Environmental Protection Authority
Te Mana Rauhī Taiao

Toxic, Corrosive and Ecotoxic Liquids Tank Wagons

For the design and construction of vehicles for the bulk transportation of Class 6 toxic, Class 8 corrosive and Class 9 ecotoxic liquids by road

HSNOCOP 39

Version 2.0 JUNE 2013

APPROVED CODE OF PRACTICE

UNDER THE HAZARDOUS SUBSTANCES AND NEW ORGANISMS (HSNO) ACT 1996

New Zealand Government

Preface

This code of practice HSNOCOP 39 version 2.0 Toxic, Corrosive and Ecotoxic Liquids Tank Wagons is approved pursuant to Sections 78 and 79 of the Hazardous Substances and New Organisms Act. It is confirmed that the requirements of Sections 78 and 79 have been met.

This code is approved as a means of compliance with Regulations 3-29, 32-37 and 42 of the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 (as amended) in respect of tank wagons that are used for the bulk transport of toxic, corrosive and ecotoxic liquids.

Approval of the code is limited to those matters in the document that relate to legislative requirements under the HSNO Act and controls set under the Act.

The intended publication date is the Gazette for the notice of approval is 11th July 2013.

Pursuant to Section 80 (1) (a) of the Act, a copy of the code may be inspected at the Wellington office of EPA New Zealand, 215 Lambton Quay, Wellington

Pursuant to Section 80 (1) (b) of the Act, a copy of the code is available from the EPA New Zealand website www.epa.govt.nz.

Approved this 27th June 2013

Andrea Gray
Acting Chief Executive
Environmental Protection Authority

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1. Purpose, scope and general

1.1. Purpose

1.1.1. Improper handling of hazardous substances may cause injury, ill health or death to a person and may cause damage to property or the environment. Hazardous substances may pose a risk to drivers, cargo handlers, emergency services and the general public during their transportation. These risks are compounded when hazardous substances are transported in bulk

1.1.2. The purpose of this approved code of practice for Toxic, Corrosive and Ecotoxic Liquids Tank Wagons (the Code) is to provide an acceptable solution for the design and construction of tank wagons for the conveyance of hazardous liquids with class 6, class 8 and/or class 9 hazard classifications by road.

1.1.3. This Code is approved by the EPA New Zealand under the HSNO Act as a means of compliance with the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 (as amended), Regulations 3, 5-24, 31 and 42, in respect of tank wagons that are used for the bulk transport of toxic, corrosive and ecotoxic liquids.

1.2. Scope of This Code

1.2.1. The aim of this Code is to ensure that bulk toxic, corrosive and ecotoxic liquids are securely contained and safely transported, thereby reducing the risks and helping to prevent accidental damage or injury to people, property and the environment. It is recognised that only a small number of toxic, corrosive and ecotoxic liquids are transported in such volumes that specific road tank wagons are required to be designed and constructed to transport them.

1.2.2. This code is not intended for application to substances with explosive, flammable or oxidising hazard classifications. Tank wagons designed and constructed to this code may however be used for conveyance of substances that have toxic, corrosive or ecotoxic properties and which also have a 3.1D flammable classification provided that the requirements of:

- section 2.5 Fire Extinguishing Equipment, and
- section 2.7.1 through to 2.7.5 Tank Truck or Prime Mover Equipment, and
- section 2.9.2 electrical resistance, and
- section 3.4 Manholes, Valves, Vents.

of code of practice HSNOCOP 6 version 2.0 Flammable Liquids Tank Wagons are complied with. HSNOCOP 6 can be downloaded from the EPA New Zealand website at: http://www.epa.govt.nz/publications-resources/publications/codes-of-practice/Pages/Completed-codes-of-practice.aspx

1.2.3. The tanks, tank fittings and attachments shall be designed and constructed in accordance with this Code, which also includes requirements for the design construction and operation of the vehicle carrying such tanks, tank fittings and attachments.

1.2.4. This Code does not detail the requirements of other legislation. Compliance with this Code does not obviate the requirement to comply with other sections of the HSNO Act or regulations made under that act, or other legislation such as the Health and Safety in Employment Act 1992, the Heavy Motor Vehicle Regulations 1974 and the Land Transport Dangerous Goods Rule 45001/1.

1.2.5. This Code does not encompass the design of intermediate bulk containers or portable tanks. Regulation 36 of the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 require these to comply with chapter 6.5 and chapter 6.7 of the United Nations (UN) Model Regulations.

1.2.6. Where transportable containers such as intermediate bulk containers or portable tanks (including ISO tank containers) are mounted on a vehicle and are used to perform the functions of a tank wagon (i.e. are filled or discharged whilst mounted on the vehicle) that vehicle is encompassed by this code.

1.2.7. This code supersedes the Tank Wagon Code for Corrosives and Poisons published by the Ministry of Health in June 1995.

1.3. The HSNO Act and the Place of Codes of Practice

1.3.1. The HSNO Act and regulations made under that act are largely performance based, that is they specify a desired outcome without prescribing how to achieve it. They do not require that a single specific means be used to comply with any regulation and this allows for variations in method.

1.3.2. The HSNO Act, as well as the regulations and transfer notices made under that act provide for Codes of Practice approved by EPA New Zealand to identify acceptable solutions to comply with the specified regulatory requirements. An approved code of practice provides users with a method of meeting the control requirements with a degree of prescription and assistance.

1.3.3. The Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 (as amended) specifies standards for the design and construction of tank wagons. This Code provides a practical means to meet these.

1.4. Limits of this Code

1.4.1. This Code applies to the design, construction and operation of tank wagons which:

- have commenced construction after the date at which this Code is approved, and
- are used for the transportation of toxic, corrosive and ecotoxic liquids with hazard classification 6,8 and 9,and

- are used for road transportation, and
- are used to convey these substances in bulk by road, and
- have tanks constructed from materials specified in this code, and
- have a tank capacity not less than 450 litres.

1.5. Definitions

Where any term used is not defined in this section, the meaning of that term shall be as defined by the Hazardous Substances (Tank Wagon and Transportable Container) Regulations 2004 (as amended). Where there is a conflict in a term, the definition in the Hazardous Substances (Tank Wagon and Transportable Container) Regulations 2004 (as amended) shall prevail.

1.5.1. Approved Fabricator

A fabricator who is approved by the EPA after written application. The fabricator is approved for the fabrication of one or more tank wagon designs.

1.5.2. Baffle

A partition in a compartment of a tank, that is not liquid tight but which limits the surge of the hazardous substance in the compartment.

1.5.3. Bulkhead

A transverse closure forming a liquid-tight division between adjacent compartments of a tank.

1.5.4. Code

This Code of Practice for Toxic, Corrosive and Ecotoxic Liquids Tank Wagons.

1.5.5. Collision bumper

The section of the rear bumper that is designed to meet the requirements of clauses 2.3.5, 2.3.6 and 2.3.7 of this Code.

1.5.6. EPA

The Environmental Protection Authority of New Zealand.

1.5.7. Head

A transverse closure at the end of a tank and which is liquid tight.

1.5.8. HSNO Act

The Hazardous Substances and New Organisms Act 1996.

1.5.9. Liquids with Class 6 or 8 Hazard Classification

Liquids, mixtures of liquids, and liquids containing solids in solution and suspension with a class 6 or 8 hazard class as determined in accordance with the Hazardous Substances (Classification) Regulations 2001 or as referenced in NZS 5433 Transport of Dangerous Goods on Land or AS/NZS3780. The Storage and Handling of Corrosive Substances.

1.5.10. Low-hazard hazardous substance

A hazardous substance with a hazard classification other than class 1, 2.1.1A, 3.1A, 3.1B, 3.1C, 4, 5.1.1A, 5.1.1B, 5.1.1C, 5.1.2A, 5.2, 6.1A, 6.1B, 6.1C, 8.2A, 8.2B, 8.2C or 9.1A.

1.5.11. Maximum capacities

For maximum capacities refer to clause 3.3 of this code. All capacities quoted are water capacity (tank full) at standard temperature and pressure.

1.5.12. Skeletal trailer

A trailer or semi-trailer constructed for the purpose of carrying portable tanks (including ISO tank containers).

1.5.13. Tank

An enclosed vessel permanently fixed to the chassis of a tank wagon used for the transport or storage of liquids with class 6 or class 8 hazard classifications, and includes:-

- any compartments and all components or materials (including coatings) necessary for the tank to perform its containment function, and
- all parts affecting the structural integrity of the tank and the means of closing the tank.

A tank may be of the following types:

- Demountable tank – a tank, other than a portable tank, that is designed to be fixed to the vehicle by bolts or similar attachments during transit, but which is also designed to be removable from the vehicle.
- Fixed tank - a tank which is mounted on a vehicle chassis by bolts or similar attachments.
- Portable tank (including ISO tank container) – a container that complies with chapter 6.7 of the UN Model Regulations
- Intermediate bulk container – a container that complies with chapter 6.5 of the UN Model Regulations

A fixed tank may be either of the following:

- A small compartment tank – a tank having one or more compartments, none of which exceed 8600 litre water capacity, or
- A large compartment tank – a tank having one or more compartments, which would not qualify as a small compartment tank.

Where transportable containers such as intermediate bulk containers or portable tanks (including ISO tank containers) are mounted on a vehicle and are used to perform the functions of a tank wagon (i.e. are filled or discharged whilst mounted on the vehicle) that vehicle is encompassed by this code.

The vehicle running tank is excluded.

1.5.14. Tank wagon

Any tank wagon constructed for the primary purpose of the bulk carriage of liquids with class 6 or

class 8 hazard classifications in a fixed tank or fixed tanks. Tank wagons may be of one of the following types.

- Tank Truck (rigid) — A single vehicle having its own means of propulsion, or
- Prime Mover – A vehicle used to pull Tank Semi-Trailers carrying Liquids with class 6 or class 8 hazard classification, or
- Tank Trailer — A vehicle which does not have its own means of propulsion. This includes a skeletal trailer but does not include a tank semi-trailer, or
- Tank Semi-trailer — A vehicle, constructed so that, when drawn through a fifth wheel or turntable connection, part of the load rests on the towing vehicle. This includes skeletal trailers and B train units.

1.5.15. Ullage at Full Capacity

The air space left when the container is filled to its liquid carrying capacity so that any expansion of the liquid will not cause overflow or excessive hydraulic pressure. The ullage space is to be calculated at 15 degrees Celsius.

1.6. Abbreviations

Abbreviations used in this code of practice include:

AS	Australian Standard
ASTM	American Society for the testing and materials
BS	British Standard
CSM	Chopped strand mat
GRP	Glass reinforced plastic
IBC	Intermediate bulk container
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
ISO	International Organization for Standardization
NZS	New Zealand Standard
NZSDDA	New Zealand stainless Steel Development Association
UN	United Nations
WR	Woven roving

1.7. References

ADG Code	The Australian Code for the Transport of Dangerous Goods by Road and Rail
AS 1210: 2010	Pressure Vessels
AS 1594:2002	Hot-rolled steel flat products

AS/NZS 1664.1:1997	Aluminium structures - Limit state design
AS/NZS 1664.2:1997	Aluminium structures - Allowable stress design
AS 1874:2000	Aluminium and aluminium alloys – Ingots and castings
AS 2634:1983	Chemical Plant Equipment made from glass-fibre reinforced plastics (GRP) based on thermosetting resins.
AS 2809.4:2001	Road tank vehicles for dangerous goods tankers for toxic and corrosive cargoes
AS 3679.1:2010	Structural steel - Hot rolled bars and sections
AS 3679.2:2010	Structural Steel - Welded I sections
AS 3990:1993	Mechanical equipment – Steelwork
AS 4100:1998	Steel Structures
AS/NZS 1163:2009	Cold formed structural steel hollow sections
AS/NZS 1554:2011	Structural Steel Welding parts 1, 4, 5 and 6
AS/NZS 1665:2004	Welding of aluminium structures
AS/NZS 1734:1997	Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate
AS/NZS 1866:1997	Aluminium and aluminium alloys – Extruded rod, bar, solid and hollow shapes
AS/NZS 2430.3.3	Classification of hazardous areas Part 3.3 Examples of area classification – Flammable liquids
AS/NZS 3678:2011	Structural steel – Hot-rolled plates, floor plates and slabs
AS/NZS 4673:2001	Cold formed stainless steel structures
BS 3396 Series	Woven glass fibre fabrics for plastics reinforcement
BS 3691:1969	Specification for glass fibre rovings for the reinforcement of polyester and of epoxy resin systems
BS 2782 Series	Methods of testing plastics
BS 3496:1973	Specification for E glass fibre chopped strand mat for the reinforcement of polyester resin systems
BS 4994:1987	Specification for design and construction of vessels and tanks in reinforced plastics
BS 3749:1991	Specification for E glass fibre woven roving fabrics for the reinforcement of polyester and epoxy resins systems

Guidelines for the Prevention of Falls, published by the Ministry of Business Innovation and Employment 2002.

Hazardous Substances and New Organisms Act 1996

Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 (as amended)

Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations (PECPR regulations)

Land Transport Rule 41001 Vehicle Dimensions and Mass 2002 (as amended)

Land Transport Rule 45001/1 Dangerous Goods 2005 (as amended)

NZS 3404:1997 Steel structures standard Parts 1 and 2

NZS 4711:1984 Qualification test for metal-arc welders.

UN Model Regulations – Recommendations on the Transport of Dangerous Goods Model Regulations 17th revised edition

1.8. Tank Wagons Carrying Class 6 or Class 9 Substances

1.8.1. The text of this Code refers mostly to corrosives (hazard class 8). However the design details given for vehicular and tank requirements for corrosives shall also be taken as applying equally to toxic substances (hazard class 6) and ecotoxic (hazard class 9) substances. Where the substance and/or its toxicity indicate the need for additional requirements, these must be undertaken.

1.9. Antecedents

1.9.1. HSNOCOP 39 version 1.0 was approved in June 2010.

2. Tank wagon design and equipment

2.1. General

2.1.1. The tank wagon shall be designed by a competent person[1] and shall as far as practicable be constructed of fire resisting materials. The tank, fittings and any part of the tank wagon that could under normal course of operation come into contact with the substance being carried must be constructed with materials that are compatible with that substance. The design of the tank wagon shall provide an integration of the tank supporting members and the 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.

The tank wagon shall, in addition, comply with all current NZ Road Transport Rules and Regulations and shall carry a valid certificate of fitness.

2.1.2. The tank wagon shall be certified by a test certifier approved by the EPA to certify the design of the tank wagon.

2.2. Road Clearance

2.2.1. Tank components and protection devices located between any two adjacent axles of a tank wagon or tank wagon combination shall have ground clearance not less than:

- 40 mm ground clearance for each metre between such axle centres, and
- not less than 350 mm when unladen.

2.2.2. Tank filling and discharge connections which are rigidly attached to the tank shall not extend lower than 40 mm below the plane through the centre line of the axles.

2.3. Rear Bumper Requirements

2.3.1. Every tank wagon shall be provided with a collision bumper to protect the tank from rear impact in accordance with the following requirements:

2.3.1.1. The impact surface of the collision bumper shall be not less than 150 mm behind the vertical plane of the rearmost bulkhead and not be less than 50 mm behind any other item located behind the tank rear elevation.

2.3.1.2. The inner face (i.e. front face) of the collision bumper shall allow at least 150 mm clearance from any component or fitting below the bottom surface of the tank sub frame

[1] In this context a competent person means a chartered professional engineer or similarly qualified person, familiar with the design and construction of road transport vehicles and road transport vehicle tanks.

which may contain liquid during loading, discharge or conveyance. The collision bumper shall be attached to the sub frame of the tank wagon or the chassis of the tank wagon. It shall not be attached directly to the tank.

2.3.1.3. In circumstances whereby the width of the tank is less than 1500 mm, the width of the bumper must be not less than the maximum width of the tank, with the full width of the bumper being the collision bumper.

2.3.1.4. The collision bumper shall be a minimum of 1500 mm wide, 750 mm either side of the centre of the tank The full width of the bumper shall not be less than:

- 1500 mm, or
- the maximum width of the tank, or
- 95% of the maximum width of the tank wagon,

whichever is the greater. Additional sections beyond the collision bumper may carry lights or other equipment.

2.3.1.5. The height of the collision bumper measured from the ground to the lowest surface of the bumper shall be not less than 500 mm and not more than 1000 mm.

2.3.1.6. The collision bumper shall be designed to withstand a horizontal load equal to 40,000 kg or twice the mass of the fully loaded tank wagon, whichever is the lesser, and uniformly distributed over the central 1500 mm section of the collision bumper. A limit state or alternative method of design can be used in accordance with NZS 3404:1997 or AS 3990:1993.

2.3.1.7. The outer section of the bumper i.e. that which extends outside the 1500 mm collision bumper, and which may be used to carry lights, does not have to comply with the strength requirements in 2.3.7. Notwithstanding this, within the practical limits of the tank wagon configuration, the outer section of the bumpers on tank wagons should be designed to withstand impacts that may be expected to occur in daily service.

2.3.2. Rear under run protection shall be fitted in accordance with the following requirements:

2.3.2.1. If the width of the tank is less than 1500 mm, the width of the bumper must be not less than the maximum width of the tank, or if the width of the tank is 1500 mm or greater, the width of the under-run bumper shall not be less than 1500 mm and

2.3.2.2. The centreline of the under run bumper shall align with the centreline of the vehicle, and

2.3.2.3. The rear under run bumper shall have an elevation, measured from the ground to the lowest surface of the bumper, of not less than 300 mm and not greater than 500 mm, and

2.3.2.4. The impact surface of the under-run bumper shall be vertically in line (i.e. within 100 mm forward or backward) with the impact surface of the collision bumper and

2.3.2.5. The under-run bumper shall be designed to withstand a horizontal load equal to 10,000 kg uniformly distributed over the central 1500 mm section of the bumper. A limit state or alternative method of design shall be used in accordance with NZS 3404:1997.

2.3.3. An energy absorbing bumper may be used provided it is suitable for the tank wagon involved and provided that its deformation under full deflection would not result in any damage to the tank or its fittings.

2.3.4. Where it is practical, one bumper may serve as both the collision bumper and under-run bumper provided it meets the requirements of both of these.

2.3.5. All bumper dimensions are to be taken in the unladen state.

2.4. Electrical Wiring

2.4.1. Electrical cables and wiring added to the original vehicle wiring shall be installed in accordance with accepted wiring practices. It shall be insulated from the chassis as well as being supported and protected from mechanical injury, chafing and exposure.

2.5. Tank Wagon Inspection

2.5.1. Regular inspections of tank wagons shall be carried out in accordance with clause 2 of Appendix A. Records of the inspection and any necessary rectifications shall be kept by the tank wagon operator and the owner for inspection. Alternative inspection procedures and frequencies may be used provided they cover the requirements of this Code.

2.6. Tank Trailer and Tank Semi-trailer Requirements

2.6.1. A tank trailer of more than 2000 litres capacity shall have 2 or more axles, which shall not be in line transversely. Any trailer having fewer than 2 axles shall be equipped with means of stabilising it when detached from the towing vehicle.

2.6.2. 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 operations). In particular, prime movers and tank semi-trailers shall not be fitted with unrestricted double oscillating fifth wheels.

2.6.3. The fifth wheel shall have a maximum tow rating of at least 1.25 times the weight of the fully laden semi-trailer, and a vertical rating of at least 1.25 times the vertical load imposed on the coupling.

2.6.4. Brake equipment is to comply with all the NZ Transport Agency requirements. As a minimum it shall be at least a dual system of airline brakes, which under all conditions of use will immediately and

automatically operate to stop and hold the trailer should it become disconnected from the vehicle to which it is attached.

2.6.5. The driver shall not be provided with the means of altering the intrinsic brake system balance.

2.6.6. Tank trailer or semi-trailer brake systems shall be provided with a remote air-operated emergency release system, having an independent air system.

2.7. Tank Wagon Tank Mounting Requirements

2.7.1. A clearance of not less than 150 mm shall be provided between the back of the cabin and the tank. Any fittings carried in this space must not interfere with the tank as it articulates on the fifth wheel. For articulated tank wagons, the clearance shall be achieved at all angular positions.

2.7.2. The tank, its supports and connections to the chassis shall be designed and constructed to resist the following forces:

- Vertically up 1g x M
- Vertically down 2g x M
- Laterally 1g x M
- Longitudinally 2g x M

Where:

g = acceleration constant due to gravity (9.81 m/s^2)

M = mass of tank, contents, and fittings (but excluding chassis)

2.7.2.1. The mass of the cargo shall be calculated from its density and volume. The density shall be taken as the density of the cargo or 1000 kg/m^3, whichever is the greater.

2.7.2.2. A limit state or allowable stress method of design shall be used.

2.7.3. Fatigue of the tank wagon chassis mountings shall be included in the design of the tank wagon (i.e. by reducing areas of stress concentration) in accordance with the provisions of NZS 3404:1997 Part 1 Section 10 or similar standard. Section 5.2.3.4 of this code is applicable.

2.7.4. If mountings of tanks are provided by twist locks and the twist locks are used to provide vertical restraint, then they shall be selected to meet the design loadings of this Code. They shall be subjected to a vertically up strength requirement that is twice the strength requirement in clause 2.7.2. This rating of the twist lock is to be certified.

2.7.5. Twist locks are to be of a type that can be mechanically held in the locked position or non-retractable.

2.7.6. The twist locks are to be free of mechanical defects and are to be subjected to proof loads in the upward direction of:

- Two (2) times that specified in clause 2.7.2 carried out at the time of assembly of the twist lock onto the tank wagon chassis, and
- One and a quarter (1.25) times that specified in clause 2.7.2 in service.

The twist locks are to be replaced if a defect is noticed.

2.7.7. The design number of twist locks must be in use e.g. if the drawings show four twist locks, then all four must be in use during service.

2.7.8. Suitable corrosion protection shall be provided so the mounting system provides adequate protection for the design life of the tank wagon in the environment it may be subjected to.

2.7.9. Conversion of demountable tanks to fixed tanks entails the following additional mounting requirements:

2.7.9.1. Installation of secondary permanent locking (e.g. bolting) removable only under workshop conditions, and

2.7.9.2. Full compliance of documentation, valves etc with this Code.

2.7.9.3. Additional tank baffling may be required depending on the existing tank size and proposed application.

2.8. Tank Wagon Welding

2.8.1. The requirements for welding the tank are specified in clause 5.4 of this Code.

2.8.2. Welding of steel components for structural purposes necessary in building any new tank wagon or in modifying any existing tank wagon shall conform to the provisions of AS/NZS 1554:2011.

2.8.3. 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 qualified welders. In New Zealand the appropriate qualification is obtained under NZS 4711:1984, relevant to the materials used and the position involved. Current certification under equivalent overseas standards is also acceptable.

2.8.4. All welding of 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 requirements of the Health and Safety in Employment Act 1992, including the Approved Code of Practice for Pressure Equipment.

2.9. Stability of Tank Wagons and Skeletal Trailers

2.9.1. The design of the tank wagon must meet the following criteria specified in Regulation 21 of the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004. This regulation is reproduced below:

- A static roll threshold of at least 0.45g.
- A maximum dynamic load transfer ratio of 0.6
- A high speed transient off-tracking of 0.8 m.

2.9.2. For the purposes of subclause 2.9.1 above, a static roll threshold means the maximum level of steady turning lateral acceleration a tank wagon can tolerate without rollover, which is calculated as a proportion of g.

2.9.3. The requirements of sub clause 2.9.1 are met if the static roll threshold, calculated in accordance with the Land Transport Rule 41001 “Vehicle Dimensions and Mass 2002” is at least 0.45g.

2.9.4. Despite 2.9.1, a Tank Wagon must have a static roll threshold of at least 0.35g in any state of loading to comply with the Land Transport Rule: Vehicle Dimensions and Mass 2002.

2.10. Certification of Design

2.10.1. Where the use of tank wagons for the transport of hazardous substances with class 6, 8 or 9 hazard classifications is contemplated, irrespective of whether the tank wagon is designed in New Zealand or overseas, details of the proposed design must be submitted to an EPA approved test certifier to obtain a design test certificate. Refer to Appendix A for further information.

2.11. Compatibility of Materials

2.11.1. All materials that are used in the construction of elements of the tank wagon that are in contact with the hazardous substance must be compatible with that hazardous substance. This includes the tank, piping, valves hoses etc. Internal lining of the tank may be necessary to achieve this.

2.12. Safety Equipment

2.12.1. Each tank wagon should carry safety equipment in the event that adverse circumstances occur. Minimum safety equipment is considered to be:

- First aid kit.
- Battery operated torch
- Road triangles
- A portable fire extinguisher with a rating of at least 30B.

2.13. Other Requirements

2.13.1. In addition to this Code, tank wagons (including the chassis) must conform fully to the regulations made under the Transport Act 1962 and carry a valid certificate of fitness.

2.13.2. Tank wagons that transport hazardous substances by sea (e.g. across Cook Strait) are required to comply with the requirements of the any applicable New Zealand Marine Transport Regulations.

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 and vessel requirements specified in this code.

3.1.2. Every cargo tank and vessel shall be designed by a competent person[2].

3.2. Tank Types

3.2.1. 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 tank design life. Both the IMDG Code and the ADG recognise these variables and their relevance to tank design by specifying a range of tank types with particular cargoes assigned to an individual tank design type.

3.2.2. AS 2809.4:2001 recognises tank types 1, 2, 3, 4 and 5 with the selection of tank type determined by the ADG Code[3]. This ADG code includes a design key (RT1 to RT10) with the relevant design keys as follows:

Design Key	Standard and Tank Type	Type of Hazardous Substance
RT4	AS 2809-Parts 1 & 4, Type 1	Toxic or corrosive liquids
RT5	AS 2809-Parts 1 & 4, Type 2	Toxic or corrosive liquids
RT6	AS 2809-Parts 1 & 4, Type 3	Toxic or corrosive liquids (substances with a high vapour pressure or which are unloaded by gas pressure)
RT7	AS 2809-Parts 1 & 4, Type 4	Toxic or corrosive liquids (density ≤1)
RT8	AS 2809-Parts 1 & 4, Type 5	Toxic or corrosive liquids (density >1)

Further to this, Section 2 of the 2001 of AS 2809.4:2001 makes the following specifications for the design pressures for tank types 1, 2 and 3:

Tank Type	Design Specification
Type 1	The vapour pressure of the cargo at 46^{o}C, + 1 MPa.
Type 2	The vapour pressure of the cargo at 46^{o}C, + 0.75 MPa.
Type 3	The vapour pressure of the cargo at 46^{o}C, or for cargo unloaded by gas pressure, the applied pressure.

[2] In this context a competent person means a chartered professional engineer or qualified person, familiar with the design and construction of road transport vehicle tanks.
[3] The seventh edition of the ADG does not include design keys. Hence it may be necessary to refer to the sixth edition for clarity.

3.2.3. For purposes of standardisation, this Code utilises the same tank types as AS 2809 Part 4.

3.2.4. In general, Type 1 and 2 tanks are required for the carriage of toxic substances in bulk. The design specifications of a Type 1 tank are not included in this Code given the relatively uncommon requirement for it. The majority of corrosives that are likely to be transported by road tank wagons require Type 4 or 5 tanks.

3.3. Filling Requirements

3.3.1. The tank compartments are limited to a liquid carrying capacity of 10,000 litres.

3.3.2. The filling of tanks must allow for ullage to prevent thermal expansion of the contents without loss of containment. The Ullage at Full Capacity of each compartment of the Tank Wagon must be a minimum of 3% of the total compartment volume or the value corresponding to the degree of filling calculated in accordance with a recognised method such as that included as Appendix D. The mean coefficient of cubical expansion for the particular substance being transported must be incorporated (refer to appendix D).

3.3.3. The Ullage at Full Capacity shall be established to minimise sloshing.

3.4. Materials

3.4.1. The materials of construction of those parts of a tank and its fittings that are likely to come in contact with the substance during transport, loading or unloading shall be:

3.4.1.1. 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 substances, so that repeated destruction of the protected layer does not result), or

3.4.1.2. Lined as described in Section 3.4.2 below, or

3.4.1.3. Of sufficient metal thickness to ensure that a predetermined service life of a minimum 10 years will be achieved under expected conditions of service, unless a shorter service life is acceptable to the certifying test certifier because of specific conditions. (Note: where loss of the 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).

3.4.2. Any lining material for tanks subject to this Code shall:

- Be substantially immune from attack by the corrosive cargo being transported therein, and
- Be able to deform with the steel without failing, and
- Be homogeneous, non-porous and free from perforations when applied, and

- Have joints and seams in the lining made by fusing the material together or by some other method that prevents the substance being transported from contacting the shell of the tank.

3.4.3. Steel – Steel shall be of a quality suitable for the conditions in which it is being used and shall be at least equivalent to the requirements of the following Australian Standards or joint Australian/New Zealand Standards (or equivalent), as appropriate:
AS/NZS 4673:2001 – Cold formed stainless steel structures
AS 1594:2002 – Hot-rolled steel flat products
AS/NZS 3679.1:2010 – Structural steel - Hot rolled bars and sections
AS/NZS 3679.2:2010 – Structural Steel - Welded I sections
AS/NZS 1163:2009 – Structural steel hollow sections
AS/NZS 3678:2011 – Structural steel – Hot-rolled plates, floor plates and slabs
Code of Practice for the Fabrication of Stainless Steel Plant and Equipment - NZSSDA

3.4.4. Glass fibre reinforced plastics (GRP) – GRP shall be of a quality suitable for the conditions in which it is being used and shall be at least equivalent to the requirements of AS 2634:1983 or equivalent international standard. Tanks constructed of glass fibre reinforced plastics are to be designed and constructed in accordance with the provisions of Appendix B of this Code.

3.4.5. Aluminium Alloys —Thicknesses specified of aluminium alloy sheet are based on aluminium alloy 5454 in the H32 temper condition. This has a tensile strength of 248 MPa unwelded, and a welded tensile strength of 213 MPa. If other alloys with lower welded tensile strength are used, the temper shall be at least H32 or T6 and the shell thickness is to be increased in the ratio 213/welded tensile strength of the alloy used. If the alloys used have a higher welded tensile strength than that of alloy 5454, the thickness may not be decreased, but tempers may be lower than H32, provided that the tensile strength is at least 248 MPa.
Aluminium alloys used in the construction of tanks shall be of a quality suitable for the conditions in which it is being used and shall not be less than the grades specified in the following Australian standards (or equivalent) as appropriate:
AS 1874:2000 - Aluminium and aluminium alloys – Ingots and castings.
AS/NZS 1734:1997 - Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate
AS/NZS 1866:1997 - Aluminium and aluminium alloys – Extruded rod, bar, solid and hollow shapes

4. Tank design and construction - 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 2809.4:2011) 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. Hence compliance with the Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations is required as they apply to Type 2 tanks. This requires compliance with a pressure vessel code such as AS 1210:2010. The following provisions are applicable.

4.2.2. The design pressure shall be the vapour pressure of the corrosive cargo at 46^{o}C plus 0.75 MPa. (Note: this design pressure is a 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:

- Substantially immune from attack by the corrosive substance, or
- lined with a material which is substantially immune from attack by the corrosive substance, or
- 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. Every tank exceeding 5000 litres shall be provided with an access hole located on the rear head of the tank or within a recess or shroud on the top of the tank.

4.3. Valves

4.3.1. Each opening into a Type 2 tank other than an opening for an access hole 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:

- The requirements of AS 1210:2010 shall apply where the application is within the scope of the standard, and

- The aggregate capacity of the pressure relief devices shall be at least 50% of the values determined in accordance with the requirements for fire exposure capacity of AS 1210:1210 (where the cargo is flammable or combustible it is outside the scope of this Code), and
- 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, and
- 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:

- Fully enclose the fittings it protects and project at least 25 mm above or beyond such fittings
- Be designed to withstand a force applied in any direction equal to: 2g * M,
  where:
  g = acceleration constant due to gravity (9.81 m/s^2)
  M = mass of tank, contents, and fittings (but excluding chassis)
  The force may be applied as a point or along a line.
- 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.

4.3.5. The piping system shall be designed to fail on impact in a manner that the tank's manual quick-acting shut-off valve remains operable.

5. Tank design and construction – 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 ADG Code as requiring the use of a Type 4 or Type 5 tank.

5.2. Tank Design and Construction

5.2.1. Design Actions

The tank, its supports and connections shall be designed in accordance with

- NZS 3404:1997, or
- AS/NZS 1664.2:1997 Aluminium structures – Allowable stress design

taking into account the loadings below. The applicability of each of these standards is limited to the tank wagon parts for which the standard is valid. The parts of the tank wagon that are to be designed by reference to Table 5.1 shall be excluded from the provisions of these standards. Where applicable a vector sum of these loads shall be taken.

5.2.2. Tank Shape

A large compartment tank shall be circular in cross section. This includes oval tanks but excludes tanks which have flat surfaces.

5.2.3. Shell Thickness

The thickness of the tank shell and the design of its supports and connections shall be calculated in accordance with AS 4100:1998 or AS/NZS 1664.2:1997 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 substance being transported exceeds 1000 kg/m3, the value thus read shall be increased as indicated in Table 5.1. The design thickness of the tank shell and the associated supports shall then be the higher of the tabulated or calculated values.

5.2.3.1. The tank and its attachments shall be designed to withstand a minimum design action of twice that due to the tank, its accessories and the maximum permissible loading quantity. The density of the cargo or a value of 1000 kg/m^3, whichever is the greater, shall be used for calculations.

5.2.3.2. Stresses due to internal pressures caused by liquid head, vapour pressure and generated gas pressure shall be added to the static loading stresses. The vapour pressure shall be 20 kPa for small compartment tanks and 30 kPa for large compartments, or the vapour pressure of the cargo at 46^{o}C, whichever is the greater. The generated gas pressure shall be the increase in pressure over two hours as the result of chemical action.

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

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

5.2.3.4. Unless fatigue life has been demonstrated by field experience or supervised tests, fatigue stresses shall be calculated and added to the stress calculated for the stationary tank wagon. The calculation shall be based on the following fatigue range for $5x10^6$ cycles:

- vertical 0.6g M
- longitudinal 0.4g M
- lateral 0.4g M

This has the effect of providing an oscillating vertical load case of ±0.3g M about an all up vertical load case of 1.0g M (gross).

The calculation must be applied to all load cases including:

- at the maximum load configuration, the sum of the mass of the empty tank plus the mass of the contents (assuming the tank is 100% full using the density of the contents or a density of 1000 kg/m, whichever is the greater), and
- at the minimum load configuration, the mass of the empty tank only, and
- in the load configuration of some full compartments and some empty compartments, the full compartments are to include, the sum of the mass of the empty tank plus the mass of the contents (assuming the tank is 100% full using the density of the contents or a density of 1000 kg/m, whichever is the greater).

5.2.3.5. Unless fatigue life has been demonstrated by field experience or supervised tests, tanks that are operated under pressure or vacuum are to have fatigue stresses calculated in accordance with $5x10^6$ pressure cycles, from -7kPa to the recommended operating pressure.

This clause is not applicable to a tank that is designed and constructed in accordance with the pressure requirements of the Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999. Tanks designed and constructed for fatigue under those regulations are considered to have met the provisions of this clause.

5.2.3.6. Where tank corrosion is accepted, the thickness after allowance for corrosion shall satisfy the provisions of this clause.

Table 5.1. Minimum Plate Thicknesses for Type 4 Tankers (Cargo Density 1,000 kg/m^3)

Tank details		Minimum nominal thickness, mm																
		Shell											Head and bulkheads					
		Small-compartment tanks Unreinforced length of shell* (L),m									Large-compartment tanks		Small-compartment tanks, and baffles for all tanks			Large-compartment tanks		
		=0.9 (L1)			>0.9=1.4 (L2)			>1.4=2.5 (L3)										
Rated capacity	Shell radius (maximum) m	LCS	HSLA SS	AL	LCS	HSLA SS	AL	LCS	HSLA SS	AL	LCS HSLA SS	AL	LCS	HSLA SS	AL	LCS HSLA SS	AL	
=1400	=1.8	2.0	1.6	2.2	2.0	1.6	2.2	2.0	1.8	2.4	5	6	2.0	1.8	2.5	6	8	
	>1.8=2.3	2.0	1.6	2.2	2.0	1.8	2.4	2.4	2.0	2.8								
	>2.3=3.2	2.0	1.8	2.4	2.4	2.0	2.8	2.8	2.4	3.0								
	>3.2	2.4	2.0	2.8	2.8	2.4	3.0	3.0	2.8	3.8								
>1400 =2100	=1.8	2.0	1.6	2.2	2.0	1.8	2.4	2.4	2.0	2.8	5	6	2.5	2.0	3.0	6	8	
	>1.8=2.3	2.0	1.8	2.4	2.4	2.0	2.8	2.8	2.4	3.0								
	>2.3=3.2	2.4	2.0	2.8	2.8	2.4	3.0	3.0	2.8	3.8								
	>3.2	2.8	2.4	3.0	3.0	2.8	3.8	3.5	3.0	4.4								
>2100 =2700	=1.8	2.0	1.8	2.4	2.4	2.0	2.8	2.8	2.4	3.0	5	6	2.8	2.4	3.0	6	8	
	>1.8=2.3	2.4	2.0	2.8	2.8	2.4	3.0	3.0	2.8	3.8								
	>2.3=3.2	2.8	2.4	3.0	3.0	2.8	3.8	3.5	3.0	4.4								
	>3.2	3.0	2.8	3.8	3.5	3.0	4.4	4.0	3.5	5.0								
>2700	=1.8	2.4	2.0	2.8	2.8	2.4	3.0	3.0	2.8	3.8	5	6	3.0	2.8	3.8	6	8	
	>1.8=2.3	2.8	2.4	3.0	3.0	2.8	3.8	3.5	3.0	4.4								
	>2.3=3.2	3.0	2.8	3.8	3.5	3.0	4.4	4.0	3.5	5.0								
	>3.2	3.5	3.0	4.4	4.0	3.5	5.0	4.0	4.0	5.5								

Legend LCS = Low carbon Steel HSLA = High Strength Low Alloy Steel SS = Austenitic Stainless steel AL = Aluminium Alloy.

5.2.4. The thickness of the shell, heads, bulkheads and baffles shall be not less than that specified on table 5.1. Notwithstanding this however, the thicknesses for heads and bulkheads for large compartment tanks may be reduced to not less than the shell thickness provided that there is a calculation undertaken for head thickness in accordance with AS 1210:2010 and this calculation indicates that it is safe to reduce the thickness.

5.2.5. Where the cargo density exceeds 1000 kg/m3, the minimum allowable value is first read from Table 5.1 and a higher minimum allowable value is then substituted from Table 5.2 according to density. Substitutions apply to shells, ends, baffles and bulkheads.

Table 5.2 Minimum plate thickness for Type 5 tankers (cargo density 1,000 kg/m^3)

Thickness value from table 5.1.	**1.6**	**1.8**	**2.0**	**2.2**	**2.4**	**2.8**	**3.0**	**3.5**	**3.8**	**4.0**	**4.4**	**5.0**	**5.5**	**6**	**8**
Density kg/m^3	**Substitute thickness values, mm**														
1000 to 1200	2.0	2.4	2.6	3.0	3.2	3.8	4.0	4.6	5.0	5.0	5.0	5.0	6	6	8
1200 to 1500	2.6	3.0	3.2	3.6	4.0	4.6	5.0	5.0	5.0	5.0	5.0	5.0	6	6	8
1500 to 1900	3.2	3.8	4.0	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6	6	8

5.2.6. Stiffening of Heads, Bulkheads and Baffles — Unless a proven equivalent form of stiffening is provided, the following requirements apply:

- heads, bulkheads and baffles for large compartment tanks shall be dished to a depth, exclusive of any flange, of not less than 250 mm, with a knuckle radius of not less than 50 mm.
- heads and bulkheads for small compartments and baffles for all tanks shall be dished to a depth, exclusive of any flange, of not less than 80 mm per metre of depth of the minor axis of the tank cross-section, but in any case not less than 100 mm.

5.2.7. Dished bulkheads should be placed with the convex facing forwards, to minimise the effect of braking loads. Double walled bulkheads shall be convex towards each other.

5.2.8. Large compartments.
Where a tank's maximum design load exceeds 15,000 kg then at least one transverse baffle shall be installed for each 15,000 kg of cargo. The surface area of each baffle shall not be less than 50 percent of the cross-sectional area of the tank.

5.3. Circumferential reinforcement

5.3.1. Tanks with shell thicknesses less than 10 mm shall, in addition to the tank heads, be reinforced circumferentially by stiffeners, bulkheads or baffles (or in any combination) in accordance with the following requirements:

5.3.1.1. Reinforcements shall be located so that the maximum unreinforced length shall not exceed that specified for the particular shell thickness in Table 5.1. The exception is where two or more full-length under frame members of an aggregate section modulus of at least 180 x 10^3 mm^3 about a horizontal axis and a shell thickness of at least that for L3 of table 5.1 extend for at least the length of the compartment. Reinforcements may be up to 2.5 m apart.

The section modulus of under frame members does not include any section of the shell and is calculated using the maximum distance from the neutral axis. If the tank is fully supported over its entire length (e.g. by a vehicle or trailer chassis) the minimum section modulus does not apply.

5.3.1.2. 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.

5.3.2. 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 formula.

I/C = K*W*L

where:

I/C = section modulus, in cubic millimetres

K = 0.0069 for all steels= 0.01186 for all aluminium alloys

W = Tank width or diameter, in millimetres

L = Ring spacing, i.e. 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, 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 5.2.

Table 5.2. Parts of Shell in Ring Stiffener

Number of circumferential ring stiffeners to tank shell welds	Distance between parallel circumferential ring stiffener to shell welds	Maximum shell section credit
1	------	20t
2	Less than 20t	d + 20t
2	20t or more	40t

Legend:
t = shell thickness
d = distance between parallel circumferential ring stiffener to shell weld

5.3.2.1. The welding that attaches stiffening members shall not be less than 50% of the total circumference and no un-welded length of the joint shall exceed 40 times the shell thickness.

5.3.2.2. 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 clause 5.3.2.1 above

5.3.2.3. Access through Baffles — a baffle shall have a manhole sized opening where no other means exists for gaining access to tank space on both sides of the baffle.

5.3.3. Flat shell sections are allowed between the valences at the top of the tank only under the following conditions:

- stiffeners of the same material as the shell are welded across the tank for the full width of the flat section. Recommended size is 75 mm deep by 5 mm thick and spaced such that unsupported shell length does not exceed 700 mm. In this case this section of the shell will not be considered in minimum shell thickness determination, or
- with no stiffeners the shell is considered as having infinite radius at that section for minimum thickness determination (i.e. shell radius > 3.2 m), or
- it is shown that the flat section has stiffness equal to a stiffened plate or curved plate (equivalent radius).

5.3.4. Distribution of Loads — the loads from supports should be taken on stiffening members and should be distributed as widely as possible through pads, gussets and the like.

5.3.5. Separation of Liquids - Tanks designed to transport different liquids which, if combined, will cause a dangerous condition or evolution of heat or gas shall be:

- provided with a double wall bulkhead, or
- separated by an empty compartment and
- each compartment of the tank shall have a separate filling and discharge system.

Note: NZS 5433 does not permit alkalis and acids to be carried on the same tank wagon.

5.3.6. Enclosed Air Spaces - The air spaces between double bulkheads, or internal or external ring stiffeners, shall be provided with screwed openings for venting and draining. Any such openings on the upper surface of the tank shall be plugged. Any such openings on the bottom of the tank wagon shall be valved and left normally open.

5.4. Welding

5.4.1. All welding of components for structural or pressure purposes in building any new or in modifying any existing vehicle for use as a tank wagon shall be carried out in accordance with recognised good practice as determined below:

5.4.2. All joints between tank shell, heads, baffles (or baffle attachment rings) and bulkheads shall be welded in accordance with AS/NZS 1554:2011 (Category GP), AS/NZS 1665:2004 (Weld quality 2) or other equivalent standard, as appropriate.

5.4.3. Joints shall be welded in accordance with recognised good practice and the efficiency of any joint shall be not less than 85% of the mechanical properties of the adjacent metal. Butt welds in the tank shell shall be full penetration.

5.4.4. 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.

5.4.5. Inspection of the welding shall be carried out in accordance with the welding specification (AS/NZS 1554:2011 or AS/NZS 1665:2004 as relevant) including:

- verification of material
- verification of filler material
- qualification of welding procedures
- qualification of welders to the above procedures
- inspection of production welds.

A minimum of 5% of the welds are to be examined by radiography.

5.4.6. Review of the x-rays (i.e. the 5% in clause 5.4.5 above) is to be carried out by properly qualified personnel. In particular, testing laboratory registration under the IANZ (or equivalent) with personnel holding currently recognised qualifications in the appropriate material category.
New aluminium tank wagons are to be inspected to weld quality class B.

5.4.7. In addition to the above, 100% of the welds are to be inspected by dye penetration.

5.4.8. As part of the approval of each unit, certification that this testing has been carried out and passed is to be made available to a test certifier approved by EPA New Zealand.

- The documents from the above inspections are to be available for inspection at any time.
- An independent inspector or inspection agency may be required at the cost of the tank wagon owner to check the welding or construction if the test certifier considers that some aspects do not conform to the requirements as specified in this Code.

6. Auxiliary equipment and components

6.1. Access holes

6.1.1. Every opening to the liquid space of a tank shall be provided with an effective means of closure in accordance with one of the requirements of this Clause 6.1 as appropriate.

6.1.2. Manholes — each compartment shall be accessible through an access hole not smaller than that specified in AS 1210:2010. The access hole cover shall be designed to provide secure closure and shall be capable of passing the tank pressure tests. All joints between the access hole 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 substance contained.

6.1.3. The access hole cover shall have a structural capacity of withstanding internal fluid pressures equal to one and a half (1 ½) times the design pressure of the tank and in no case less than 100 kPa without permanent deformation. Safety devices to prevent the access hole and/or fill cover from opening fully when internal pressure is applied shall be provided.

6.2. Outlets

6.2.1. 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.

6.2.2. Except as provided in paragraphs 6.2.3 and 6.2.4 of this section, each bottom outlet must be equipped with a shut-off valve designed, installed and protected as in Section 6.6.5

- Each bottom outlet valve must be located as close as practical to the outlet point outside the tank.
- Each bottom discharge valve must be equipped with a remote means to activate a valve closure manually.
- In addition, a blank flange, sealing cap, or shut-off valve is required at the discharge end of the outlet.

6.2.3. 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 of this Code. In addition, a supplementary closure is required at the discharge end of this piping.

6.2.4. Bottom outlet valves need not meet Section 6.2.2 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.

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

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

6.2.7. Filling Provisions. The provisions for filling the tank shall comply with the following requirements:

- Unless it is impractical, the fill tube of a top-filled tank shall terminate not more than 50 mm or less than 35 mm from the bottom of the tank, and shall be stayed.
- The bottom end of the tube shall be cut square and the flow of liquid from the pipe shall be directed away from any objects which might cause the liquid to spray.

6.2.8. Loading and Unloading Protection — Any tanks that are bottom loaded shall be provided with sufficient liquid-venting capacity to discharge the whole of the liquid delivery rate of the pump, and with sufficient air inflow capacity to match the liquid withdrawal rate. The vent capacity must be adequate such that the pressure and vacuum limits of 45 kPa and 7 kPa (negative) are not exceeded.

6.2.9. All pipes must be cleaned (or capped and locked) prior to traversing on the road.

6.3. Level indication system

6.3.1. An indicating system shall be installed. If it is a dipstick which measures by contacting the bottom of the tank it shall be provided with:

- A dip tube, and
- A pressure equalizing hole that connects the upper end of the dip tube with the upper tank space, and
- A durable striker pad of a thickness not less than that of the tank shell or 5 mm, whichever is the greater, and of the same material as the shell shall be welded to the tank bottom below the dip opening.

The dip tube shall terminate not more than 50 mm from the bottom of the tank and shall be stayed.

6.3.2. Maximum fill indication. There must be a maximum fill level indicator and it is recommended that tank wagons are equipped with over fill protection.

6.4. Valves and fittings

6.4.1. Each opening into a tank other than an opening for an access hole or safety relief device shall have a manual shut-off valve. The valve shall be connected directly to the flange for the vessel opening unless it is precluded due to insufficient room over the connecting vehicle turntable (in which case it is to be mounted as close as practicable to the tank with schedule pipe between the tank and valve). Liquid transfer and vapour return shut off valves shall be quick- acting types.

6.4.2. 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:

- fully enclose the fittings it protects and project at least 25 mm above or beyond such fittings, and
- be designed to withstand a load applied in any direction equal to twice the mass of the fully laden tanker, and
- be drained sufficiently to prevent the accumulation of rainwater etc.

6.4.3. External shut off valve

- Each delivery line shall be provided with a valve at the outlet of the line.
- The external shut off valve shall be a quick-shut type suitable for the hazardous substances and pressures involved shall be fitted in a readily accessible position.

6.4.4. The outlet connection for a tank shall not incorporate quick-release couplings. Every outlet connection shall be provided with a blank flange, cap or a screwed plug or an equivalent means of positively closing the outlet.

6.5. Vents

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

6.5.1.1. The requirements of AS 1210:2010 shall apply where the application is within the scope of that standard, or

6.5.1.2. Where the substance being contained is not flammable (if it is flammable it is outside the scope of this Code) the aggregate capacity of the pressure relief devices shall be determined in accordance with the requirements for fire exposure of AS 1210:2010 but may be reduced to 50% of such value, and

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

6.5.1.4. Except for a dust cap or similar device, fitted to the outlet of the relief device, venting shall be direct to atmosphere.

6.5.1.5. Each vent shall be marked with the manufacturer's name, model identification, discharge capacity and related pressure.

6.5.1.6. The discharge capacity of each model and type of vent shall be determined before use.

6.5.1.7. Vents shall be designed and installed to prevent leakage of liquid past the vent in the event of surge or tank wagon overturn.

6.5.1.8. Each vent shall communicate with the vapour space.

6.5.1.9. Shut-off valves shall not be installed between the tank and the vent.

6.5.1.10. Vents shall be mounted, shielded, or drained, so as to prevent the accumulation of water in such a manner that freezing could impair the operation of the vent.

6.5.1.11. The vent shall open at not more than one and a half (1½) times the design pressure of the tank. If air inlet devices are provided, a relief valve shall have adequate capacity to limit the pressure to 130% of the design pressure at the maximum inlet flow rate. Air lines if permanently connected to an air source shall be equipped with a check valve.

6.5.1.12. The pressure opening setting shall not exceed 17 kPa and the vacuum opening setting shall not be less than 7 kPa vacuum.

6.5.1.13. When tilted to any angle exceeding 90^0 from the vertical, the pressure vent shall open at a minimum of 30 kPa or shall lock shut.

6.6. Pipework and Pipe Fittings

6.6.1. Strength of Piping — Piping and associated fittings shall be designed for the pressure to which they may be subjected in service, and shall be designed and supported to allow for expansion, contraction and vibration. Unrestrained slip joints shall not be used for this purpose.

6.6.2. Discharge Piping — Discharge piping shall be located so that it is protected from damage that could occur in the normal operation of the tank wagon.

6.6.3. Pipework shall be identified by compartment.

6.6.4. Discharge valves shall be numbered and locked out whilst in transit. A lock out system may consist of product identification tags which prevent the valve being accidentally opened – refer to clause 9.2.3 of this code.

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

- 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
- by suitable guards capable of successfully absorbing a concentrated horizontal force of at least 36 kN applied from any horizontal direction, without damage to the discharge piping which will adversely affect the product retention integrity of the discharge valve.

6.6.6. 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.

6.6.7. 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.

6.6.8. 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.

6.6.9. 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.

6.6.10. Hoses and Hose Couplings.

6.6.10.1. Hoses shall not be used in the section of piping prior to the first valve outside the tank.

6.6.10.2. Any hose or coupling used shall be designed for a working pressure not less than 20% in excess of the design pressure of the system and shall be so designed that there will be no leakage when connected.

6.6.10.3. Where unloading by pressure is permitted, hoses shall be designed for a bursting pressure of 700 kPa, or two times the maximum pressure it could be subject to in use, whichever is the greater.

6.6.10.4. The hoses are to be properly maintained and checked frequently.

6.6.10.5. Hoses are to be compatible with the substances being transported.

6.6.10.6. Hoses are not to be carried whilst containing a hazardous substance.

6.6.10.7. They shall preferably be washed prior to transit. If this is not possible they shall be drained and capped with fittings at both ends to prevent any leakage.

6.6.11. Tank fill and discharge pipework

6.6.11.1. Pipework shall be washed clean and capped prior to the vehicle being in transit. If this is not possible the pipework is to be drained and all connections secured shut by padlock or an equivalent means.

6.7. Pumps

6.7.1. Suitability — A pump intended for handling the tank wagon's cargo shall be suitable for use with that cargo, and for the required flow rates and pressures.

6.7.2. Pressure Regulation — A pumping system shall be provided with an automatic means to ensure that the design pressure of any component is not exceeded.

6.7.3. Location of Controls — Power driven pumps shall be provided with controls which shall comply with the following requirements:

6.7.3.1. Controls shall be clearly marked, easily accessible, and located in a position remote from the pump.

6.7.3.2. Dual shut off controls for the engine or motor shall be provided. One shall be provided at the discharge side of the tank wagon with at least one provided clear of any chemical operating range remote from the pump and discharge outlets (i.e. rear of tanker on opposite side),

6.7.3.3. All such devices shall be clearly identified and easily accessible. They must be able to stop the engine within 5 seconds.

6.7.4. Shielding of Pump Shaft — The pump shaft between the pump and the engine shall be shielded to prevent leakage from the pump seal from dripping or being thrown onto hot parts of the engine. Materials used in the shielding shall be of a type that will not create sparks when struck.

6.8. Handrails

6.8.1. Hand rails shall comply with clause 6.9 of this Code and the design shall minimise puncturing of the tank in the event of roll over.

6.8.2. The fall protection devices fitted to tank wagons shall comply with Guidelines for the Prevention of Falls, published by the Department of Labour (now the Ministry of Business Innovation and Employment) 2002 or a requirement that is at least equivalent.

6.9. Component Attachment

6.9.1. Fittings

6.9.2. 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.

6.9.3. The design of the component and/or its method of attachment shall be such that the component will break away before damage is caused to the shell.

6.9.4. 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.

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

6.9.6. 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 no thicker 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.

6.9.7. 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^{o} of normal.

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

6.9.9. Lightweight attachments such as skirting structures, conduit clips and brake line clips may be secured directly to the tank shell or head providing they are:

6.9.9.1. of a metal thickness, construction or material appreciably less strong but no more than 72% of the thickness of the tank shell or head

6.9.9.2. designed and installed so that damage to them will not affect the product retention integrity of the tank

6.9.9.3. 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.

6.10. Roll Over Protection

6.10.1. Every tank shall be provided with roll-over protection which shall comply with the following requirements:

6.10.1.1. 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.

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

6.10.1.3. 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.

6.10.1.4. A guard in the form of inverted U coamings, the space between which is closed by valances level with the top of the coamings at the front, and at least 50 mm high at the rear (refer also to clause 5.3.3 of this Code).

6.10.1.5. The thickness of the material of the U coamings and valences shall not be less than 5 mm for aluminium, 3 mm for mild steel, 2.5 mm for high strength low alloy steel or stainless steel.

6.10.1.6. Bulkheads shall be placed between the coamings to provide lateral strength.

6.10.1.7. Any guard shall project at least 20 mm above the top of the fittings which it protects.

6.10.1.8. The material of the guard shall be compatible with the tank shell.

6.10.1.9. Any air space enclosed inside a coaming or guard shall have openings to permit draining and purging before repair. When the enclosed space is used to transfer vapour, the openings shall be plugged.

6.10.1.10. If the overturn protection is constructed to permit accumulation of liquid on the top of the tank, it shall be provided with drains directed to a safe point of discharge. Drains shall discharge at the rear, as close to the ground as practicable. They shall be unobstructed and free flowing – i.e. not valved.

7. Testing

7.1. Each tank or an individual tank compartment shall not leak, distort or suffer any permanent distortion, or show evidence of impending failure after application of a hydrostatic test for a minimum period of 10 minutes. The following is applicable when undertaking such a test:

7.1.1. the tank shall be filled with water, the temperature of which does not exceed 38^{o}C. (Note that the water may be pressurised by air over the top of the water).

7.1.2. the test shall be conducted at 1.5 times the design pressure but not less than 30 kPa.

7.1.3. The pressure shall be gauged at the top of the tank.

7.1.4. each compartment is to be tested individually and adjacent compartments are to be

- empty in both instances; and
- at atmospheric pressure.

7.1.5. relief devices which could prevent the test pressure from being reached shall be made inoperative during testing e.g. by clamping or plugging. They shall be made operative immediately following the test.

7.2. A vapour-recovery transfer system and a coaming that is part of a vapour recovery system shall not leak when subjected to a pressure of 35 kPa with the pressure maintained without leaks for 10 minutes.

7.3. Piping — Piping systems shall be tested in accordance with the following regime:

7.3.1. A piping system subject to pumping pressure shall be tested to a pressure 1.5 times the maximum working pressure.

7.3.2. Valves, manifolds, piping and fittings in a bottom loading system, which can be subject to surge pressures due to closure of some valves in the system, shall be tested to 1600 kPa.

7.3.3. Where piping is not subject to pump pressure or tank test pressure, it shall be tested at a pressure of 200 kPa before attachment to the tank.

7.3.4. 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.

8. Repairs

8.1. Major Repairs to Tank Wagons

8.1.1. Major modifications or repairs affecting the structural integrity of any tank used for conveying liquids with class 6, 8 or 9 hazard classification in bulk shall be carried out only after a design test certificate has been issued by an EPA approved test certifier.

8.1.2. A major repair or modification is defined as altering the sub frame and or tank, and includes remounting of tanks or where the structural integrity of the tank is changed.

8.1.3. Repairs shall be carried out as above only when the tank has been rendered free of hazardous liquid and gas.

8.1.4. Any entry into a compartment of the tank shall be undertaken with adherence to confined space entry requirements. This should include monitoring of oxygen levels where appropriate.

8.2. Repairs and Servicing of Tank Wagons

8.2.1. Tank wagons that are gas-freed may be serviced at any location or in any building, subject to clause 8.1 above.

8.2.2. Tank wagons that carry class 8 or 9 hazardous substances and which are not gas-freed may be taken into a building for repairs or servicing, including maintenance, but not hot work, provided that:

- the tank is drained and valves closed or sealed, and
- no hot work is undertaken on the tank wagon, and
- the room is well vented to the outside of the building, and
- where the servicing is over a pit, all connections to the tank are isolated e.g. locked off.

8.2.3. Tank wagons may be serviced outside a building provided that:

- the tank is drained and valves closed or sealed;
- no hot work is undertaken on the tank wagon.

8.3. Emergency Repairs

8.3.1. Emergency repairs not involving the load tank may be carried out in a building if:

- it is impractical to do the work otherwise;
- the tank wagon remains in the building for the minimum period of time, and
- the tank wagon does not remain in building overnight, and
- the person in charge of the building is given written notice of presence of hazardous substances and their hazard classifications.

8.3.2. Emergency repairs or operations (where the tank wagon cannot be moved) may be carried out at other locations provided no source of ignition is permitted within 8 m.

8.4. Re-testing

8.4.1. See clause 5.4 of Appendix A.

9. Placards and markings

9.1. Placards

9.1.1. The tank shall be placarded and marked in accordance with the requirements of the Land Transport Rule 45001/1 Dangerous Goods 2005 (as amended) and subsequent amendments. Appendix C outlines these requirements.

9.2. Marking

9.2.1. Marking must be permanently attached to each tank or tank sub-frame that specifies:

- the recommended operating pressure for each part of the tank and fittings that are intended to operate at different pressures, and
- the maximum gross filling level of each tank compartment, and
- the maximum density of any liquids to be carried, and
- the material used to construct the tank, and
- the date of manufacture, and
- the manufacturer of the tank, and
- the serial number of the tank, and
- any limitations on substances that can be transported.

9.2.2. This plate shall be affixed in a place readily accessible for inspection, preferably on the true left hand side near the front of the tank. The information shall be stamped, embossed, or applied by suitable means, into the material of the plate in characters at least 5 mm high. The plate shall not be painted so as to obscure the marking thereon. The tank serial number shall also be stamped on a substantial part of the tank structure.

9.2.3. Separately from the above, the following are also to be permanently attached:

9.2.3.1. the name and contact details of the test certifier who certified the last in service test certificate for the tank wagon is to be permanently attached to each tank or sub-frame. This can be a plate or label, and

9.2.3.2. the design registration number issued by the Authority (or TSR number issued by the Ministry of Health if the tank was constructed prior to 1st April 2004), is to be permanently fixed on the tank in letters and numerals 75 mm high, preferably on the front right hand side of the tank, and

9.2.3.3. all tank outlets are to be labelled with the hazardous substance carried in each compartment. This can be achieved by fitting each compartment outlet with a tumbler incorporating the different hazardous substances carried in that compartment or a tag, and

9.2.3.4. if different hazardous substances are carried in each tank compartment, markings must be attached to the tank to identify:

- the hazardous substance contained in each tank compartment, and
- the hazardous properties of each substance in each compartment, and
- the tank filling and connection system to be used if more than one option is available.

Appendix A - Means of compliance with this code

The following are the actions are to be undertaken by a tank wagon owner or the owner's agent to comply with this Code.

1. Design and Construction

1.1. The design of any new tank wagon or the assessment of any existing vehicle which is undergoing major modification, for use under this Code is to be carried out by a competent person[4] with relevant experience in the road transport industry. Except for tank wagons that will carry only low-hazard hazardous substances and which are less than 450 litres capacity, the completed designs and assessments are to be forwarded to the EPA approved test certifier to obtain a design test certificate. This certificate may be issued with conditions of approval.

1.2. The person seeking the approval of the test certifier will be expected to provide the following information:

1.2.1. Two copies of the general assembly drawing of the tank wagon for which approval is sought. This drawing shall show all major dimensions.

1.2.2. 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 designs, a copy of the assessment report and two copies of any drawing showing any modifications to be made before the tank wagon enters service.

1.2.3. The design calculations for the rear bumper and rear under-run bumper.

1.2.4. The design calculations for the tank mounting arrangements.

1.2.5. For a trailer or semi-trailer, the chassis design certification

1.2.6. The static roll threshold criteria assessment.

1.2.7. If available the registration number and fleet number of the tank wagon concerned.

1.2.8. The identification of the qualified person[4] responsible for the design or assessments.

1.2.9. The identification of the qualified person1[5] to be responsible for the supervision of construction of the tank wagon.

1.3. Once the test certificate for the design is issued, a copy of this test certificate and the design information (including the drawings) is to be forwarded to the EPA who will issue a register number of

[4] In this context a competent person means a chartered professional engineer or similarly qualified person familiar with the design and construction of road transport vehicles.
[5] In this context a competent person is a person who is skilled and experienced in the construction of tank wagons or similar items.

the form “TAN XXX”. If this design is to be used for other tank wagons that have tanks 2000 litres or larger, these shall be designated by separate numbers.

1.4. Before the tank wagon enters service a pre-commissioning test certificate issued by a test certifier approved by the EPA must be obtained. The tanks wagon must undergo an inspection which will include:

1.4.1. the obtaining of a written declaration from the manufacturer responsible for the supervision and construction of the tank wagon stating that the tank wagon has been constructed according to the approved design and drawings and is in accordance with this Code (refer to the Manufacturer’s Declaration included with this Appendix).

1.4.2. a check for compliance with this Code, including the inspection that is required during construction.

1.5. A pre-commissioning test certificate is not required for a tank wagon

1.5.1. with a tank capacity of less than 450 litres and which carries a low-hazard hazardous substance, or

1.5.2. with a tank capacity of less than 2000 litres and which is manufactured by an approved fabricator in accordance with the terms and conditions of the fabricator’s approval.

2. Inspection

2.1. The tank wagon 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 tank wagon owner or owner’s agent or inspection as required by the EPA approved test certifier. These inspection requirements include:

2.2. Ongoing – the tank wagon driver shall observe any flexible hoses used in the transfer system and check for damage and wear.

2.3. Every 3 months - an inspection carried out by a suitably experienced serviceman for continued compliance. This shall include

2.3.1. inspection of any flexible hoses used in the transfer system for damage and wear and for electrical conductivity (if applicable), and

2.3.2. inspection of any earthing straps for continuity and serviceability (where fitted).

2.4. Every six months –

2.4.1. present the tank wagon to the New Zealand Transport Agency Automotive Survey Section for a certificate of fitness inspection, and

2.4.2. undertake a pressure test on the delivery hoses (hydrostatic test). The hoses should be tagged and dated.

2.5. Every two years - an in service test certificate issued by a test certifier approved by EPA New Zealand is to be obtained. The following items are to be included in the check (some items may be undertaken at alternate inspections):

2.5.1. The tank and fittings are compatible with the substances being carried.

2.5.2. The tank wagon including the load tank and pumping equipment are to be checked for hazardous substance leaks and if any are found they are to be repaired before entering service.

2.5.3. The tank is to be checked for significant corrosion. Where corrosion is found the tank must still meet the stress, pressure resistance and fatigue resistance that it was originally designed for.

2.5.4. The shut off valves both operate as originally intended and have no leaks.

2.5.5. The means of shutting off any delivery pump operates as originally intended.

2.5.6. The tank wagon fuel tank is free from any leaks and still meets the requirements of this Code.

2.5.7. The vents of each tank compartment are tested to ensure they operate correctly.

2.5.8. The tank compartments are pressure tested without permanent distortion or leaks (not required for tank trailers less than 2000 litres capacity).

2.5.9. The rear run-under protection requirements are in place.

2.5.10. The rear end collision protection requirements are in place.

2.5.11. Verification of the height of the overfill probes

2.6. At 10 years from construction and at intervals of 5 years thereafter, an internal inspection is to be undertaken with each compartment pressure tested.

2.7. Test method for a tank that is found to be leaking. If there is any reason to suspect a leak or the tank wagon is involved in any significant accident or if repairs are carried out to the tank, each affected compartment shall be tested in accordance with the provisions of clause 7.1.1 of this Code.

2.8. Tanks failing the above tests shall be suitably repaired, and the above described tests shall be continued until no leaks are discovered before any tank is put in service

2.9. In circumstances whereby these inspection procedures are unable to be used, alternative inspection procedures may be used provided that they approved by the test certifier issuing the test certificate for the tank wagon.

MANUFACTURERS DECLARATION – TOXIC, CORROSIVE AND ECOTOXIC LIQUIDS TANK WAGONS

I . . . . . certify that I have design checked /inspected the following:

Vehicle:	Reg No:
Owner:	Fleet No:
Type of Vehicle:	Tank No:
Hazardous substances:	
Tank/compartment capacities:	
Relevant Drawings:	

I declare that I have made such detailed examinations and checks as I considered necessary and it is my opinion that:

- The design is in accordance with the Code of Practice for Toxic Corrosive and Ecotoxic Liquids Tank Wagons, Reference HSNOCOP 39 (the Code)
- The construction is in accordance with good and widely accepted engineering practice and the design as shown on the drawing list attached.
- An inspection has been carried out and the requirements of the Code have been complied with.
- I have witnessed and/or verified non-destructive testing/hydro testing in accordance with the requirements of clauses 5.4.5, 5.4.6, 5.4.7 and 7.1.1 of the Code.
- This tank wagon is subject to additional conditions as follows:

Therefore I recommend that this tank wagon be approved for transport of hazardous substances with class …….. (fill in as appropriate) classifications under the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004.

Signed . . . . . .

for and on behalf of . . . . . .

Appendix B – Glass reinforced plastic tanks

1. 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 series, BS 3496:1973, BS 3691:1969 or BS 3749:1991 and having 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 4994:1987. Alternatively tanks may be designed using the provisions of BS 6464:1984 for laminate strength and construction.

1.2. 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.

1.3. 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.

1.4. Materials testing is to be carried out in accordance with BS 2782 series of standards or the applicable ASTM methods.

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

2. Tank material thickness

3.1. Non-pressure tanks

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

3.2. Shell thickness

3.2.1. 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.

3.2.2. Reinforced plastics baffles should not be less than 5 mm thick.

Table C 1 Minimum shell thickness

Capacity of tank/compartment	Reinforced plastics (hand lay up)	Reinforced plastics (closed mould) (mm)
Up to 3000	5	4
3000–5000	6	5
5000–7600	6	5
Over 7600	6	–

3.3. Ends and bulkheads

3.3.1. 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.

3.3.2. 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.

3.3.3. In case of doubt the requirements of BS 4994:1987 are to be followed. The thickness of the ends and bulkheads should in no case be less than the minimum requirement for the shell.

3.4. Low pressure tanks

3.4.1. 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.

3.5. Pressure tanks

3.5.1. For the maximum design pressures above 50 kPa, the tank shall be designed and constructed to the full requirements of the Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) regulations 1999.

3.6. Tank linings

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

3.7. Electrical conductivity

3.7.1. 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 m^2 per m^3 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 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
- a metallic grill of wire thickness not less than 1 mm diameter and whole area not greater than 4 cm2 provided that the total area of the grill in contact with the liquid is not less than that specified.

3.7.2. 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.

3.7.3. 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.

3.7.4. 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 is waived.

3.8. Tank construction – general

3.8.1. 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.

3.8.2. 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 (e.g., sandwich type) or greater wall thicknesses give considerably greater tank stiffness (both overall and local), this dimension may be exceeded.

3.8.3. The use of screwed pipe fittings is not approved.

3.8.4. Specimens for material testing are to be taken whenever possible from the walls of the tank (e.g., aperture cut-outs). Testing of specimens is to be carried out in accordance with the applicable material standard (e.g., BS 4994:1987, the relevant ASTM standard).

3.9. Testing

3.9.1. Tanks designed and constructed to an approved standard shall be tested in accordance with that standard. Tanks designed for static liquid head (see 2.1) shall be tested by filling with water to the maximum design head.

3.9.2. Hydrostatic pressure tests are to be carried out on the complete tank. The test 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

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

3.9.4. Periodic retesting may be required as a condition of in service certification.

3.10. Tank fittings

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

3.10.2. 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 (e.g., bursting discs) are to be submitted for approval.

Appendix C – Signage

1. Tank wagons transporting substances with hazard class 6, 8 or 9 must display hazard class placards, emergency information panels and other markings as set out in Land Transport Rule: Dangerous Goods 2005. These requirements are summarised in this appendix, but you must refer to the rule for full details.
2. In this appendix, tank wagon includes tank trucks, tank trailers and tank Semi-trailers.
3. Placards must be clean, visible, unobscured and positioned on a contrasting background on the vehicle or tank so that the nature of the load can be readily identified from a distance of 25 metres in daylight.
4. Tank wagons must display for all dangerous goods in the load:
   - the class placards that identify the primary risk and any subsidiary risks of the hazardous substances being transported; and
   - the emergency information panel, which specifies the UN Number, the Hazchem code and the emergency telephone number; and
   - the proper shipping name, which must be legible from a distance of 10 metres. The proper shipping name may be included in the emergency information panel; and
5. Tank wagons must display:
   - the class placard at the front of the prime mover or tank wagon combination, and
   - all the information in clause 4 above on the rear and on both sides.
6. Placards on the front of a prime mover or tank wagon combination must be at least 250 mm measured along any edge.
7. Placards and emergency information panels on the rear or sides of a tank wagon must be at least 400 mm measured along any edge.
8. When a tank semi-trailer is disconnected from a towing vehicle, 250 mm class placards must be displayed on the front of the tank semi-trailer.

Note: To ensure adequate legibility distance of markings on a tank wagon, all letters and numerals should be at least 40 mm high.

Appendix D – Maximum degree of filling

1. General Use

The maximum degree of filling (in %) for general use is determined by the formula:

$$\text{Degree of filling} = \frac{97}{1+\alpha(t_r-t_f)}$$

2. Hazard Classes 6, 8 and 9

The maximum degree of filling (in %) for liquids with hazard classes 6 or 8, in packing groups I and II , and liquids with an absolute vapour pressure of more than 1.75 bar at 65^{o}C, or for liquids identified as marine pollutants is determined by the formula:

$$\text{Degree of filling} = \frac{95}{1+\alpha(t_r-t_f)}$$

In these formulae α is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (tf) and the maximum mean bulk temperature during transport (tr) (both in ^{o}C). For liquids transported under ambient conditions, α could be calculated by the formula:

$$\alpha = \frac{d_{15} - d_{50}}{35d_{50}}$$

in which d_{15} and d_{50} are the densities of the liquid at 15^{o}C and 50^{o}C respectively.

The provisions of this clause 2 shall not apply to tanks which contain substances maintained at a temperature above 50^{o}C during transport (such as by means of a heating device). In such cases the degree of filling at the outset shall be such that through the action of the temperature regulator, the degree of filling shall be not more than 95% full at any time during transport.

Environmental Protection Authority
Te Mana Rauhī Taiao

215 Lambton Quay, Wellington 6011, New Zealand

New Zealand Government