tank car which is *normally filled at atmospheric pressure* and in which the product to be transported does not have a vapour pressure in excess of 175 kPa at 38°C. Includes class A, B, Bh, C, Ch, D, E and F.

Owning System:

The system which owns or leases the vehicle, or with which the vehicle is registered for maintenance purposes.

Pressure Tank Car:

Including classes H and J which are normally *filled at a pressure in excess of atmospheric pressure* or where the product to be transported has a vapour pressure in excess of 175 kPa at 38°C.

Safety Relief Valve:

A safety relief device having its operating parts held in position to close the valve by spring force. The device is intended to open and close at predetermined pressures.

Safety Vent:

A safety relief device having as its operating part a frangible (bursting) disc so held in position to close the outlet of the device. The disc is intended to burst at a predetermined pressure.

Tank Car:

A rail car, having one or more tanks designed for the transportation of liquids, compressed gases or bulk materials which form part of, or are permanently attached to, the car. These tanks cannot be readily detached from the car for the purposes of filling, emptying or storing their contents.

Thermal Protection:

External tank covering designed to reduce the effects of flame impingement on the tank shell and lading during a fire.

Ullage:

The difference between the volume of a container and the volume of its contents. It may be expressed as an absolute volume or as a percentage of the container volume.

Underframe Tank Car:

A tank car having a separate car frame consisting of centre sills, outer sills and braces etc. onto which a tank is permanently mounted.

Underframeless Tank Car:

A tank car having end assemblies comprising stub-sills, headstocks and bolsters welded or otherwise attached directly to the tank. The tank portion of the car acts as a load bearing member to directly withstand dead and live loads and the forces generated by train action in transit.

15.1.3 RAIL TANK CAR CLASSIFICATIONS

- 15.1.3.1 Rail tank cars are classified in groups as non-pressure (filled at atmospheric pressure) and pressure (filled at a pressure greater than atmospheric). Some non-pressure tanks may be subjected to internal pressure for discharging the contents.
- 15.1.3.2 Individual classes of tanks with required features, design parameters and AAR and US DOT equivalents are given in Table 15.1. Each class of tank is identified by an upper case letter.
- 15.1.3.3 Rail tank cars fitted with equipment for heating the contents are identified by the lower case suffix 'h' added to the tank class letter.

TABLE 15.1 Tank Car Requirements

N/A = Not applicable or not required

| Tank Car Class | A | B | C | D | E | F | G | H | J |
|--------------------------|----------------------------------------|------------------------------------------------------|------------------------------------------|------------------------------|-------------------------------|-------------------------------------------------|-------------------------------|------------------------------------------------------------------------------|--------------------|
| 1 Material | Steel, Al | Steel, Al, S.S. | Steel, Al | Steel | S.S. | Steel, S.S. | Steel, Al, S.S. | Steel, S.S. | Steel, S.S. |
| 2 Insulation | Optional | Optional | Optional | N/A | N/A | Optional | N/A | Optional | Required |
| 3 Cladding | N/A | N/A | N/A | N/A | N/A | Optional | N/A | N/A | N/A |
| 4 Lining | N/A | N/A | N/A | Rubber | N/A | Optional | N/A | N/A | N/A |
| 5 Heater | N/A | Bh | Ch | Prohibited | N/A | Prohibited | N/A | Optional | N/A |
| 6 Burst pressure (Kpa) | as per AAR | as per AAR | as per AAR | as per AAR | as per AAR | as per AAR | as per AAR | as per AS 1210 | as per AS 1210 |
| 7 Dome | Optional | Optional | Optional | Optional | Optional | Optional | Prohibited | Prohibited | Prohibited |
| 8 Expansion capacity | 2% | 1% | 1% | 1% | 1% | 1% | 1% | N/A | N/A |
| 9 Filling pressure (kPa) | Atmospheric | Atmospheric | Atmospheric | Atmospheric | Atmospheric | Atmospheric | as per AAR | 500 - 3 100 | As applicable |
| 10 Test pressure (kPa) | 420 | 420 | 420 | 420 | 420 | 420 | as per AAR | as per AS 1210 | as per AS 1210 |
| 11 Safety vent | Prohibited | Required | Required | Required | Prohibited | Required | Optional | Prohibited | Inner & Outer |
| 12 Safety relief valve | Required | Prohibited | Prohibited | Prohibited | Required | Prohibited | Optional | Required | Inner Tank Only |
| 13 Relief pressure (kPa) | 240 | 420 | 420 | 420 | 240 | 240 | as per AAR | as per 9 +/- 3% | as per 9 +/- 10% |
| 14 Retest | Required | Required | Required | Prohibited | Required | Prohibited | Required | Required | Required |
| 15 Bottom outlet | Optional | Required | Prohibited | Prohibited | Prohibited | Optional | Optional | Prohibited | Prohibited |
| 16 Bottom sump | Optional | Optional | Optional | Optional | Optional | Prohibited | Optional | Prohibited | Prohibited |
| 17 Side outlet | Optional | Pipes Optional | Prohibited | Prohibited | Prohibited | Pipes Optional | Pipes optional | Prohibited | Prohibited |
| 18 Top outlet | Optional | Prohibited | Required | Required | Required | Optional | Prohibited | Required | Required |
| 19 Fire protection | N/A | Optional | Optional | N/A | N/A | Optional | N/A | Required | Required |
| 20 Dangerous goods class | 3 & 6 | 3 & 8 | 3 & 8 | 8 | 8 | 8 | - | 2.1, 2.3 & 6 | 2.2 |
| 21 Typical application | General, Flammable & Poisonous Liquids | General, Combustible & Corrosive Liquids | General, Combustible & Corrosive Liquids | Highly Corrosive Liquids | Very Highly Corrosive Liquids | Corrosive Liquids, Food Stuffs & Pure Chemicals | Dry Bulk & Granular Materials | Chlorine, L.P.G., Anhydrous Ammonia & Highly Toxic Liquids | Cryogenic Liquids |
| 22 US DOT class | 103W, ALW 104W 111A***W* | 103A-ALW, 103CW, EW 111**ALW1, W1, W3 115A**W* | 103AW, *ALW, 111**ALW2, W2 | 103BW, A*ALW | 103CW, EW 117A**W7 | 103CW, EW | | 105A, J, S**W, 107A** 109A**ALW, W 112A, J, S & T**W 114J, S & T**W | 105J**W 113***W |
| 23 AAR class | 203*W 211A**W* | 203DW, 211A**W6 211A**ALW | 203DW, 211A**W6 211A**ALW | 203DW, 211A**W6 211A**ALW | 211A**W7 | | 207A**W* | | 204W |

15.1.4 GENERAL TANK CAR REQUIREMENTS

15.1.4.1 The design and construction of a tank car shall at least meet the requirements of this Section for its class and type, (Section 15.1.3) or the United States DOT or AAR equivalent, and shall include such safety equipment as is specified in this Section, including where required, head shields, double shelf couplers, safety vents and/or valves, and other equipment as detailed in Section 15.2 and 15.3.

15.1.4.2 When the tank car is loaded with the heaviest product for which it is to be approved, the designed tank capacity and tank size shall be limited by:

- (a) The length and load gauge restrictions of the system or systems concerned
- (b) Gross rail load permitted
- (c) The maximum height of the centre of gravity above the rail as specified by the rail authority concerned; this shall not normally exceed 2130 mm

15.1.4.3 With Non-Pressure Tanks the specific gravity at 15°C of the product permitted to be loaded, shall be indicated on the tank, see Figure 5, Section 22.

With Pressure Tanks the maximum gross load permitted on the rail shall be indicated on the tank, see Figure 6, Section 22.

15.1.5 GENERAL TANK REQUIREMENTS

15.1.5.1 Tanks shall be circular in section, fusion welded with heads dished convex outwards, fitted with an inspection entry and such other fittings as are prescribed herein. An expansion dome shall be fitted if required by the rail System concerned.

Suitable protection against damage shall be provided for fittings mounted directly on the tank and not contained inside an expansion dome.

15.1.5.2 When the interior of the tank is divided into compartments, each compartment shall be complete with all features such as the inspection entry, fittings and expansion dome (if fitted) as prescribed above for a single tank.

15.1.5.3 Tanks shall be marked to show the capacity when filled to the inside top of the shell and to the top of the port in the skirt of the safety valve or vent opening and at such other positions as required by the owner, or rail System concerned. A measuring device shall be provided to indicate the level of product in the tank.

15.1.5.4 Where approval is given by the rail System concerned, pressure assistance may be used to accelerate the loading or discharge rate of tank cars which are fitted with safety relief valves.

15.1.6 MATERIALS

15.1.6.1 All plates for construction of tank car tanks, expansion domes and appurtenances shall, unless otherwise approved by the rail System concerned, conform with the following standards:

- (a) AS 1449 Wrought Alloy Steels, Stainless and heat resisting steel plate, sheet and strip
- (b) AS 1548 Steel Plates for Boilers and Pressure Vessels
- (c) AS 1734 Aluminium and Aluminium alloys - Flat sheet, coiled sheet and plate
- (d) Integrally Clad Metals to ASTM A 263, 264 and 265
- (e) Other materials approved or permitted by AS 1210 or AAR

15.1.7 STRUCTURAL WELDING

15.1.7.1 The welding of all structural components other than the tank shell shall be carried out in accordance with AS 1554, Part 1, Manual Welding and Part 2, Automatic and Semi-automatic Welding.

15.1.8 INSPECTION, CERTIFICATION AND APPROVAL

- 15.1.8.1 When the construction or major modification of a tank car is proposed four legible copies of all drawings together with two copies of the specification and one copy of the design calculations and/or finite element analysis shall be submitted to, and approved by, the rail System concerned before any material is ordered, or any constructional work is authorised by the tank car owner. In submitting any design of tank car for approval a fully completed material safety data sheet, in Worksafe Australia format, shall be provided for each product to be transported.
- 15.1.8.2 Tank cars may be inspected during the progress of their construction, and before being placed in service, by Inspectors acting for and on behalf of the rail System which has approved the design. When the rail System concerned is satisfied that the car and its equipment meet the requirements of the specification it shall certify accordingly and allot a vehicle number to the car. The tank car shall then be marked in accordance with Figure 6, Section 22 for Non-Pressure Tanks or in accordance with Figure 7, Section 22 for Pressure Tanks.
- 15.1.8.3 Where the car is liable to run interstate, its construction shall be acceptable to all Systems concerned and certification by the System supervising construction shall be accepted by all other Systems.

15.2 DETAILED REQUIREMENTS FOR TANK CARS, TANKS AND ATTACHMENTS

15.2.1 END ASSEMBLIES

End assemblies, comprising headstock, bolster and drawgear longitudinals, shall be attached to the tank in such a manner that the end compressive and tensile loads as specified by AAR are satisfactorily transmitted into the tank. The design of the end assembly shall be carried out in accordance with AAR and with reference to the requirements of AS 1210. The stress distributions may be analysed using finite element analysis.

15.2.2 BOUNDARY MEMBERS

On underframeless tank cars and where the side sills have been omitted, suitable boundary members shall be provided. The minimum width over boundary members shall be 2600 mm.

15.2.3 ATTACHMENTS

15.2.3.1 Suitable ladders, handholds and inspection or filling platforms shall be fitted to the tank car to enable access to the inspection entries, expansion domes and other tank fittings while the car is stationary. These fittings shall conform to AS 1657, SAA Code for Fixed Platforms, Walkways, Stairways and Ladders.

15.2.3.2 All attachments to the tank including ladders, steps and handholds are to be made using attachment pads in accordance with AS 1210.

15.2.3.3 Holes, loops and other devices may be fitted to the tank car to enable towing, propelling or lifting as approved by the rail System concerned.

15.2.4 TANK DESIGN

15.2.4.1 General Requirements

The tanks of all rail tank cars shall be designed to comply with the requirements of AAR Specification M1002. Where the owning system is required to conform to the requirements of a Department of Occupational Health and Safety, Department of Labour and Industry or similar Statutory Authority with appropriate jurisdiction, the design and construction of tanks shall, in the first instance, be subject to the requirements and approval of that Authority.

15.2.4.2 Ullage and Loading Requirements

A full tank is defined as one filled to the minimum ullage load for non-pressure tanks as specified in Section 15.1.3 or for tanks carrying compressed liquefiable gases the maximum cargo load shall be calculated on the basis of the mass filling ratio as found in AS 2809-3, Tankers for Compressed Liquefiable Gases.

All tank car tanks shall be fitted with a measuring device to determine the loaded condition of the tank.

When an ullage bar is used as a liquid load indicator it shall be permanently attached to the shell, inside each tank compartment immediately below the manhole opening. It shall be positioned such that the percentage of volume of the tank shell above the ullage bar is equivalent to that specified in Section 15.1.3.

In order that the setting of the ullage bar may be checked, the car owner shall provide certification of the following:

- (a) Capacity in kilolitres to the inside top of the tank shell
- (b) Capacity in kilolitres to the level of the ullage bar or filling level
- (c) Capacity in kilolitres when filled to the safety vent opening or top of the ports in the skirt of the safety valve, whichever is fitted. If the safety valve is applied to the side of the dome, the capacity to the top of the safety valve opening in the dome shall be substituted

Tank Cars are not permitted to operate with the level of product more than 610 mm below the inside top of the tank.

Where bottom loading of the tank is permitted by a rail System, American Petroleum Industry (API) or AAR standard fittings shall be used and automatic overflow protection shall be provided.

15.2.4.3 Valves and Fittings

All valves and fittings including safety relief, vacuum relief, and excess flow valves and safety vents etc shall be approved.

Provision should be made in the design for the locking of fill and empty caps and discharge valves etc.

Some statutory authorities may also require valves to comply with AS 1210 and AS 1271.

15.2.4.4 Expansion Domes

When an expansion dome is fitted it shall be circular in plan and shall have a minimum capacity when measured from the inside top of the shell of the tank to the top of the ports in the skirt of the safety valve, in accordance with that specified for the tank type in Section 15.1.3.

15.2.4.5 Inspection Entries

Inspection entries shall be provided in accordance with the requirements of AS 1210 either in one end or on top of each compartment of a tank car, with provision for the locking of each entry.

The inspection cover shall be of an approved type and, unless otherwise required, be of forged or fabricated steel or aluminium alloy, ductile iron or a steel casting. It shall preferably be hinged to the tank, and designed to prevent opening while the interior of the tank is subjected to a pressure above atmospheric pressure.

The joint between the cover and ring shall be made tight against vapour pressure, and where necessary to secure this, a satisfactory gasket shall be used.

15.2.4.6 Heater Installations

Tank heater installations shall comply with the requirements of AS 1210 Unfired Pressure Vessels Code, AS 1797, Boilers - Fire-tube, Shell and Miscellaneous, and the AAR as applicable.

Tanks fitted with devices for heating of the contents are identified by the lower case suffix 'h' in the tank class, eg Bh, Ch.

When ends of steam coils are not attached to a manifold or steam jacketed chamber, they shall be attached to pads or tank reinforcements. Outside pipe connections to steam coils shall not be an integral part of the interior coils and shall be welded onto the outside of pads or reinforcements.

Inlets and outlets of heater pipes shall be equipped with a valve, cock, cap, plug or other suitable closure. Caps, plugs or other removable closures shall be secured by a steel chain with a link material not less than 5 mm diameter.

When flame tubes are used the outlet end shall be fitted with an efficient spark arrester.

Fitting of a heater which uses the shell or ends of the tank as part of the flame duct is prohibited.

15.2.4.7 Discharge Outlets and Valves for Non-Pressure Tanks

Discharge outlets and valves shall conform with the requirements of the AAR or API.

Side discharge pipes may be attached to form part of a bottom discharge outlet, in which case each outlet shall be fitted with an AAR approved type outlet closure or male dry-break couplings to API Specification RP 1004.

15.2.5 COMMISSIONING

All tank car tanks and associated equipment being placed in service for the first time or following a major repair or modification shall be inspected and approved by the rail System concerned.

15.3 SPECIFIC CLASS REQUIREMENTS

15.3.1 SPECIAL REQUIREMENTS FOR CLASS F CARS

The lining or cladding used on the inside of these tanks must be compatible with the product/s carried.

15.3.2 SPECIAL REQUIREMENTS FOR CLASS G CARS

As specified by the AAR for Class 207A**W*

15.3.3 SPECIAL REQUIREMENTS FOR CLASS H CARS

As specified by the AAR. Class H tank cars shall be fitted with:

- (a) double shelf couplers
- (b) head shields
- (c) thermal protection
- (d) internal and external valves and fittings

Tank cars carrying liquefied flammable gases are not permitted to carry discharge hoses as permanent attachments and must be overhead gantry loaded with angle valves positioned to discharge in a vertical direction.

Sub-classes and their allowable pressures for Class H tanks:

| Class of Tank | Design Pressure (kPa) |
|---------------|-----------------------|
| H 500 | 500 |
| H1,000 | 1,000 |
| H1,600 | 1,600 |
| H1,800 | 1,800 |
| H2,000 | 2,000 |
| H2,600 | 2,600 |
| H3,100 | 3,100 |

15.3.4 SPECIAL REQUIREMENTS FOR CLASS J CARS

Class J tanks shall be designed in accordance with AAR requirements.

The data shown in the following example is typical of that which shall be permanently stamped on a data plate welded to the outer vessel. The stamping or data plate shall be near the centre of one end of the vessel.

TYPICAL DATA MARKING

| | |
|-----------------------------|-----------------|
| Inner Vessel | |
| Minimum Loading Temperature | -217°C |
| Material | AS 1449 - 304 L |
| Shell Thickness | 5 mm |
| End Thickness | 5 mm |
| Inside Dia. | 1,800 mm |
| Water Capacity | 45,000 kg |
| Working Pressure | 420 kPa |
| Test Pressure | 630 kPa |
| Date of Manufacture | MM/YY |

15.4 MAINTENANCE OF TANK CARS

15.4.1 GENERAL REQUIREMENTS

15.4.1.1 All repairs, retests and inspections of tank car tanks and fittings shall comply with the requirements of AS 3788 Boilers and Pressure Vessels: Inservice Inspection. If a tank car has been designed and constructed in accordance with the AAR and AAR approved valves and fittings have been installed, retesting and inspection of the tank and its fittings may be carried out in accordance with the AAR requirements.

15.4.1.2 The repair, retest and maintenance of rail tank cars in service before 1 January 1992 shall be in accordance with the provisions of Section 7 of the ANZR Manual of Standards and Recommended Practices.

15.4.1.3 All necessary repairs to underframes, and bogies, shall be carried out as arranged between the rail System concerned and the Tank Car Owner, and to the entire satisfaction of the rail System. Any defect in running gear which may affect the safety of the vehicle in transit may be rectified without notice by the rail System concerned. In particular the right of periodical inspection, adjustment, maintenance, or repair of triple valves and other portions of the air brake equipment is reserved by the rail System concerned and may be exercised without reference to the Tank Wagon Owner. No person other than an authorised employee or representative of the rail System concerned shall interfere with any portion of such equipment.

15.4.2 ALTERATIONS, RE-BUILDS AND HEAVY REPAIRS

Before any tank car is altered, re-built or is subject to heavy repairs, drawings of the proposals shall be submitted to the rail System for approval as for new cars (15.1.8).

Tank cars which do not comply in every respect with the requirements of the rail System shall not be permitted to continue in service without its express approval, and shall not be permitted to run in interchange service without the express approval of all the rail Systems concerned.

15.4.3 HAZARD REMOVAL

15.4.3.1 Before any tank car used for the transportation or storage of flammable, toxic or corrosive substances is brought under cover in any Railway Workshop, and/or any repairs or alterations are commenced, it shall be examined by an authorised officer who shall make all tests and inspections and supervise the carrying out of all preparations using appropriate Australian Standards and industry association codes of practice, including:

- (a) Australian Institute of Petroleum (CP-13)
- (b) Australian Liquefied Petroleum Gas Association
- (c) Australian Chemical Industry Council

15.4.3.2 On completion of the tests the authorised officer shall issue the appropriate certificates or make such other recommendations as are necessary to permit the required work to be performed.

15.4.3.3 In no case shall entry into the tank be permitted without suitable breathing apparatus unless the levels of atmospheric contamination are below those recommended by the National Occupational Health and Safety Commission (Worksafe Australia).

15.4.4 SAFE WORK PRACTICES

Each System shall compile and implement internal codes of practice defining procedures and requirements for hazard removal, decontamination, atmospheric testing, entry of personnel and repair methods in relation to tank cars, based on the recommendations and codes of appropriate industry associations and Worksafe Australia.

15.4.5 DISCHARGE OUTLETS AND CAPS FOR NON-PRESSURE TANK CARS

Discharge outlets and caps shall be re-tested at the same time as the tank, and shall contain the re-test pressure for a period of ten minutes.

For bottom outlet valves the test may be made by filling the space between the outlet valve and cap with the test fluid and applying pressure through the RP1/2/15 plug hole in the outlet cap, both valve and cap being in the closed position. There shall be no evidence of leakage or distress. Alternatively a pocket of air may be retained on the underside of the outlet valve and a pool of liquid above the valve, so that any leakage during the test will be indicated by air bubbles passing through the liquid pool.

If the tank is fitted with top outlets, the outlet caps shall be subjected to the test pressure when the tank is tested.

15.4.6 INSPECTIONS CARRIED OUT BY OTHER AUTHORITIES

In cases where tank cars are maintained other than by the rail System they shall be inspected as to workmanship during the process of repairs, and before being returned to service, by inspectors acting for and on behalf of the rail System concerned.

When the repairs meet the requirements contained within this standard, the inspector shall certify accordingly to the car owner and to the rail System concerned.

APPENDIX A

**PRODUCT CLASSIFICATION
AND THEIR ALLOTMENT TO TANK CAR TYPES**

| PRODUCT GROUP | TYPICAL PRODUCT | ROA TANK WAGON CLASS PERMITTED | REMARKS |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| FLAMMABLE LIQUIDS with Flash Point below 61°C, and Vapour Pressure not exceeding 175 kPa absolute 75 kPa gauge at 38°C Dangerous Goods Class 3.1 and 3.2 | Acetone Alcohol, (including Butanol Ethanol Methanol Methylated spirits) (not including Allyl alcohol) | A | ¹ Some of these products are also manufactured with Flash Points exceeding 61°C and may then be accepted as 'General Liquids'. |
| | Amyl or Butyl acetate Benzol, Benzolene, Toluol ¹ Cleaning Fluids (flammable) ¹ Coal tar oil ¹ Coal tar naphtha Kerosene Lacquers and Lacquer thinners Monochlor benzene Motor spirits ¹ Paint, Paint and varnish driers and thinners ¹ Petroleum naptha Turpentine Turpentine substitutes | | <i>All fittings to be secured against interference.</i> |
| GENERAL LIQUIDS products with Flash Point above 61°C and Vapour Pressure not exceeding 275 kPa absolute, 175 kPa gauge at 38°C. Dangerous Goods Class 3.1 and 3.2 | (a) Bone oil Bitumen Coconut oil Cotton seed oil Fish oil Fuel oil Glucose Glycerine Lard oil Linseed oil Lubricating oil Molasses Oleine and Oleic acid Palm oil Peanut oil Residual oil Silicate of soda Tallow Tar Tanning Products Whale oil | A, B, Bh | For tanks transporting bitumen, residual oil or tar, the safety vent may be left open. |

| PRODUCT GROUP | TYPICAL PRODUCT | R.O.A. TANK WAGON CLASS PERMITTED | REMARKS |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Dangerous Goods Class 3.2 and 8 | (b) Crude oil Petroleum distillate (dieseline) Ammonia aqua Ammoniacal gas liquor (crude) Corflex Di-methyl phthalate Di-ethyl phthalate Di-nonyl phthalate Di-phenylamine Formaldehyde | A, B or C | Any product here listed but manufactured with Flash Point below 61°C shall be classed as a 'Flammable Liquid', Tank Car Type A only. |
| POISONOUS LIQUIDS Dangerous Goods Class 6 | Acetone Cyanhydrin Arsenic acid (not to contain more than 0.05% nitric acid) Arsenical compounds and mixtures, sheep dips, etc. Carbon tetrachloride Dinitrobenzol Insecticides Mercuric iodide Nicotine and nicotine compounds Nitrobenzol Nitrochlorbenzene (ortho) Nitrozylol Sodium and Potassium cyanide Tree or weed killing compounds (not including chlorate type, which are classed as 'corrosive liquids'). | A, B or C | <i>All fittings to be secured against interference especially side discharge pipes where these are permitted.</i> |
| CORROSIVE LIQUIDS Dangerous Goods Class 8 | (a) Aniline oil Carbolic acid Cresylic acid Orthocresol Metacresol Phenol | C or Ch | May be carried under concession in Type A or B Tanks. |
| | (b) Sludge acid Spent sulphuric acid and spent mixed acid | C | If too viscous for top outlet may be carried under concession in Type B Tanks. |
| | (c) Mixed acid Nitric and sulphuric | C | |

| PRODUCT GROUP | TYPICAL PRODUCT | R.O.A. TANK WAGON CLASS PERMITTED | REMARKS |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------|
| (d) | Chloro-sulphuric acid and mixtures of Chloro-sulphuric acid sulphuric trioxide Dimethyl sulphate Hydro-fluoric acid 60% to 80% strength subject to adequate passification. Sulphuric acid 1.84 or greater specific gravity. Sulphur trioxide (stabilised) Fluosulphonic acid Phosphoric acid | C | <i>All fittings to be secured against interference.</i> |
| (e) | Acetyl chloride Antimony pentachloride Benzyl chloride Benzyl chloride (stabilised) Pyro-sulphuryl chloride Silicon chloride Sulphur chloride (mono-and di-) Sulphuryl chloride Thionyl chloride Titanium tetra-chloride | C | |
| (f) | Potassium hydroxide and sodium hydroxide (potash and caustic soda) solutions Alkaline battery fluids Alkaline corrosive fluids N.O.S. | C or Ch | |
| (g) | Hydrogen peroxide up to 40% strength (by volume) | C | |
| (h) | Tree and weed killing compounds, chlorate type. | B, C or F | |

| PRODUCT GROUP | TYPICAL PRODUCT | R.O.A. TANK WAGON CLASS PERMITTED | REMARKS |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------|
| HIGHLY CORROSIVE LIQUIDS Dangerous Goods Class 8 | Flame retardant compound. | D | ² Must not contain oil or solvents. |
| | Electrolyte acid, (not to exceed 47% strength) | | |
| | ² Hydrochloric acid and mixtures (not to exceed 38% strength) | | |
| | Hydro-fluosilicic acid (not to exceed 40% strength) | | |
| | Sulphuric acid, (not to exceed 1.408 specific gravity) | | |
| | Sodium Chlorate solution (not to exceed 40% sodium chlorate) | | <i>All fittings to be secured against interference.</i> |
| VERY HIGHLY CORROSIVE LIQUIDS Dangerous Goods Class 8 | (a) Acetic anhydride | E | Note: May be carried in Aluminium Tanks |
| | (b) Nitric acid (not to contain more than 1% sulphuric acid and 0.1% hydrochloric acid) | | <i>All fittings to be secured against interference.</i> |
| | Formic acid and Formic acid solutions | | Tank cars containing Formic acid to be marked 'FOR FORMIC ACID ONLY' |
| FOODSTUFFS PURE CHEMICALS ETC. | Beer Fruit Juices Milk | F | No safety vent required for milk. |
| | Vinegar Pure chemicals which need protection from contamination arising from interaction with shell, but are not themselves corrosive. | | |
| | Wine | B or F | |
| | | | |

| PRODUCT GROUP | TYPICAL PRODUCT | R.O.A. TANK WAGON CLASS PERMITTED | REMARKS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <p>GASES OR LIQUEFIED GASES (a) Pressures not exceeding 1 600 kPa at maximum service temperature Dangerous Goods Class 2.1 & 2.3</p> | <p>³ Chlorine</p> | <p>H 1 600 mandatory Interior pipes of the valves to be equipped with excess flow valves of an approved design.</p> | <p>³ Insulation</p> |
| <p>(b) Pressures not exceeding 1 800 kPa at maximum service temperature.</p> | <p>Liquefied petroleum gas Anhydrous ammonia</p> | <p>H 1 800</p> | |
| <p>HIGHLY TOXIC Pressures not exceeding 1 600 kPa at maximum service temperature. Dangerous Goods Class 6.1</p> | <p>^{3,4} Motor fuel, anti-knock compound</p> | <p>H 1 600</p> | <p>⁴ To be marked '<i>FOR MOTOR FUEL ANTI-KNOCK COMPOUND ONLY</i>'</p> |

APPENDIX B

STANDARDS AND CODES OF PRACTICES USED IN THE DESIGN, CONSTRUCTION AND MAINTENANCE OF RAIL TANK CARS

Standards Association of Australia

| | |
|---------|-----------------------------------------------------------------------------------|
| AS 3788 | Boilers and Pressure Vessels: Inservice Inspection |
| AS 2809 | Road Tank Vehicles for Dangerous Goods |
| AS 2809 | Part 3 Tankers for Compressed Liquefiable Gases |
| AS 2022 | Anhydrous Ammonia Code |
| AS 1940 | SAA Flammable and Combustible Liquids Code |
| AS 1797 | Boilers - Fire Tube, Shell and Miscellaneous |
| AS 1796 | SAA Welder Certification Code |
| AS 1734 | Aluminium and Aluminium Alloys - Flat sheet, coiled sheet and plate |
| AS 1657 | SAA Code for fixed Platforms, Walkways, Stairways and Ladders |
| AS 1596 | L.P. Gas - Storage and Handling |
| AS 1665 | Aluminium Welding |
| AS 1548 | Steel Plates for Boilers and Pressure Vessels |
| AS 1554 | SAA Structural Steel Welding Code |
| AS 1449 | Wrought Alloys Steels - Stainless and Heat-Resisting Steel Plate, Sheet and Strip |
| AS 1271 | Valves, Water Gauges and other Fittings for Boilers and Unfired Pressure Vessels |
| AS 1210 | SAA Unfired Pressure Vessels Code |
| AS 1200 | Boilers and Pressure Vessels |

British Standards

| | |
|---------|-----------------------------------------------------------|
| BS 5500 | Specification for Unfired, Fusion Welded Pressure Vessels |
|---------|-----------------------------------------------------------|

Australian L.P. Gas Association

Australian L.P. Gas Safety Handbook

Australian Institute of Petroleum

| | |
|-------|------------------------------------------------------------------------|
| CP 8 | Precautions against Electrostatic Ignition During Tank Vehicle Loading |
| CP 13 | Road and Rail Tanker Gas Freeing and Work Authorisation |

Association of American Railroads

Manual of Standards and Recommended Practices Specification for Tank Cars (M-1002)

ROA

The ROA Code of Practices and Conditions for the Carriage of Dangerous Goods