Tank Wagon Code for Corrosives and Poisons
A Code of Practice for the design and construction of road vehicles for the bulk transportation of Class 8 corrosives and Class 6.1 poisons
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Section 1: Scope and General

General information
Improper handling of hazardous substances may cause injury, ill health, or property damage. These may result when such substances are accidentally released to the environment. Corrosives (Class 8) and toxic substances (Class 6.1) may pose a risk to drivers, cargo handlers, emergency services and the general public during their transportation, particularly in bulk.

The aim of this Code is to ensure that corrosives and toxic substances are securely contained and safely transported thereby reducing the risks and preventing damage or injury to people, property and the environment.

1.1 Scope

1.1.1 The Tank Wagon Code for Corrosives and Poisons applies to any vehicle used to transport corrosive and toxic substances in bulk by road. It also includes the requirements for the design, construction and operation of such vehicles.

1.1.2 Tanks, tank fittings, and attachments for use in the transport of a hazardous substance that is classified as a Class 8 Corrosive or a Class 6.1 Poison in the Transport Recommendations (refer regulation 35A as inserted by regulation 12 of Amendment No. 1 of the Toxic Substances Regulations 1983) shall be designed and constructed according to the requirements of this Code. This Code has been approved for the purpose by the Director, as designated under Section 8A of the Toxic Substances Act 1979.

1.1.3 This Code shall apply to any tank wagon which starts service after this Code is introduced.

1.1.4 This Code formally applies to all substances classified as corrosives or toxic substances in the Transport Recommendations as referred to in the Toxic Substances Regulations 1983, Amendment No. 1. However, it is recognised that only a small number of these substances are transported in such volumes that specific road tankers are designed and built to transport them. For most corrosives and toxic substances, transport is in packages or container tanks carried on conventional trucks. In practice, therefore, the Code applies to a limited number of substances.

1.1.5 This is particularly true for toxic substances, which are rarely transported in bulk by tank wagons. The text of this Code therefore refers mostly to corrosives and does not specifically mention toxic substances, except in a few instances. However, in general, all of the design details given for vehicular and tank requirements for corrosives shall also be taken as applying equally to toxic substances, except where special provisions for toxic substances are specifically mentioned, as in Section 3 and particularly Appendix D.
1.2 Definitions

The following definitions of terms apply throughout this Code. Where any term used is not defined below, the meaning of that term shall be that defined by the Act and Regulations.

Approved type

An item of a type approved for use by the appropriate statutory authority.

Corrosives

Hydrochloric acid

Hydrofluosilicic acid

Sulphuric acid (including oleum)

Potassium hydroxide in solution

Sodium hydroxide in solution

Aqueous ammonia

Chlorosulphonic acid

Phenol

Phosphoric acid

Nitric acid

A cetic acid

Sodium hypochlorite in solution

and any other substance that may be included in Class 8 as defined in the Transport Recommendations.

Corrosives tank

A vessel exceeding 250 litres water capacity used for the transport or storage of corrosive substances in bulk.

Tanks may be of the following types:

(a) fixed tank - a tank which is permanently mounted on a vehicle chassis. Includes pipework, pumps, etc

(b) demountable tank (multi-modal tank) - a tank designed to convey corrosive substances by road or rail. Generally approved for bulk service only (nominally full or empty)

(c) skid tank - a tank designed for temporary storage of corrosive substances, and suitable for transportation from one location to another

(d) intermediate bulk container (IBC) - a container designed, constructed and tested to United Nations Recommendations, Chapter 16.
Corrosives tank wagon

Any vehicle used for the carriage of corrosives in bulk in a fixed tank or tanks. Tank wagons may be of one of the following types:

(a) tank truck – a single vehicle having its own means of propulsion
(b) tank semi-trailer – a vehicle including a prime mover constructed so that when drawn through a fifth wheel or turntable connection, part of the load rests on the towing vehicle
(c) tank trailer – a vehicle which does not have its own means of propulsion, but does not include a tank semi-trailer.

1.3 Limits of Code

1.3.1 If it is desired to use materials other than those specified in this Code, or methods of construction and processes not in conformity with this Code, details shall be submitted to the Ministry of Health as the approving authority for a determination of their suitability.
Section 2: Vehicle Design and Equipment
Requirements

2.1 General

2.1.1 The vehicle shall be strongly built and as far as practicable be constructed of fire resisting materials. The vehicle design shall integrate the tank supporting members and the vehicle chassis. The means of securing the tank to the chassis, and in the case of tank trailers or tank semi-trailers, the means of attaching the prime mover to the trailer or semi-trailer shall be designed to withstand the design loads of this Code.

2.1.2 The total mass of the fully laden vehicle shall not exceed the load rating of the tyre as recommended by the tyre manufacture at the specified inflation pressure and for the operational speed of the vehicle. Where a manufacturer’s rating is not available the load ratings recommended by the Tyre and Rim Association, Australia, shall apply. The inflation pressure used to carry the load imposed on each tyre shall not be less than that recommended for the tyre and load by the tyre manufacturer, or by the Tyre and Rim Association, Australia (as appropriate). In no case shall the inflation pressure exceed that permitted by the Heavy Motor Vehicle Regulations 1974 and any subsequent amendments.

2.1.3 The maximum load imposed on any axle shall not exceed that allowed for the axle type and road classification by the Heavy Motor Vehicle Regulations 1974. Also, reference is to be made to the Guide to Vehicle Standards - Heavy Vehicles (GVS-HV), published by the Land Transport Safety Authority.

2.1.4 The dimensions and loadings of any tank wagon shall not exceed those allowed by the Traffic Regulations 1976 for normal operations. Also reference should be made to the GVS-HV.

2.2 Road clearance

The minimum allowable road clearance of any tank component or protection device shall not be less than the requirements set out in the GVS-HV.

2.3 Rear bumper requirements

2.3.1 Every tank wagon shall be provided with a rear bumper to protect the tank, piping and fittings in the event of a rear end collision and to minimise the possibility of any part of the colliding vehicle striking the tank.

2.3.2 The bumper shall be located at least 150 mm behind the rear of the tank and at least 150 mm behind any vehicle component which is used for loading or unloading purposes or which may contain fluid whilst in transit. The width of the bumper shall be not less than the maximum width of the tank.
2.3.3 The bumper and its fixings shall be designed to withstand a load equal to twice the mass of the fully laden tank wagon uniformly distributed across the central 1.5 m long section of the bumper. In this load circumstance the maximum stress in any member of the bumper or fixing shall not exceed the yield stress of the material involved.

The bumper shall be attached to either the tank wagon chassis or to the suspension sub frame of the tank wagon.

2.3.4 A collision bumper can be used as the central 1.5 m wide section with an additional full width bumper to carry lights, indicators, etc and to provide under-run protection.

2.3.5 An energy absorbing bumper may be used providing it is of an approved type for the vehicle concerned and provided that deformation under full deflection would not result in any damage to the tank or its fittings.

2.3.6 Mounts for trailer towing connections may intrude into the 150 mm clearance area referred to in 2.3.2 above if there is adequate vertical clearance to any other fitting.

2.3.7 If the tank and/or pipework is exposed under the bumper and/or behind the last axle and wheels, under-run protection shall be provided.

2.3.8 Bumpers for full trailers shall be designed to a minimum design load equal to twice the fully loaded weight of the trailer.

2.3.9 In all cases the maximum bumper design load shall be 40 tonnes.

2.4 Vehicle inspection

Regular inspections of tank wagons shall be carried out by a qualified automotive engineer (motor mechanic) at intervals not exceeding three months, in accordance with B3(ii) of Appendix B. Records of inspection and any necessary rectifications shall be kept by the vehicle operator and owner. Alternative inspection procedures approved by the Ministry of Health may be used.

2.5 Tank truck or prime mover equipment

2.5.1 In addition to this Code, tank wagons are required to fully conform to regulations made under the Transport Act 1962 and carry a valid Certificate of Fitness.

2.5.2 Tank wagons that transport corrosives across water (eg, Cook Strait) must also comply with the Maritime Safety Authority’s requirements.

2.5.3 The cab of each vehicle shall be fitted with a suitable wired rear window demister so the load is visible at all times.
2.5.1.4 The cab windscreen shall be kept clean and clear at all times and shall comply with the Transport (Vehicle Standards) Regulations 1990.

2.5.2 Brake equipment

2.5.2.1 Each vehicle shall be fitted with braking equipment complying with regulations outlined in the GVS-HV.

2.5.2.2 Tank trucks and prime movers should be fitted with a balanced braking system between axle groups, with sequencing to prevent jack-knifing. Australian design regulations ADR35 and ADR38 give requirements for most types of vehicles and trailers.

2.6 Tank trailer and tank semi-trailer requirements

2.6.1 Tank trailers and tank semi-trailers shall be of an acceptable design and must meet the requirements of this Code.

2.6.2 Tank trailers and tank semi-trailers are to be designed by and constructed under the supervision of a registered engineer or registered engineering associate with relevant experience in the road transport industry.

2.6.3 Plans for any tank trailer or tank semi-trailer and/or the results of any assessment of any trailer or semi-trailer shall be deposited with the Ministry of Health as per Appendix B.

2.6.4 Drawbars and drawbar connections for tank trailers shall be designed and constructed in accordance with NZS 5446:1987 Code of Practice for Heavy Motor Vehicle Towing Connections: Drawbar Trailers and meet the requirements outlined in the GVS-HV.

2.6.5 The suspension system for tank trailers and tank semi-trailers shall be selected so that the roll stiffness of the suspension is maximised and consistent with providing adequate dynamic performance of the suspension. The correct selection of a suspension should be designated in accordance with AS 2809 Part 1.

2.6.6 Tank semi-trailer fifth wheels

2.6.6.1 Fifth wheel couplings for tank semi-trailers shall be of a type which transmit a portion of the roll motion of the semi-trailer to the prime mover (under normal road operations). Unrestricted, double-oscillating fifth wheels shall not be used.

2.6.6.2 The fifth wheel shall have a drawbar pull rating of at least 1.25 times the weight of the fully laden semi-trailer, and a vertical load rating of at least 1.25 times the vertical load imposed on the coupling.
2.6.7 **Brake equipment requirements**

2.6.7.1 Brake equipment on tank trailers or tank semi-trailers shall comply with the requirements of sections 2.5.2.1 and 2.5.2.2 of this Code.

2.6.7.2 Tank trailer and tank semi-trailer brake systems shall be arranged to ensure full brake balance between the prime mover and trailer under all conditions of load. This balance shall be achieved by the intrinsic properties of the prime mover or trailer or semi-trailer brake systems. The driver shall not be provided with any means of altering the intrinsic brake system balance.

2.7 **Tank wagon tank mounting requirements**

2.7.1 The tank shall be separated from the rear of the cab by a gap of not less than 150 mm.

2.7.2 The mountings on the tank wagon chassis shall be designed and constructed to withstand the following loads. In these circumstances stresses in the mountings shall not exceed the yield stresses of the materials involved divided by 1.7.

(i) Longitudinally - in each direction loads of twice the total weight of the fully loaded tank and its fittings.

(ii) Vertically downwards - loads of twice the total weight of the fully loaded tank and its fittings.

(iii) Vertically upwards and transversely - loads equal to the total weight of the fully loaded tank and its fittings.

2.7.3 Due consideration for fatigue of the tank wagon chassis mountings shall be included in the design, to the satisfaction of the approving authority.

2.7.4 If tank wagon tank mountings are provided solely by twist locks and the twist locks are used to provide vertical restraint, then they shall be selected to meet the proof strength requirements noted below, and to withstand the design loadings of this Code. Twist locks are to be of a type which can be mechanically held in the locked position. Non-retractable twist locks should be used. Twist lock assemblies shall be subjected to a proof load, vertically upwards of twice that specified in section 2.7.2(iii) of this Code. The test shall be carried out at the time of assembly of the twist lock onto the tank wagon chassis.

Thereafter twist lock assemblies shall be subjected to vertical proof loads of 1.25 of that specified in section 2.7.2(iii) at 12-monthly intervals. Records of such testing shall be kept for inspection and should satisfy the requirements of NZS/BS 5237 Lifting Twist Locks.
2.7.5 Conversion of demountable tanks to fixed tanks entails the following additional mounting requirements:
(a) installation of secondary permanent locking (e.g., bolting) removable only under workshop conditions
(b) full compliance of paperwork, valves, etc with this Code.
Additional tank baffling may be required depending on the existing tank size and proposed application.

2.7.6 Intermediate bulk containers (IBCs) shall be attached to vehicles through mountings designed to withstand forces of 2 g in any direction without exceeding the yield stress of the material. Containers shall not be stacked vertically during conveyance.

2.7.7 Suitable corrosion protection shall be provided so the mounting system provides adequate protection for the expected life of the vehicle in the environment it may be subjected to.

2.8 Tank wagon welding
2.8.1 All welding of steel components for structural purposes necessary in building any new tank wagon or in modifying any existing vehicle for use as a tank wagon shall conform to the provisions of New Zealand Standard NZS 4701.

2.8.2 All welding for structural purposes necessary in building any new tank wagon or in modifying any existing vehicle for use as a tank wagon shall be carried out by suitably qualified welders.

In New Zealand the appropriate qualification certificate is obtained under NZS 4711, relevant to the materials used and the position involved. Current certification under equivalent overseas standards is also acceptable.

2.8.3 All welding of steel components for pressure purposes necessary in building any new tank wagon or in modifying any existing vehicle for use as a tank wagon shall conform to the provisions of BS 5500 or ASME 8 as defined by the Health and Safety in Employment Regulations for pressure purposes.

2.8.4 All welding for pressure purposes (as defined by the Health and Safety in Employment Regulations) necessary in building any new tank wagon or in modifying any existing vehicle for use as a tank wagon shall be carried out by suitably qualified welders. In New Zealand the appropriate qualification certificate is obtained under EN 287 and EN 288 or ASME 9, relevant to the materials used and the position involved.
2.9 Stability of tank wagons
2.9.1 The stability of tank wagons is to comply with the guidelines in AS 2809 Part 1.

2.10 Overseas designs
2.10.1 A ruling from the Ministry of Health approving the use of tank wagons in New Zealand must be obtained before tank wagons designed and built overseas are able to be used in New Zealand. Ministry approval is also required for tank wagons built in New Zealand to an overseas design.
Section 3: Tank Design and Construction
Requirements - General

3.1 Introduction
3.1.1 Every cargo tank and vessel shall be designed and constructed with recognised good practices as well as the applicable tank requirements specified in this Code.

3.2 Tank types
3.2.1 The tank types for carriage of corrosives referred to in this Code are those specified in the International Maritime Dangerous Goods (IMDG) Code. These tank types are cited extensively in Section 2 of AS 2809, “Road Tank Vehicles for Dangerous Goods Part 4 - Tankers for Toxic and Corrosive Cargoes”.

3.2.2 The precise design of a tank for the carriage of a corrosive cargo in bulk is governed by several parameters, in particular the density of the corrosive substance, its vapour pressure and the design tank life. The IMDG Code recognises these variables and their relevance to tank design by specifying a range of tank types (Types 1-5), with particular cargoes assigned to an individual tank design type. (Note that in the 1995 revision of the IMDG Code tank design Type 3 was deleted.)

3.2.3 In general, Type 1 and 2 tanks are required for the carriage of toxic substances in bulk. However, the Transport Recommendations (and the IMDG Code) list one corrosive substance, nitric acid, red, fuming, as requiring a Type 1 tank. Up to 20 other corrosives are listed as requiring a Type 2 tank, including fuming sulphuric acid and nitric acid, other than red, fuming.

3.2.4 The comment made in Section 1.1.4 still applies, ie, it should be recognised that only a small number of common corrosives are transported in such a volume that specific road tankers are constructed to handle them. However, this Code still gives guidance on Type 2 tank design (see Section 4 below).

3.2.5 Design requirements for a Type 1 tank are not, however, specified in this Code, given that only one (relatively uncommon) corrosive is listed by the IMDG Code (and thus AS 2809 Part 4) as requiring a Type 1 tank.

If necessary the Australian Standard should be consulted.

3.2.6 The majority of corrosives likely to be transported by road tankers require IMDG Type 4 or Type 5 tanks.
3.3 **Filling requirements**

3.3.1 The filling of tanks must allow for ullage to prevent thermal expansion of the contents without loss. This ullage space must be a minimum of 4 percent of the total tank volume, or the value corresponding to the degree of filling calculated in accordance with a recognised method (see NZS 5433: 1988, section 6.8.3 or an equivalent method). The ullage space must also incorporate the mean coefficient of cubical expansion of the particular corrosive being transported.
Section 4: Tank Design and Construction
Requirements - Type 2 Tanks

4.1 Application
4.1.1 This section applies to tanks for the bulk transportation of corrosives in which the cargo is classified in the IMDG Code (and thus the Australian Code for the Transport of Dangerous Goods and AS 2809 - Part 4) as requiring the use of a Type 2 tank.

4.2 Tank design and construction
4.2.1 In general Type 2 tank design requires base compliance with a transportable pressure vessel code, such as AS 1210 or an equivalent standard. Variation to the requirements of AS 1210 as they apply to Type 2 tanks are given below.

4.2.2 The design pressure shall be the vapour pressure of the corrosive cargo at 46°C plus 0.75 MPa. (Note: this design pressure is a simple requirement to ensure that the tank shell construction is sufficiently thick and strong to minimise the chance of loss of contents in the event of an accident, and to ensure that the integrity of the tank is maintained for as long as possible in the event of accidental heating).

4.2.3 The materials of construction of the parts of the tank and its fittings that are likely to come into contact with the cargo during transport, loading or unloading shall be:
(a) substantially immune from attack by the corrosive substance or
(b) lined with a material which is substantially immune from attack by the corrosive substance or
(c) of sufficient metal thickness to ensure that the minimum design thickness of the part is not reached during the expected life of the tank.

4.2.4 Where the maximum design load of a Type 2 tank exceeds 15,000 kg, or where the volume of the tank exceeds 15,000 litres, then at least one transverse baffle shall be installed for each 15,000 kg of corrosive cargo or 15,000 litres of tank volume. The surface area of each baffle shall not be less than 50 percent of the cross-sectional area of the tank. Baffles shall be evenly spaced along the length of the tank.

4.2.5 Every tank exceeding 5000 litres shall be provided with an accesshole located on the rear head of the tank or within a recess or shroud on the top of the tank.
4.3 **Valves and fittings**

4.3.1 Each opening into a Type 2 tank other than an opening for an accesshole or safety relief device, shall have a manual shut-off valve. The valve shall be connected directly to the flange for the vessel opening. Liquid transfer and vapour return valves should be quick-acting types.

4.3.2 Each tank shall be provided with at least one but not more than two pressure relief devices in accordance with the following requirements:

(a) the requirements of AS 1210 shall apply where the application is within the scope of the standard

(b) where the cargo is flammable or combustible, the aggregate capacity of the pressure relief devices shall be determined in accordance with the requirements for fire exposure capacity of AS 1210. Otherwise the capacity may be reduced to half such value

(c) the direction of discharge shall be vertical. Where a cover is provided above the relief device, there shall be a permanent opening to allow escaping vapour to pass freely to the atmosphere

(d) except for a dust cap or similar device fitted to the outlet of the relief device, venting shall be direct to the atmosphere.

4.3.3 All valves on the sides, upper surfaces, and heads of the tank shall be protected either by recessing or by being located within a shroud or other equivalent protection. Any shroud shall:

(a) fully enclose the fittings it protects and project at least 25 mm above or beyond such fittings

(b) be designed to withstand a load applied in any direction equal to twice the mass of the fully laden tanker

(c) be drained sufficiently to prevent the accumulation of rainwater etc.

4.3.4 The outlet connection for a tank shall not incorporate quick-release couplings. Every outlet connection shall be provided with a blank flange or a screwed plug or an equivalent means of positively closing the outlet.
Section 5: Tank Design and Construction
Requirements - Type 4 and 5 Tanks

5.1 Application

5.1.1 This section applies to tanks for the bulk transportation of corrosives in which the cargo is classified in the IMDG Code (and thus the Australian Code for the Transport of Dangerous Goods and AS 2809 – Part 4) as requiring the use of a Type 4 or Type 5 tank.

5.2 Materials of construction

5.2.1 Materials used in the construction of tanks shall be at least equivalent to the grades specified in the following standards:

(a) for low alloy steels: AS 1204, AS 1205, AS 1449 or equivalent international standard
(b) for aluminium alloys: AS 1734, AS 1866, AS 1874 or equivalent international standard
(c) for high alloy steels: as agreed in consultation with the approving Authority
(d) for glass-fibre reinforced plastics: AS 2634 or equivalent international standard.

Note: Specifications for design and construction of glass-fibre reinforced plastic tanks are given in Appendix C of this Code.

5.2.2 The materials of construction of those parts of a tank that are likely to come into contact with the corrosive cargo during transport, loading, or unloading shall be:

(a) substantially immune from attack by the corrosive cargo. (Note: The material may be considered to be immune if, after an initial reaction with the cargo, an impervious surface layer is formed which prevents further reaction. This is on the provision that the tank is not frequently cleaned or used for transporting other cargo, so that repeated destruction of the protective layer results), or

(b) lined as described in Section 5.2.3 below, or

(c) of sufficient metal thickness to ensure that a predetermined service life of a minimum of 10 years will be achieved under expected conditions of service, unless a shorter service life is acceptable to the approving Authority because of specific conditions. (Note: where loss of tank shell material by corrosion is accepted, maintenance procedures must include a requirement to monitor the shell thickness at least annually, and to repair defective areas as required.)

5.2.3 Any lining material for tanks subject to this Code shall be:

(i) substantially immune from attack by the corrosive cargo being transported therein
(ii) not less elastic than the metal of the tank itself
(iii) homogeneous, non-porous and free from perforations when applied.

Joints and seams in the lining shall be made by fusing the material together or by some other approved means.

5.3 Design of tanks and supports

5.3.1 The thickness of the tank shell and the design of supports and connections shall be calculated in accordance with AS 1250 or AS 1664 if of metal, or similar appropriate construction standards if of some other material. The calculated value for the shell thickness shall then be compared with the values specified in Table 5.1. Where the density of the corrosive cargo exceeds 1000 kg/m$^3$, the value thus read shall be increased as indicated in Table 5.2. The design thickness of the tank shell and associated supports shall then be the higher of the tabulated or the calculated values.

5.3.2 The following factors shall influence thickness determinations:

(a) The design load for the tank and its attachments shall not be less than twice the total mass of the tank, its accessories and its cargo. The mass of the cargo shall be calculated from its actual density or 1000 kg/m$^3$ (whichever is the greater) and the maximum permissible loading quantity.

(b) Stresses due to internal pressures caused by liquid head, vapour pressure and generated gas pressure shall be added to the static load stresses. The vapour pressure shall be 20 kPa or 30 kPa for small-compartment or large-compartment tanks respectively, or the vapour pressure of the cargo at 46°C, whichever is the greater. The generated gas pressure shall be the increase in pressure over two hours as the result of chemical action.

(c) Local loadings shall be taken into account, as relevant. If applicable a vector summation of any combination must also be considered, as follows:

(i) dynamic loading of the tank wagon in motion under all configurations of product load
(ii) superimposed loads such as operating equipment, insulation, linings, hose tubes, cabinets and piping
(iii) effect of supporting lugs and saddles or other supports
(iv) effect of temperature gradients resulting from product and ambient temperature extremes.

(d) Fatigue stresses shall be calculated and added to the stress calculated for the stationary vehicle (unless fatigue resistance has been satisfactorily demonstrated by supervised tests or logged field experience). The calculation shall be based on the following values at constant amplitude:

(i) vertical ± 0.3 g
(ii) longitudinal ± 0.2 g
(iii) lateral ± 0.2 g.

(e) Where a degree of tank corrosion is accepted, the thickness determined shall satisfy the provisions of Section 5.2.2(c) above.

(f) The thickness of the bulkheads and baffles of a metal tank shall not be less than that specified in Tables 5.1 or 5.2, as applicable, where the cargo is not corrosive to the material of the tank. If the cargo is corrosive, Section 5.2.2(c) shall apply.

Table 5.1: Minimum plate thickness for Type 4 tankers (cargo density = 1000 kg/m$^3$)

<table>
<thead>
<tr>
<th>Tank details</th>
<th>Minimum nominal thickness, mm</th>
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<td></td>
<td>Shell</td>
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<tr>
<td></td>
<td>Small-compartment tanks</td>
</tr>
<tr>
<td></td>
<td>Unreinforced length of shell (L), m</td>
</tr>
<tr>
<td>Rated capacity per metre of tank length L</td>
<td>LCS</td>
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<tr>
<td>&gt;1400</td>
<td>&gt;1.8</td>
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<tr>
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<tr>
<td>&gt;2300</td>
<td>&gt;2.3</td>
</tr>
<tr>
<td>&gt;2900</td>
<td>&gt;2.3</td>
</tr>
</tbody>
</table>

Table 5.2: Minimum plate thickness for Type 5 tankers (cargo density 1000 kg/m$^3$)

Where the cargo density exceeds 1000 kg/m$^3$, the minimum allowable value is first read from Table 5.1 and a higher minimum allowable value is then substituted from the following according to density. Substitutions apply to shells, ends, baffles, bulkheads.

<table>
<thead>
<tr>
<th>Thickness value from Table 5.1</th>
<th>1.6</th>
<th>1.8</th>
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<th>2.2</th>
<th>2.4</th>
<th>2.8</th>
<th>3.0</th>
<th>3.5</th>
<th>3.8</th>
<th>4.0</th>
<th>4.4</th>
<th>5.0</th>
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<th>6</th>
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</thead>
<tbody>
<tr>
<td>Density kg/m$^3$</td>
<td>Substitute thickness values, mm</td>
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<td></td>
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<tr>
<td>1000 to 1200</td>
<td>2.0</td>
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<td>5.0</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>1500 to 1900</td>
<td>3.2</td>
<td>3.8</td>
<td>4.0</td>
<td>4.6</td>
<td>5.0</td>
<td>5.0</td>
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<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

Notes:

1. See AS 2809 - Part 4 for allowable tempers for aluminium alloys with lowered welded tensile strengths.
2. The values for fatigue stresses and thickness are applicable to normal road conditions; they may need to be increased if the tanker is consistently used on rough roads.
3. The thicknesses for heads and bulkheads for large-compartment tanks may be reduced to equal the shell thickness provided that a calculation for head thickness carried out in accordance with AS 1210 indicates that it is safe to do so.

5.3.3 Cargo tanks with frames not made integral with the tank by welding shall be provided with restraining devices to eliminate any relative motion between the tank and frame which may result from a 2 g downwards force, or a 1 g upwards force on the vehicle. Such restraining devices shall be readily accessible for inspection and maintenance, except that insulation and jacketing are permitted to cover the restraining devices.

5.3.4 Any cargo tank designed and constructed so that it constitutes in whole or in part the structural member used in lieu of a frame shall be supported so that the resulting stress levels in the cargo tank do not exceed those calculated in Sections 5.3.1 and 5.3.2.

5.4 Stiffening and reinforcement

5.4.1 Unless a proven equivalent form of stiffening is provided, the following requirements shall apply:

(a) heads and bulkheads for large-compartment tanks shall be dished to a depth, exclusive of the flange, of not less than 250 mm, with a knuckle radius of not less than 50 mm. Dished bulkheads should be arranged with the convex surface facing forwards, to minimise the effect of braking loads

(b) heads and bulkheads for small-compartment tanks, and baffles for all tanks shall be dished to a depth, exclusive of any flange, or not less than 80 mm per metre of depth of the minor axis of the tank cross-section, but in any case the amount of dishing shall be not less than 100 mm.

5.4.2 Tanks with shell thicknesses less than 10 mm shall, in addition to the tank heads, be circumferentially reinforced with either bulkheads, baffles, or ring stiffeners. It is permissible to use any combination of the aforementioned reinforcements in a single cargo tank. The following requirements shall apply:

(a) Reinforcements shall be located so that the maximum unreinforced length (L) shall not exceed that specified for the particular shell thickness. The exception is Table 5.1, where two or more underframe members of an aggregate section modulus of at least $180 \times 10^3 \text{ mm}^3$ and a shell thickness of at least that for $L_3$ extend for at least the length of the compartment, reinforcements may be up to 2.5 m apart.

(b) The reinforcements shall be located within 25 mm of points where the longitudinal alignment of shell sheets changes direction by more than 10 degrees, unless otherwise reinforced sufficiently to keep stresses within the specified limits.

(c) Ring stiffeners shall be continuous, and shall have a section modulus about the neutral axis of the ring section parallel to the shell not less than that determined from the following equation:

$$Z = K bL$$

where
Z = section modulus
K = 0.0069 for all steels
    = 0.01186 for all aluminium alloys
b = tank width or diameter, in millimetres
L = ring spacing, ie, the maximum distance from the midpoint of the
    unsupported shell on one side of the ring stiffener to the midpoint of the
    unsupported shell on the opposite side of the ring stiffener, in millimetres.

Where a ring stiffener is welded to the shell in accordance with (d), the maximum
portion of the shell which may be used as part of the ring for computing the
section modulus shall be as described in Table 5.3.

(d) The welding which attaches stiffening members, including the underframe
members mentioned in (a) above, shall not be less than 50 percent of the total
length (or circumference) of the member, and no unwelded length of the joint shall
exceed 40 times the shell thickness.

<table>
<thead>
<tr>
<th>Table 5.3: Reinforcement of tank shell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of parallel circumferential</td>
</tr>
<tr>
<td>ring stiffener to shell welds</td>
</tr>
<tr>
<td>Distance between welds</td>
</tr>
<tr>
<td>Shell section credit</td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Less than 20 t</td>
</tr>
<tr>
<td>20t</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>20t or more</td>
</tr>
<tr>
<td>40t</td>
</tr>
</tbody>
</table>

where:

<table>
<thead>
<tr>
<th>t = shell thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>S = distance between parallel circumferential ring stiffener to shell welds</td>
</tr>
</tbody>
</table>

5.4.3 If baffles or baffle attaching rings are used as reinforcing members they shall be circumferentially welded to the tank shell. The welding requirements shall satisfy the minimum specifications of Section 5.4.2(d) above.

5.4.4 Tanks designed to transport different commodities which, if combined during transit, will cause a dangerous condition or the evolution of heat or gas shall be provided with compartments separated by double wall bulkheads. The resulting air space shall be vented and shall be equipped with screwed openings for drainage which shall be kept operative at all times. Any drainage openings on the upper surfaces of the tank shall be plugged and the lowest opening shall be fitted with a valve.

5.4.5 For a large-compartment tank the dishings of a double walled bulkhead shall be convex towards each other.

5.5 Miscellaneous design provisions

5.5.1 A large-compartment tank shall be circular in cross-section. A small-compartment tank may be any shape.
5.5.2 Flat shell sections are allowed across the valence at the top of the tank only under the following conditions:

(a) stiffeners of the same material as the shell are welded across the tank for the full width of the flat section. The recommended stiffener size is 75 mm deep by 5 mm thick and spaced so that the unsupported shell length does not exceed 700 mm. In this case this section of the shell will not be considered in minimum shell thickness deteriorations, or

(b) with no stiffeners in place the shell shall be considered to have infinite radius at that section for minimum shell thickness determinations (ie, shell radius > 3.2 m), or

(c) it can be shown that the flat shell section has a stiffness equal to a stiffened plate or a curved plate of equivalent radius.

5.5.3 The loads from supports should be taken on stiffening members and should be distributed as widely as possible through pads, gussets, etc.

5.5.4 Any baffle shall be provided with an accesshole-sized opening where no other means exists for gaining access to tank space on both sides of the baffle.

5.6 Welding and inspection of welds

5.6.1 All joints between tank shell, heads, baffles (or baffle attachment rings) and bulkheads shall be welded in accordance with NZS 4701, AS 1554 (Category GP), AS 1665 (Weld quality 2), or other equivalent standard, as appropriate.

5.6.2 Joints shall be welded in accordance with recognised good practice and the efficiency of any joint shall be not less than 85 percent of the mechanical properties of the adjacent metal in the tank.

5.6.3 Butt welds in the tank shell shall be for full penetration.

5.6.4 Welding consumables shall be suitable for the material being welded and for any conditions arising from the nature of the corrosive cargo, in particular the possibility of stress-corrosion cracking.

5.6.5 Inspection of welding and testing of sample welds may be required. Such testing will be in accordance with a recognised testing code acceptable to the tank wagon owner (or constructor) and the Ministry and carried out by a Telarc registered testing authority. In general, NZS 4701 will be used for structural steel.

Note: Testing may be specified in the event of unusual construction (materials or methods), doubt as to constructor experience, etc.
Section 6: Auxiliary Equipment, Service and Transfer Arrangements

6.1 Accessholes

6.1.1 Each tank compartment shall be accessible through an accesshole not smaller than that specified in AS 1210. The accesshole cover shall be designed to provide secure closure and shall be capable of passing the tank pressure tests (see Section 7 below). All joints between accesshole covers and their seats shall be made tight against leakage of vapour and liquid. Gaskets, if used, shall be of suitable material not subject to attack by the corrosive cargo.

6.1.2 The accesshole cover shall have a structural capacity of withstanding internal fluid pressures equal to one and one-half \((1\frac{1}{2})\) times the design pressure of the tank and in no case less than 103 kPa without permanent deformation. Safety devices to prevent the accesshole and/or fill cover from opening fully when internal pressure is presented shall be provided.

6.2 Vents

6.2.1 Safety vents

Energy cargo tank compartment shall be equipped with approved pressure relief devices. Such devices shall be designed to operate at not more than one and one-half \((1\frac{1}{2})\) times the design pressure of the tank. If air inlet devices are provided, a relief valve shall have adequate capacity to limit tank pressure to 130 percent of design pressure at maximum inlet flow rate. Air inlet lines if permanently connected to an air source shall be equipped with a check valve. Shut-off valves between the tank and relief valve are prohibited.

6.3 Outlets

6.3.1 Each outlet at or near the top of a tank used for discharge or loading must be equipped with a shut-off valve located as close as practical to the point of outlet from the tank. Each such outlet having its discharge end below the top liquid level in the tank must be equipped with an additional shut-off valve, blank flange or sealing cap at the discharge end of the outlet.

6.3.2 Except as provided in paragraphs 6.3.3 and 6.3.4 of this section, each bottom outlet must be equipped with a shut-off valve designed, installed and protected as in Section 6.4.3.1.

6.3.2.1 Each bottom outlet valve must be located as close as practical to the outlet point outside the tank.
6.3.2.2 Each bottom discharge valve must be equipped with a remote means to activate a valve closure manually.

6.3.2.3 In addition, a blank flange, sealing cap, or shut-off valve is required at the discharge end of the outlet.

6.3.3 A bottom opening for purposes other than corrosive discharge may be closed by a bolted flange at the tank shell. If any piping extends from such an opening, it must be fitted with a shut-off valve designed, installed, and protected as described in Section 6.4.3.1. In addition, a supplementary closure is required at the discharge end of this piping.

6.3.4 Bottom outlet valves need not meet Section 6.3.2.2 when the cargo tank is transporting a corrosive liquid containing solids in suspension in sufficient quantity that settling may form a layer of solid material that may interfere with the sealing of the valve seat.

6.3.5 Any seals, o-rings or gaskets shall be constructed of a material that is compatible with the contents.

6.3.6 Tanks with separate compartments that may carry products that are not compatible shall be provided with separate discharge lines.

6.4 Accident damage protection

6.4.1 Fittings

The term ‘fitting’ means any cargo tank accessory attachment that has no liquid product retention or other liquid containment function, and provides no structural support to the tank.

6.4.1.1 The design, construction and installation of any fitting to the shell or head of the cargo tank must be such as to minimise the possibility of fitting damage or failure adversely affecting the product integrity of the tank.

6.4.1.2 Structural members, such as the suspension subframe, overturn protection and external rings, when practicable, should be utilised as sites for attachment of fittings and any other accessories to a cargo tank.

6.4.1.3 Except as prescribed in Section 6.4.1.6, the welding of any fitting to a shell or head must be made by attachment to a mounting pad. The thickness of a mounting pad must not be less than that of the shell or head to which it is attached. A pad must extend at least 25 mm in each direction from any point of attachment of a fitting. Pads must have rounded corners or otherwise be shaped in a manner to preclude stress concentrations on the shell or head. The mounting pad must be attached by a continuous weld around the pad, unless a gap for drainage is provided at the bottom. A ‘telltale’ hole shall be provided where such a drainage gap is not provided.
6.4.1.4 The fitting must be attached to the mounting pad so there will be no adverse effect upon the product retention integrity of the tank if any force is applied to the fitting, in any direction, except normal to the tank, or within 45° of normal.

6.4.1.5 The means of attachment to the mounting pad shall not create pockets which could initiate corrosion.

6.4.1.6 Lightweight attachments such as skirting structures, conduit clips and breakline clips may be secured directly to the tank shell or head providing they are:
   (a) of a metal thickness, construction or material appreciably less strong but no more than 72 percent of the thickness of the tank shell or head
   (b) designed and installed so that damage to them will not affect the product retention integrity of the tank
   (c) secured to the tank shell by continuous weld or in such manner as to preclude formation of pockets which may become sites for incipient corrosion.

6.4.2 Overturn protection

6.4.2.1 All closures for filling, access hole or inspection openings shall be protected from damage which will result in leakage of contents in the event of overturning of the vehicle by being enclosed within the body of the tank or dome attached to the tank, or by guards. Such protection shall project at least 25 mm above the top of the fittings it protects.

6.4.2.2 For demountable tanks where the capacity does not exceed 2500 litres, a vertical metal strip not less than 4.5 mm thick surrounding the fittings may be used.

6.4.2.3 When guards are required they shall be designed and installed to withstand a load of twice the weight of the loaded tank in any direction. These design loads may be considered independently. The ultimate strength of the material shall be used as the calculation base. If more than one guard is used each shall carry its proportionate share of the load. If protection methods other than guards are considered the same design load criteria are applicable.

6.4.2.4 A guard in the form of inverted U-coamings may be used, with a minimum thickness of 3 mm if of mild steel, 2.5 mm if of stainless steel and 5 mm if of aluminium.

6.4.2.5 The material of any guard shall be compatible with that of the tank shell.
6.4.2.6 Except for pressure actuated vents no overturn protection is required for non-operating nozzles or fittings less than 130 mm in diameter (which do not contain product while in transit) that project a distance less than the inside diameter of the fitting. This projected distance may be measured either from the shell or the top of an adjacent ring stiffener provided that such a stiffener is within 700 mm of the centre of the nozzle or fitting.

6.4.2.7 If the overturn protection is constructed to permit accumulation of liquid on the top of the tank, it shall be provided with drainage facilities directed to a safe point of discharge, clear of and below the engine and exhaust system.

6.4.3 Piping

6.4.3.1 Product discharge piping shall be provided with protection which reasonably assures the accidental escape of contents. Such protection may be provided by:

(i) a shear section located outboard of each emergency valve seat and within 100 mm of the vessel which will break under strain and leave the emergency valve seat and its attachment to the vessel and the valve head intact and capable of retaining product. The shear section shall be machined in such a manner as to abruptly reduce the wall thickness of the adjacent piping (or valve) material by at least 20 percent, or

(ii) by suitable guards capable of successfully absorbing a concentrated horizontal force of at least 3600 kg applied from any horizontal direction, without damage to the discharge piping which will adversely affect the product retention integrity of the discharge valve.

6.4.3.2 Strength of piping, hose and hose couplings: hose, piping and fittings for tanks to be unloaded by pressure shall be designed for a bursting pressure of:

- not less than 700 kPa, and
- not less than four times the pressure generated by any vehicle mounted pump or other device (excluding safety valves), the action of which may be to subject certain portions of the tank piping and hose to pressures greater than the design pressure of the tank.

Any coupling used on the hose to make connections shall be designed for a working pressure of not less than 20 percent in excess of the design pressure of the hose and shall be designed so there will be no leakage when connected.

6.4.3.3 Provisions for movement: to prevent damage, suitable provisions shall be made in every case for expansion, contraction, vibration and, where necessary, movement of all pipes and fittings. Unrestrained slip joints shall not be used for this purpose.

6.4.3.4 Heater coils, when installed, shall be so constructed that the breaking off of their external connections will not cause the contents of the tank to leak.
6.4.3.5 Gauging, loading and air-inlet devices, including their valves, shall be provided with adequate means for their secure closure, and means shall also be provided for the closing of pipe connections of valves. Provision shall be made for fail-safe isolation of the contents in the event of gauge failure.

6.4.4 Loading or unloading pumps mounted on tractor or trailer units, if used, shall be provided with automatic means to prevent the pressure from exceeding the design pressure of the tank-mounted equipment.

6.4.5 Any pump-driving engine or electric motor shall be located as far from the filling points as possible, and shall be protected against the attack of corrosive products. Where a spilled cargo material may become dangerous if overheated, provision shall be made to prevent contact with hot parts.

6.4.6 The shaft between the pump and the engine shall be shielded to prevent the spraying of any corrosive leakage from a pump seal.

6.4.7 Power-driven pumps shall be provided with controls which shall comply with the following requirements:
   (a) controls shall be clearly marked, easily accessible, and located in a position remote from the pump and discharge outlets
   (b) an emergency stop for an electric motor or engine shall be provided at the discharge side of the vehicle. All such devices shall be clearly identified and easily accessible.
**Section 7: Testing, Certification and Repairs**

**7.1 Testing requirements**

7.1.1 Every tank or individual tank compartment shall be tested by completely filling the tank and dome with water, the temperature of which shall not exceed 38°C during the test, and applying a pressure of 1.5 times the design pressure but not less than 30 kPa.

7.1.2 The pressure shall be gauged at the top of the tank. The tank shall hold the prescribed pressure for at least 10 minutes without failure, undue distortion, leakage or evidence of impending failure. All closures shall be in place while the test is made. During these tests, operative relief devices shall be clamped, plugged or otherwise rendered inoperative; such clamps, plugs and similar devices shall be removed immediately after the test is finished.

7.1.3 If failure of the tank or compartment impends or occurs, the tank shall not be placed in or returned to service unless an adequate repair is made. The adequacy of such a repair shall be determined by the same method of test as described above.

7.1.4 Pipes and piping systems shall be tested in accordance with the following regime:

   (a) a piping system subject to pumping pressure shall be tested to a pressure 1.5 times the maximum working pressure

   (b) valves, manifolds, piping and fittings in a bottom loading system, which can be subjected to surge pressures due to the closure of some valve in the system, shall be tested to 1600 kPa.

7.1.5 After an interior heating system consisting of coil piping is installed, and before the tanks to which it is fitted are placed in service, the heating system shall be tested. Systems using steam or hot water under pressure for heating the contents of cargo tanks shall be tested with hydrostatic pressure and proved to be tight at 1400 kPa.

**7.2 Certification**

7.2.1 Certification by a registered engineer or registered engineering associate is required to show that such cargo tanks have been designed, constructed and tested in accordance with this code. Refer to Appendix B for details of certification procedures and formal requirements.
Each tank must have a certification plate of a material compatible with the tank and permanently attached to its shell or to an integral supporting structure. The plate must not be subject to corrosion and shall be permanently fixed to the left side (facing forward) near the front, in a place readily accessible for inspection. The lettering shall be at least 6 mm high and applied to the plate by stamping, embossing or other suitable means. The plate shall not be painted so as to obscure the marking thereon. The plate shall convey the following information:

(i) the tank manufacturer’s name
(ii) the manufacturer’s serial number
(iii) the tank design approval number, issued by the Ministry of Health as the approving authority. This approval number will be in the form: MOHXXX
(iv) the design code (usually AS 2809, Part 4) or codes
(v) the date of manufacture
(vi) the date of testing
(vii) the design pressure, in kilopascals
(viii) the shell material (grade, and thickness in millimetres)
(ix) the head material (grade, and thickness in millimetres)
(x) the tank capacity (litres) by compartments (listed front to rear)
(xi) the maximum liquid load, in kilograms
(xii) the maximum loading rate, in litres per minute
(xiii) the maximum unloading rate, in litres per minute.

As well as appearing on the certification plate, the tank serial number shall also be stamped on a substantial part of the tank structure.

Repairs

No modifications or major repairs of a tank wagon or a demountable tank shall be carried out without the consent of the approving authority.
Section 8: Markings and Placarding

8.1 Markings
8.1.1 Tank wagons and demountable tanks shall be clearly marked with the proper shipping name and either the technical or trade name of the contents, whichever best describes the hazardous nature of the goods.

8.2 Placarding
8.2.1 Tank wagons and demountable tanks shall be marked with a placard of the type, dimensions and colour shown in Appendix A.

8.2.2 Placards as required in Section 8.2.1 shall be displayed at both the front and the rear of the vehicle and on each side, on a substantially vertical plane. They should be legible, kept clean, clearly visible and free from obstruction (except that the rear placard need not be kept clearly visible and free from obstruction when the vehicle is being loaded or unloaded) whenever the vehicle is carrying product.
Appendix A: Placarding Requirements

Size: minimum of 400 mm x 400 mm – measured along the sides of the diamond.

Colour: white
In all other respects the label shall comply with the requirements of the New Zealand Standard NZS 5417:1986.

Size: minimum of 400 mm x 400 mm – measured along the sides of the diamond.

Colour: white
In all other respects the label shall comply with the requirements of the New Zealand Standard NZS 5417:1986.

Size: minimum of 400 mm x 400 mm – measured along the sides of the diamond.

Colour: black and white
In all other respects the label shall comply with the requirements of the New Zealand Standard NZS 5417:1986.
Appendix B: Means of Compliance with Code

The following are the actions to be undertaken by a vehicle owner or the owner’s agent to comply with this Code.

B1  The design of any new tank wagon, or the assessment of any existing vehicle, for use under this Code is to be carried out by a registered engineer or a registered engineering associate with relevant experience in the road transport industry. Completed designs and assessments are to be forwarded to the Ministry of Health, for a ruling on the acceptability of the design and conditions of approval.

The person seeking approval will be expected to provide the following information.

(a) General design information, including products to be carried, proposed tractor unit, etc.
(b) Two copies of the general assembly drawing of the tank wagon for which approval is sought including, where appropriate, the anticipated prime mover to be used. This drawing shall show all major vehicle dimensions.
(c) In the case of new designs two copies of the working drawings to be used in the construction of the tank wagon. In the case of assessments of existing design, a copy of the assessment report and two copies of any drawings showing any modifications is to be made before the tank wagon enters service.
(d) The design calculations for the rear bumper.
(e) The design calculations for the tank mounting arrangements.
(f) The roll stability criteria assessment.
(g) If available, the registration number and fleet number of the vehicle concerned.
(h) The identification of the registered engineer or the registered engineering associate responsible for the design or assessments.
(i) The identification of the registered engineer or registered engineering associate to be responsible for the supervision of construction of the tank wagon.

In lieu of design checking by the Ministry, certification by a qualified person with relevant experience in the road transport industry (preferably a registered engineer) will be accepted with the approval of the Ministry. The certificate and supporting information are to be forwarded to the Ministry for validation.

B2  After acceptance of the design, or modification, construction may proceed under the supervision of a registered engineer or registered engineering associate. Note that independent inspection of construction and welding may be required.

The approved design will be allocated an approval number. This approval number is to be painted on the tank in letters and numerals 75 mm high preferably on the front right-hand side of the tank.
Before the tank wagon enters service it will be inspected for compliance with the requirements of this Code.

The supervision of construction and inspection may be carried out and certified by a qualified person with the approval of the Ministry. The certificate stating that the tank wagon has been constructed according to the approved design and drawings in accordance with this Code with any supporting information shall be forwarded to the Ministry for validation.

**B3** The vehicle shall be operated and inspected in accordance with the requirements of this Code, and all records of inspection required by this Code shall be kept by the vehicle owner or owner’s agent for inspection as required by the approving authority. The inspections required are:

(i) each month - the tank wagon operator shall inspect any flexible hose used in the transfer system for damage and wear

(ii) every three months - the tank wagon shall be inspected by a qualified automotive engineer for continued compliance with Section B2 of this appendix

(iii) every six months - present the vehicle to an inspection agency approved by the Director, Land Transport Safety Authority as competent to carry out the required inspections for a Certificate of Fitness.

Alternative inspection procedures approved by the Ministry of Health may be used.

**B4** Finally the vehicle is required to undergo regular inspection by an inspector for compliance with this Code and the Regulations. Maximum period between full inspections is two years.

**Engineer’s certificate**

for tank wagon, tank trailer
intermediate bulk container
fixed bulk container (delete as required)

I, ____________________________, an engineer and holder of a current annual practising certificate certify that I have inspected the design/construction (delete as required) and made such detailed examinations and checks as I considered necessary and it is my opinion that:

- the design is in accordance with __________________________________________ (state standard(s) code, or specification)
- the construction is in accordance with good and widely accepted engineering practice and the design as shown on the drawing list attached
- the inspection has been carried out in accordance with the requirements of the design code.
I have witnessed and/or verified non-destructive testing/hydrotesting.

Signed ____________________________________________________________________ Registered Engineer No ____________________________________________________________________
for and on behalf of ____________________________________________________________________

This certificate refers to the following described tank wagon, tank trailer, intermediate bulk container or fixed bulk container (delete as required).

Full description ____________________________________________________________________

Situated/owned by/at ____________________________________________________________________

Inspection of tank wagon

Owner: Registration No:
Make and model: Fleet No:
Type: truck/tractor: Product:

1 Motive power diesel/petrol turbo
2 Fifth wheel unrestricted double oscillating not allowed

1 Tank manufacturer
2 Approval number
3 Capacity Litres WC
4 Compartments Number and size
5 Discharge pipe
6 Remote shut-off valve • Emergency • Shutdown
7 Pressure relief valve • Number • Location
8 Dip pipe
9 Accesshole
10 Flexible hose • Approved type • Condition
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Valve and accesshole protection</td>
<td></td>
</tr>
</tbody>
</table>
| 12 | Labelling | - Product type tags  
|   |   | - Hazchem  
|   |   | - DG diamond  |
| 13 | Bumper |   |
| 14 | Tank mounts |   |
| 15 | Draw bar | - Approved type  
|   |   | - Serial number  |
| 16 | Draw bar connection | - Approved type  
|   |   | - Serial number  |

---

Inspected:  
Qualifications:  
Date:
Appendix C: Glass Reinforced Plastics Tanks

C1 General
1.1 As the characteristics of glass reinforced plastics (GRP) or fibreglass laminate may vary according to its structure, minimum values are not prescribed for tensile strength but for forces input to the material.

The minimum force value should be:
- up to 3000 litres – 440 N/mm width
- over 3000 litres – 750 N/mm width.

The values given apply to laminates incorporating only E glass reinforcement complying with the requirements of BS 3396, BS 3496, BS 3691 or BS 3749 and having a glass content by weight within the range 30 percent to 45 percent for chopped strand mat (CSM) and 50 percent to 55 percent for woven roving (WR) cloth. Values for laminates including other types of reinforcement, other glass contents or sandwich construction should be at least equivalent to those quoted herein.

The reference standard for mechanical properties is BS 4994. Alternatively tanks may be designed using the provisions of BS 6464 for laminate strength and construction.

The tank should be constructed such that the Barcol hardness will be no less than 75 percent of the resin manufacturer’s or laboratory findings on fully cured resin.

The materials of tanks in contact with the contents should not contain substances liable to react with the contents or to affect the strength of the material.

1.2 Materials testing is to be carried out in accordance with BS 2782 or the applicable ASTM methods.

1.3 GRP or fibreglass tanks are to conform generally with Section C2 of this appendix.

C2 Tank material thickness

2.1 Non-pressure tanks
This applies to tanks for gravity or pump discharge with a compartment minimum test pressure of 32 kPa.

2.1.1 Shell thickness
The thickness of the tank shell should be not less than the appropriate value in the following table. In the case of reinforced plastics with sandwich construction the minimum thickness is the minimum total thickness of all reinforced plastic layers.

Reinforced plastics baffles should not be less than 5 mm thick.
### Table C1: Minimum shell thickness

<table>
<thead>
<tr>
<th>Capacity of tank/compartment (litres)</th>
<th>Reinforced plastics (hand lay up) (mm)</th>
<th>Reinforced plastics (closed mould) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 3000</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>3000–5000</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>5000–7600</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Over 7600</td>
<td>6</td>
<td>–</td>
</tr>
</tbody>
</table>

#### 2.1.2 Ends and bulkheads

Flat ends, bulkheads and baffles without reinforcement should not be used. Where dished divisions or baffles are used the depth of dish excluding the flange should not be less than 8 percent of the minor axis of the tank cross-section and in no case less than 100 mm unless adequate dish stiffeners are provided.

Recommended minimum thickness of ends and bulkheads should be as follows:

- Spherical, semi-ellipsoidal 100 percent of shell
- Torispherical 150 percent of shell
- Flat depends on reinforcement.

In case of doubt the requirements of BS 4994 are to be followed. The thickness of the ends and bulkheads should in no case be less than the minimum requirement for the shell.

#### 2.2 Low pressure tanks

For tanks designed for pressure discharge, an applicable standard (e.g., BS 4994) is to be used. Note the design pressure shall be equal to or greater than the discharge pressure.

#### 2.3 Pressure tanks

For the maximum design pressures above 200 kPa, the tank shall be designed and constructed to the full requirements of the Engineering Safety Division, OSH, Department of Labour. It is recommended that ASME Boiler and Pressure Vessel Code Section X, “Fibreglass Reinforced Plastic Pressure Vessels”, be consulted.

#### C3 Tank linings

Protective linings may be applied internally providing that provision is made to dissipate electrostatic charges adequately.

#### C4 Electrical conductivity

In order to dissipate charges during filling, an area of metal connected to earth shall be provided in each compartment, of not less than 0.04 square metres per cubic metre of
product carried. Furthermore, no part of the product carried shall be further than 2 m from the earthed metal component. The metal component may take the form of:

(a) a metal foot valve, pipe outlet or plate, situated in the base of the compartment, provided that the total area in contact with the liquid is not less than that specified, or

(b) a metallic grill of wire thickness not less than 1 mm diameter and whole area not greater than 4 cm$^2$ provided that the total area of the grill in contact with the liquid is not less than that specified.

In addition to the above, the GRP laminate which is in contact with the product shall have a bulk resistivity of less than $10^8$ ohm metres.

When the tanker is of a sandwich construction, the FRP inner tanks containing the product must meet the above specification but the outer laminate which does not come into contact with the product must have a surface resistance of not less than $10^{10}$ ohms.

If it can be shown that the product has minimal static charge build-up or that the provision of metallic grills would cause a problem with a corrosive product, this requirement will be waived.

### C5 Tank construction - general

5.1 The materials used for the construction of all load carrying mountings attached to the tanks shall have properties equal to or greater than the tank material.

5.2 The distance between tank ends, baffles or ring stiffeners shall not exceed 2500 mm with the thicknesses given in Table C1. If it can be shown that alternative construction (eg, sandwich type) or greater wall thicknesses give considerably greater tank stiffness (both overall and local), this dimension may be exceeded.

5.3 The use of screwed pipe fittings is not approved.

5.4 Specimens for material testing are to be taken whenever possible from the walls of the tank (eg, aperture cut-outs). Testing of specimens is to be carried out in accordance with the applicable material standard (eg, BS 4994, ASTM).

### C6 Testing

6.1 Tanks designed and constructed to an approved standard shall be tested in accordance with that standard.

6.2 Tanks designed for static liquid head (see 2.1) shall be tested by filling with water to the maximum design head.

6.3 Hydrostatic pressure tests are to be carried out on the complete tank. The maximum pressure is to be the higher of 1.5 x maximum working pressure or 1.5 x safety relief
value operating pressure. In a compartmentalised tank each compartment is to be pressurised with adjacent compartments empty at atmospheric pressure.

6.4 Retesting will be required if any of the pressure containing parts of the tank are modified or repaired in any way.

6.5 Periodic retesting may be required as a condition of approval.

C7 Tank fittings

7.1 Pressure/vacuum vents are to be fitted to tanks designed for atmospheric pressure.

7.2 For low pressure tanks, pressure relief valves will be required to be set at the maximum design pressure and in no case higher than 200 kPa. The valve and its internals are to be compatible with the contents. Type-test certificates of ‘once-only’ devices (eg, bursting discs) are to be submitted for approval.

7.3 Since GRP is very susceptible to collapsing under vacuum, generously sized vents and vacuum reliefs are to be used.
Appendix D: Toxic Substances Tank Wagons

While this Code applies primarily to corrosives it should be noted that the Code provisions shall be followed wherever possible and relevant when it is desired to transport toxic substances (ie, Class 6.1 hazardous substances) in bulk by road tank vehicles. Modification of provisions may be allowed by the approving authority where the product and/or its toxicity indicate the need for additional requirements.

Section 2 of this Code pertaining to vehicle requirements applies without reservation or qualification to vehicles for the transport of toxic substances as well as those for corrosives.

Section 4 of this Code sets out details of appropriate parameters for a Type 2 road tanker. AS 2809 - Part 4 contains relevant requirements for a Type 1 road tanker. These tank types (ie, Type 1 and Type 2) are those normally prescribed by the International Maritime Dangerous Goods Code (and hence by the Australian Code for the Transport of Dangerous Goods and AS 2809 - Part 4) as being required for the bulk transport of toxic substances.