

LPG TANK WAGON CODE

Bulk Transport of Class 2D Dangerous Goods by Road

A code of practice for the design and construction of vehicles for the bulk transportation of liquefied petroleum gas by road.



Published by
Explosives and Dangerous Goods
Occupational Safety and Health
A Service of the Department of Labour

First edition 1982
Reprinted 1986
Reprinted 1989

ISBN 0-477-03465-9

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1. SCOPE AND GENERAL

1.1 Scope

1.1.1 This code of practice applies to any vehicle used for the transportation of LP gas in bulk by road.

1.1.2 Tanks, tank fittings and attachments for use under this code shall be designed and constructed according to the requirements of the Dangerous Goods (Class 2 -Gases) Regulations 1980 and subsequent amendments and Part XI of the New Zealand Boiler Code *Pressure Vessels Used for the Transportation on Land of Pressurised Fluids*.

This code includes requirements for the design, construction and operation of vehicles carrying such tanks.

1.2 Definitions

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

1.2.1 Approved Type

Means that the item referred to is of a type approved by the Chief Inspector of Dangerous Goods for the use to which it is to be put.

1.2.2 LP Gas

A substance which is composed predominantly of any of the following hydrocarbons or mixtures of all or any of them:

propane (C_3H_8)

propylene (C_3H_6)

butane (C_4H_{10})

butylene (C_4H_8)

1.2.3 Tank

A pressure vessel exceeding 250 litres water capacity used for the transport or storage of LP gas in bulk. Tanks may be of the following types:

- (a) Fixed tank — a tank which is permanently mounted on a vehicle chassis. Includes permanent pipework, valving, meters, pumps.
- (b) Multi-modal tank — a tank designed to ISO dimensions to transport LPG. Generally approved for bulk transport only (nominally full or empty).
- (c) Demountable or skid tanks — a tank designed for temporary storage of LP gas, and suitable for transportation from one location to another.

1.2.4 Tank Wagon

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

- (a) Tank truck (or rigid) — a single vehicle having its own means of propulsion;

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

NOTE: The use of a tank trailer requires the specific approval of the Chief Inspector of Dangerous Goods. Such approval will be conditional on the type of use to which the tank trailer may be put.

1.3 Maximum Capacities

No tank wagon or tank wagon combination shall carry any tank or combination of tanks whose total water capacity exceeds 35,000 litres. All tanks must be of a type approved by the Chief Inspector of Dangerous Goods. Demountable tanks are to have water capacities not exceeding 8,000 litres.

1.4 Limits of Code

- 1.4.4 If it is desired to use materials other than those specified in this code or methods of construction and processes not in conformity with this code, details shall be submitted to the Chief Inspector of Dangerous Goods for determination as to their suitability.

2. VEHICLE DESIGN AND EQUIPMENT REQUIREMENTS

2.1 General

- 2.1.1 The vehicle shall be strongly constructed, as far as practicable, of fire resisting materials. The design of the vehicle shall provide an integration of the tank supporting members and the vehicle chassis. The means of securing the tank to the chassis, and in the case of tank trailers or tank semi-trailers, the means of attaching the prime mover to the trailer or semi-trailer shall be designed to withstand the design loads of this code.
- 2.1.2 The total mass of the fully laden vehicle shall not exceed the vehicle manufacturer's stated gross vehicle mass. The maximum load carried on each tyre shall not exceed the load rating of the tyre as recommended by the tyre manufacturer at the specified inflation pressure and for the operational speed of the vehicle. Where a manufacturer's rating is not available the load ratings recommended by the Tyre and Rim Association, Australia, shall apply. The inflation pressure used to carry the load imposed on each tyre shall be not less than that recommended for the tyre and load by the tyre manufacturer, or by the Tyre and Rim Association, Australia, (as appropriately, and in no case shall the inflation pressure exceed that permitted by the Heavy Motor Vehicle Regulations 1974 and any subsequent amendments.
- 2.1.3 The maximum load imposed on any axle shall not exceed that allowed, for the axle type and road classification, by the Heavy Motor Vehicle Regulations 1974 and subsequent amendments (see Appendix B).
- 2.1.4 The dimensions and loadings of any tank wagon shall not exceed those allowed by the Traffic Regulations 1976 and subsequent amendments for normal operations (see Appendix A).

2.2 Road Clearance

The minimum allowable road clearance of any tank component or protection device shall be not less than 40 mm for each metre away from any axle, and in any case be not less than 300 mm.

2.3 Rear Bumper Requirements

- 2.3.1 Every tank wagon shall be provided with a rear bumper to protect the tank, piping and fittings in the event of a rear end collision and to minimise the possibility of any part of the colliding vehicle striking the tank.
- 2.3.2 The bumper shall be located at least 400 mm behind the rear of the tank and at least 150 mm behind any vehicle component which is used for loading or unloading purposes or which may contain fluid whilst in transit. The width of the bumper shall be not less than the maximum width of the tank.
- 2.3.3 The bumper shall be designed to withstand a load equal to twice the mass of the fully laden tank wagon uniformly distributed across the central 1.5 m long section of the bumper. In these load circumstances the maximum stress in any member of the bumper shall not exceed the yield stress of the material involved.

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

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

2.4 Electrical Wiring

Electrical wiring shall comply with the following requirements:

- 2.4.1 The nominal voltage shall not exceed 24 volts.
- 2.4.2 The battery shall be secured in front of a fire resistant shield, but if this is not practicable it may be carried in a steel box or secured in a steel frame as close to the cab as is practicable. The battery terminals shall, by means of an effective acid resisting insulating cover held securely in place, be prevented from accidental shorting.
- 2.4.3 Except in the case of switches approved by the Chief Inspector of Dangerous Goods both as regards design and location (e.g. see 2.4.4), the generator, switches and fuses shall be carried in front of a fire resistant shield.
- 2.4.4 A means of cutting off the current by means of a double pole switch or other approved method shall be provided in a readily accessible position as close to the battery as is practicable. The switch should be adjacent to the battery and preferably no further than 600 mm from it.
- 2.4.5 Electrical wiring shall be adequately insulated from the chassis and the wiring shall be supported and protected from mechanical injury, chafing and exposure to contact with oil, grease, **or petroleum products**, and shall be so located as to avoid damage to insulation from heat.

2.5 Fire Extinguishing Equipment

- 2.5.1 Each vehicle shall carry fire extinguishers selected from the following list:
- (i) Vapourising type extinguishers employing as the extinguishing agent a substance such as bromotrifluoromethane, bromodichlorofluoromethane (BCF) or other similar agent contained under pressure of a capacity of at least 1.8 kg.
 - (ii) Foam-producing extinguishers which can be applied to blanket the surface of burning liquids or substances of a capacity of not less than 8 kg.
 - (iii) Dry powder extinguishers which expel a powder such as specially treated sodium bicarbonate by means of a stream of nitrogen, carbon dioxide or other approved inert gas or a capacity of at least 2 kg of powder.
 - (iv) Fractionising dry powder extinguishers which expel a powder such as specially treated decrepatating potassium salt by means of a stream of nitrogen, carbon dioxide or other approved inert gas of a capacity of at least 2 kg of powder.
- 2.5.2 Tank trailers shall be provided with at least one extinguisher of either types (i), (ii), (iii) or (iv).
- 2.5.3 Tank wagons and all other vehicles carrying LP gas in bulk shall be provided with at least one extinguisher of either types (i), (ii), (iii) or (iv) PLUS either one extinguisher of type (iii) of 8 kg capacity or one extinguisher of type (iv) of 7 kg capacity.

2.6 Vehicle Inspection

Regular inspections of *tank* wagons shall be carried out by a tradesman automotive engineer (motor mechanic) at intervals not exceeding 3 months, in accordance with part 3(ii) of appendix D. Records of inspection and any necessary rectifications shall be kept by the vehicle operator for inspection as required by the Chief Inspector of Dangerous Goods, and shall also be presented for inspection during the Ministry of Transport certificate of fitness inspection of the tank wagon.

2.7 Tank Truck or Prime Mover Equipment

2.7.1 Unless otherwise approved by the Chief Inspector of Dangerous Goods, the vehicle shall be powered by a compression ignition (diesel) engine.

2.7.2 If windows are fitted in the rear wall of the cab, they shall be securely clipped or fitted with fire resistant framing and with wired glass or other approved type of heat resisting material, and shall not be capable of being opened. Curved corner windows in vehicle cabs further than 2 m from the load tank are not considered as being in the rear wall of the cab.

2.7.3 The fuel tank of the vehicle shall be so located as to minimise mechanical damage and the spread of fire and:

- (a) A fuel feed apparatus placed in front of the rear wall of the cab shall be used to lift the contents from the fuel tank. Fuel lines shall be substantial to give a measure of fire resistance and protected if outside the cab shield;
- (b) If mounted in a vulnerable position, the fuel tank shall be protected from mechanical damage by stout steel guards and shall have its filling hole fitted with a secure closure;
- (c) If the tank shell thickness is less than 5 mm thick aluminium or 3 mm thick steel, then a guard shall be fitted unless the tank is otherwise approved as having equivalent protection. The guard shall take the form of a metal plate of the above minimum thicknesses covering the vulnerable vertical surface projection of the tank and securely attached to the vehicle not tank.

2.7.4 The exhaust system shall be free from leaks and shall be located so as to minimise the accumulation of oil or grease and shall be discharged sideways in front of the front wheels or above the cab roof, and shall be so designed as to inhibit the ejection of sparks.

NOTE: Turbocharged engines under normal conditions are considered to inhibit spark ejection.

If prime mover engine powers pump via a power take-off, additional conditions apply — see paragraph 3.3.2.

2.7.5 Windscreen Washing and Demisting

2.7.5.1 The cab of each vehicle shall be fitted with effective means of windscreen washing and wiping. Preferably such equipment should comply with the requirements of Federal Motor Vehicle Safety Standard 104.

2.7.5.2 The cab of each vehicle shall be fitted with a device which allows effective demisting of the windscreen. Preferably the equipment should comply with the requirements of Australian Design Rule 15, or with the requirements of Federal Motor Vehicle Safety Standard 103.

2.7.6 Brake Equipment

- 2.7.6.1 Each vehicle shall be fitted with braking equipment meeting the requirements of the Traffic Regulations 1976 and subsequent amendments, and of the Goods Service Vehicle Construction Regulations 1936, and subsequent amendments.
- 2.7.6.2 Tank trucks and prime movers should preferably be fitted with a braking system of the fast acting type, (such as braking systems which comply with Australian Design Rules, United States Federal Motor Vehicle Safety Standards or EEC directives).

2.7.7 Illumination

- 2.7.7.1 At least one certified flame-proof battery-operated torch shall be carried in the cab.

2.8 Tank Trailer and Tank Semi-Trailer Requirements

- 2.8.1 Tank trailers may be used with the approval of the Chief Inspector of Dangerous Goods, and must be used subject to such conditions as may be specified by him.
- 2.8.2 Tank trailers and tank semi-trailers shall be of a design acceptable to the Chief Inspector of Dangerous Goods and, in addition, must meet the requirements of this code.
- 2.8.3 Tank trailers and tank semi-trailers are to be designed by and constructed under the supervision of a registered engineer or registered engineer's associate with relevant experience in the road transport industry.
- 2.8.4 If the use of trailers or semi-trailers previously used for road transportation of other types of goods is contemplated, such trailers or semi-trailers shall be assessed by a registered engineer or a registered engineer's associate with relevant experience in the road transport industry and any modifications necessary shall be carried out under his supervision.
- 2.8.5 Plans for any tank trailer or tank semi-trailer and/or the results of any assessment of any trailer or semi-trailer shall be deposited with the Chief Inspector of Dangerous Goods — see Appendix D, clause 1.
- 2.8.6 The suspension system for tank trailers and tank semi-trailers shall be chosen such that the roll stiffness of the suspension is maximised consistent with providing adequate dynamic performance of the suspension. The correct selection of a suspension system depends on the following:
 - (a) Spring rate (a high spring rate improves roll stiffness);
 - (b) Transverse distance between springs, which should be maximised;
 - (c) Anti-roll devices incorporated in the suspension which improve roll stiffness;
 - (d) Shock absorbers, whose effect is to improve stability by damping any oscillations which may cause swaying in corners.

2.8.7 Tank Semi-Trailer Fifth Wheels

- 2.8.7.1 Fifth wheel couplings for tank semi-trailers shall be of a type which transmit a portion of the roll motion of the semi-trailer to the prime mover (under normal road operations). In particular, unrestricted double oscillating fifth wheels shall not be used.
- 2.8.7.2 The fifth wheel shall have a drawbar pull rating of at least 1.25 times the weight of the fully laden semi-trailer, and a vertical load rating of at least 1.25 times the vertical load imposed on the coupling.

2.8.8 Brake Equipment Requirements

- 2.8.8.1 Brake equipment on tank trailers or tank semi-trailers shall comply with the requirements of paragraph 2.7.6.1 of this code.
- 2.8.8.2 It is preferred that tank trailer and tank semi-trailer brake systems shall be arranged to ensure full brake balance between the prime mover and trailer under all conditions of load. This balance shall be achieved by the intrinsic properties of the prime mover and trailer or semi-trailer brake systems. The driver should not be provided with any means of altering the intrinsic brake system balance.
- 2.8.8.3 Tank trailer or semi-trailer brake systems shall provided with a remote air-operated emergency release system, having an independent air system.

2.8.9 Wheel Chocks

Every tank wagon shall carry wheel chocks to be used to secure the tank wagon from movement during transfer operations.

2.9 Tank Wagon Tank Mounting Requirements

- 2.9.1 The tank shall be separated from the rear of the cab by a gap of not less than 150 mm.
- 2.9.2 The tank and its fittings shall be electrically bonded to the chassis of the tank wagon. The electrical resistance between the tank and the tank wagon chassis shall not exceed 10 ohms. Means shall be provided for bonding the load tank to any container to or from which any transfer of LP gas is made.
- 2.9.3 The mountings on the tank wagon chassis shall be designed and constructed to withstand the following loads acting independently at the mounts. In these circumstances stresses in the mountings shall not exceed the yield stresses of the materials involved divided by 1.7:
 - (a) Longitudinally, in each direction loads of twice the all up weight of the fully loaded tank and its fittings;
 - (b) Vertically downwards, loads of twice the all up weight of the fully loaded tank and its fittings;
 - (c) Vertically upwards and transversely, loads equal to the all up weight of the fully loaded tank and its fittings.
- 2.9.4 Due consideration for fatigue of the tank wagon chassis mountings shall be included in the design of the tank wagon.
- 2.9.5 If tank wagon tank mountings are provided solely by twist locks and the twist locks are used to provide vertical restraint, then they shall be selected to meet the proof strength requirements noted below, and to withstand the design loadings of this code. Twist locks are to be of a type where the twist lock can be mechanically held in the locked position. Non-retractable twist locks should be used. Twist lock assemblies shall be subjected to a proof load, vertically upwards of twice that specified in paragraph 2.9.3 (c) of this code, at the time of assembly of the twist lock onto the tank wagon chassis. Thereafter, twist lock assemblies shall be subjected to vertical proof loads of 1.25 that specified in paragraph 2.9.3 (c) at 12-monthly intervals. Records of such testing shall be kept for inspection as requirement by the Chief Inspector of Dangerous Goods.
- 2.9.6 Conversion of multi-modal tanks to fixed tanks entails:
 - (a) Installation of a mounting system which cannot be removed except with workshop facilities;

(b) pipework, valves, etc. to conform fully with this code.

2.9.7 Suitable corrosion protection shall be provided for the mounting system.

2.10 Tank Wagon Welding

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

2.10.2 All welding necessary in building any new tank wagon or in modifying any existing vehicle for use as a tank wagon shall be carried out by suitably qualified welders. In New Zealand the appropriate qualification is certification obtained under New Zealand Standard, NZS 4711, and relevant to the materials used and the position involved. Current certification under equivalent overseas standards is also acceptable.

2.11 Stability of Tank Wagons

2.11.1 The geometric centre of a cross section of the tank or tanks, taken in a vertical plane midway along the length of the tank(s) shall fall within an isosceles triangle, having a base length at ground level equal to the overall width between the outside walls of the tyres of the major load axle or axles of the vehicle, and base angles of 65°, with the tank(s) unladen.

2.11.2 As an alternative to 2.11.1, the entire tank wagon, including the prime mover in the case of a tank semi-trailer, shall be demonstrated to be capable of being statically tilted to an angle representing a transverse loading of 0.33 times the all up weight of the tank wagon and its load (under all conditions of load) acting at the centre of gravity of the loaded tank wagon without rollover occurring.

2.11.2.1 As an alternative to physical demonstration of compliance with paragraph 2.11.2 compliance may be claimed by production of calculations to the satisfaction of the Chief Inspector of Dangerous Goods showing that the tank wagon would meet the requirements of paragraph 2.11.2 if so tested.

2.12 Overseas Designs

2.12.1 If the use of tank wagons designed and built overseas is contemplated, or if the building of overseas designs in New Zealand is contemplated, details of the proposal are to be submitted to the Chief Inspector of Dangerous Goods, who will rule as to their acceptability for use in New Zealand.

In general the following requirements are to be met:

- (a) Design and construction to be to an acceptable overseas code (e.g. DOT MC 331, AS 2809). Note that this does not obviate the necessity for the unit to be approved under this code.
- (b) Dimensions, axle weight, etc. to be to the requirements of the Road Transport Division, Ministry of Transport.
- (c) Pressure vessel to be approved to the requirements of the Marine Division, Ministry of Transport.
- (d) Design, construction and operation of the unit to comply with this code (see Appendix D).

3. Auxiliary Equipment

3.1 Tanks

3.1.1 Tanks shall comply with the requirements of the Marine Division, Ministry of Transport. This also includes safety relief valve requirements.

3.1.2 The materials of construction shall be steel alloy or other as approved by MOT.

3.1.3 For the purposes of the regulations and this code, 0.5 kg of LPG is regarded as equivalent to one litre.

3.1.4 The maximum filling ratio shall be such that:

(a) the container does not become liquid full at a temperature of less than:

for tanks 5,000L and below — 47 1/2°C

for tanks exceeding 5,000L — 45°C

(b) the liquid will not exceed 97% of total liquid capacity under normal conditions of storage.

3.1.5 The maximum filling ratios as given below will comply with the above requirement:

	For tanks 5,000L and below	For tanks exceeding 5,000L
n-butane	0.533	0.535
iso-butane	0.512	0.515
propane	0.449	0.454

For mixtures of the above, the approved maximum filling ratio is that which complies with paragraph 3.1.4.

3.1.6 The maximum pressure attained by LPG at a temperature of 45°C (for containers over 5,000L but not exceeding 26,000L) or 40°C (for containers exceeding 26,000L) shall be used for the minimum allowable working pressure of the vessel.

3.1.7 For tanks exceeding 15,000L, transverse baffles shall be installed effectively dividing the tank into compartments of 15,000 L max size. Each baffle shall cover a minimum of 50% of the cross-sectional area of the tank and with at least 50% of the baffle area in the bottom 50% of the tank.

3.1.8 Tank and pipework shall be predominantly painted a gloss white.

3.1.9 It is preferred that all connections to tank pipework are labelled with their function.

3.2 Valves and Fittings

3.2.1 Every tank shall be fitted with the following devices located for easy access or with provision for easy access:

(a) Pressure gauge (in MPa) and liquid contents gauge (indicating a percentage of water capacity, percentage of LPG capacity, litres or tonnes);

(b) At the delivery connection of the tank, a quick closing internal valve, designed

to close automatically on the operation of a fusible link and manually by release from either of two remote points;

- (c) An external shut-off on any connection with an opening exceeding 1.4 mm diameter located as close to the tank as practicable;
- (d) A liquid drain incorporating an excess flow valve plus a shut-off valve or alternatively a check-lock valve and a means for attaching a hose.

3.2.2 Every tank shall be fitted with a pressure relief valve (or safety valve) in accordance with the requirements of the Marine Division, MOT.

3.3 Liquid Transfer Pumps and Compressors

3.3.1 Liquid transfer pumps and compressors shall be designed for use with LPG. Compressors shall take suction from the vapour space of the tank. Pumps with a self-priming bypass shall have a check valve fitted where the bypass enters the tank and a manually operated shut-off valve as close as possible to the tank (this valve shall be fitted with an extension spindle for easy operation from the side or end of the tank).

3.3.2 Pumps shall be powered by one of the following:

- (a) A flameproof electric motor complying with the Electrical Wiring Regulations 1976;
- (b) Power take-off from the main diesel engine fitted as follows:
 - (i) air intake terminating above the level of the top of the cabin;
 - (ii) strangler to be fitted on air intake with dual controls operable from inside the cab and at a point remote from the cab; strangler to be clearly identified by label and easily accessible;
 - (iii) a switch to isolate the field circuit of the generator or alternator (separate from the battery isolating switch);
 - (iv) exhaust pipe terminating above the level of the cabin roof.
- (c) Separate diesel engine for pumping fitted as follows:
 - (i) all electrical equipment removed;
 - (ii) air intake terminating above the level of the top of the tank;
 - (iii) an air intake strangler with dual controls situated one near the controls and the other remote; strangler to be clearly identified by a label and easily accessible;
 - (iv) exhaust pipe terminating above the tank or remote from the pump and control valves.
 - (v) engine fuel lines, including contents sight glasses to be of fire resisting material.

3.4 Transfer Systems, Pipework and Hoses

3.4.1 Pipework for LPG shall be made from seamless pipe designed to allow for expansion and comply with any requirements of the Marine Division, MOT. All pipework and hoses shall be suitable for the required duty. Design shall be to an approved code (BS 3351 is acceptable).

3.4.2 Piping, valves and fittings shall be located, protected and secured to provide protection from damage. Screwed joints shall only be used on 50 mm die pipe and smaller.

Pipework shall be maintained free from leaks.

- 3.4.3 Flexible hose shall be of an approved type and shall be marked with the design working pressure together with “LP GAS” or “LPG” or the number of the specification to which it was manufactured. Hoses which may be subjected to container pressure shall be tested to the design working pressure without leaking.
- 3.4.4 A relief valve shall be installed between two shut-off valves in any pipe and shall discharge to a safe location.

3.5 Testing of Pipework and Transfer Systems

- 3.5.1 The pipework shall be tested in accordance with the design specification and Marine Division, MOT requirements at least once every 5 years. This includes a hydrostatic test and a leak test (e.g. soap bubble).
- 3.5.2 Flexible hoses shall be tested as follows:
 - (a) Visually once every month;
 - (b) Hydrostatically at a pressure not less than the design pressure once a year.
- 3.5.3 A written record of every test shall be kept by the operator.

4. REPAIRS

4.1 General

4.1.1 Major modifications or repairs to any tankwagon used for conveying Class 2D Dangerous Goods in bulk shall be carried out only with written authority from an Inspector of Dangerous Goods and in the case of tanks and pipework an Engineer Surveyor of the Ministry of Transport.

A major repair or modification is defined as affecting the subframe, tank or pipework and includes remounting of tanks, changing tank design etc. and includes work that is generally considered hot work (i.e. operations that could cause a spark or dangerous rise in temperature).

4.1.2 Repairs shall be carried out as above only when the tank has been rendered free of flammable liquid and gas by a method approved by the Chief Inspector of Dangerous Goods.

4.2 Repairs and Servicing of Tank Wagons

4.2.1 Tank wagons that are gas-freed may be serviced at any location or in any building, subject only to section 4.1 above.

4.2.2 Tank wagons that are not gas-freed may be taken into a building for repairs or servicing, including maintenance, but not hot work, only if:

- (a) The building is approved by an inspector which will include compliance with the following requirements:
 - (i) building is well vented;
 - (ii) electrical wiring and fittings are in accordance with the requirements for hazardous areas;
 - (iii) building to have acceptable fire resistance or an installed sprinkler or alarm system.
- (b) Alternatively:
 - (i) the pressure within the tank is reduced to atmospheric pressure or low pressure (preferably below 35 kPa);
 - (ii) the load tank is sealed gas tight;
 - (iii) the person in charge of the work is instructed in writing not to interfere with the load tank and its fittings.
 - (iv) no source of ignition permitted within 8 m.

4.2.3 Tank wagons may be serviced outside a building only if no source of ignition is permitted within 8 m (electrical fittings or wiring is not considered a source of ignition when disconnected).

4.3 Emergency Repairs

4.3.1 Emergency repairs not involving the load tank may be carried out if:

- (a) The driver or other responsible representative (who is authorised and able to operate the vehicle) of the owner remains with the vehicle until the repair is completed;

- (b) The vehicle is not located where it is subject to heating; and
 - (c) No source of ignition is permitted within 8 m of the tank.
- 4.3.2 Emergency repairs or operations (where the tankwagon cannot be moved) may be carried out at other locations provided no source of ignition is permitted within 8 m.

4.4 Re-Testing

See Appendix D Section 3(iv) and 3(v).

4.5 Accidents and Incidents

All accidents and incidents involving tankwagons transporting dangerous goods must be reported to an inspector. No repairs to be attempted without the approval of an inspector.

Refer sections 33 and 34 of the Dangerous Goods Act 1974.

5. MARKINGS

5.1 Tank Markings

- 5.1.1 The tank shall be marked according to the requirements of Part XI of the New Zealand Boiler Code *Pressure Vessels used for the Transportation on Land of Pressurised Fluids*.

5.2 Tank Wagon and Demountable Tank Markings

- 5.2.1 Tank wagons and remountable tanks shall be marked to comply with the requirements of the Dangerous Goods Labelling Regulations 1978 as follows:
- 5.2.2 Tank wagons and remountable tanks shall be conspicuously marked on both sides, the front and rear of the tank on a sharply contrasting background with the words “FLAMMABLE LP GAS” in letters at least 125 mm high and on both sides and the rear with a label of the form specific in Appendix C of a size of at least 400 mm by 400 mm.
- 5.2.3 Tankwagons are to carry portable notices reading “No Smoking or Naked Lights” in large legible letters visible from 8 m.

APPENDIX A: MAXIMUM PERMITTED VEHICLE DIMENSIONS

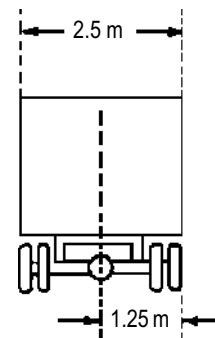
The following are maximum dimensions of motor vehicles permitted by regulation 48, Traffic Regulations 1976. Where two conflicting dimensions are shown, the vehicle must not exceed the lesser of the two, i.e. the most restrictive of the two measurements.

WIDTH

48 (1) No person shall operate any vehicle, if the vehicle or its load or both exceed 2.5 m in width or extend more than 1.25 m from the longitudinal centre line of the vehicle. The provisions of this subclause shall not apply to any agricultural trailer or agricultural machine, where:

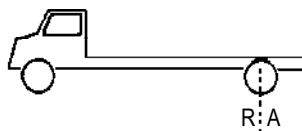
- (a) The vehicle does not exceed 3.7 m in width; and
- (b) The vehicle is not operated during the hours of darkness; and
- (c) The vehicle is not driven at a speed exceeding 25 km/h; and
- (d) The extreme right-hand front edge of the vehicle is indicated by a flag of the type specified by regulation 50 hereof to indicate excess dimensions.

2. For the purpose of subclause 1 of this regulation, any mirrors, side marker lights, or direction indicators shall be deemed not to be part of the vehicle or its load. Except agricultural vehicles 3.7 m in width travelling no faster than 25 km/h in daylight.

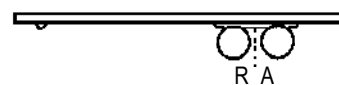


DEFINITION — REAR AXIS

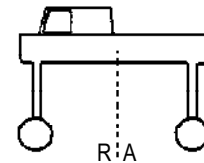
(a) In relation to a vehicle with only one non-steering axle, means that axle:



(b) In relation to a vehicle with 2 or more non-steering axles, means a horizontal line at right angles to the longitudinal centre line of the vehicle and midway between the first and last non-steering axles:



(c) In relation to a vehicle with no non-steering axle, means a horizontal line at right angles to the longitudinal centre line of the vehicle at a point to be determined by the Secretary.

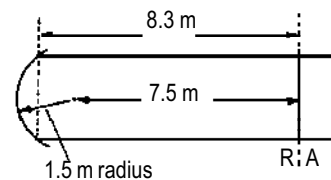


DISTANCE AHEAD OF REAR AXIS

48 (3) No Person shall operate any vehicle if any part of the vehicle or its load extends more than 8.3 m ahead of the rear axis of the vehicle.

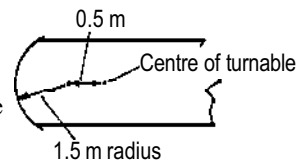
Provided that this subclause does not apply —

- (a) In the case of any trailing unit, to its towbar or to any load the forward end of which is supported by the towing vehicle:
- (b) In the case of a vehicle the load of which does not extend forward of the body, provided no part of the body of the vehicle extends forward beyond the arc of a circle of 1.5 m radius with its centre on the vehicle centre line 7.5 m ahead of the rear axle.



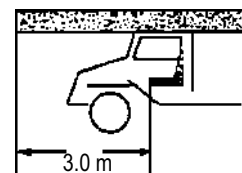
DISTANCE AHEAD OF KINGPIN OR TURNTABLE

48 (4) No person shall operate any articulated vehicle if any part of the trailing unit or its load extends forward beyond the arc of a circle of 1.5 m ahead of the centre of the turntable or kingpin on which the trailer is hinged.



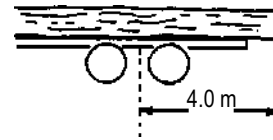
FRONT OVERHANG

48 (5) No person shall operate any vehicle other than a trailer if the vehicle or its load extends more than 3 m forward from the front edge of the driver's seat.



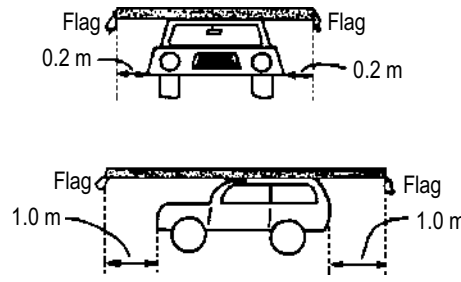
REAR OVERHANG

48 (6) No person shall operate any vehicle if the vehicle or its load extends backward more than 4 m from the rear axle.



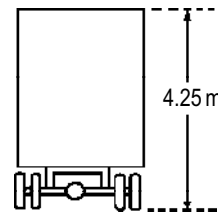
FLAGS TO INDICATE EXCESS DIMENSIONS

50 (1) No person shall operate a motor vehicle under a permission given under regulation 40 hereof, or any motor vehicle the load of which projects more than 1 m backward from the body of the vehicle or more than 1 m forward from the body of the vehicle or more than 200 mm out from the side of the body of the vehicle, unless the projecting load or the excess dimensions of the vehicle are suitably indicated by means of a clean white flag or a red or orange or yellow fluorescent flag. Such flags shall be at least 400 mm long and 300 mm wide.
 50 (2) For the purposes of this regulation any rear vision mirror or direction indicator shall be deemed not to form part of the vehicle.



HEIGHT

48 (7) No person shall operate any vehicle if the vehicle or its load or both rise to such a height as to be liable to damage any construction or wires lawfully over the roadway used by the vehicle, or in any case to a height exceeding 4.25 m from the ground.



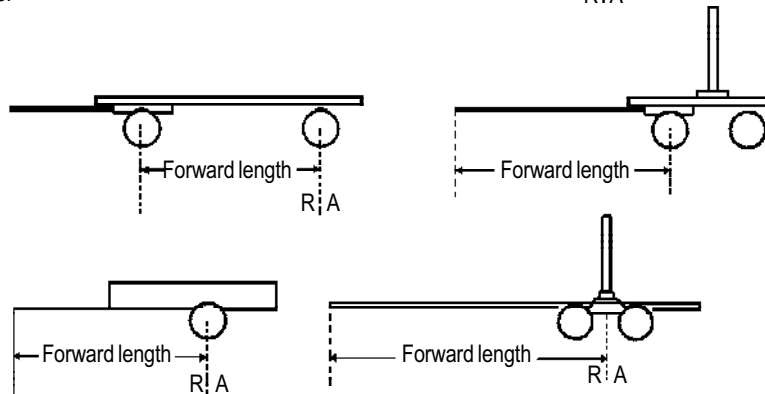
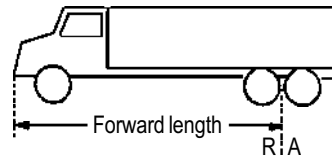
DEFINITION OF FORWARD LENGTH

(a) In relation to a motor vehicle other than a trailing unit, means the distance from the rear axis to the foremost part of the vehicle or its load, whichever is the greater;

(b) In relation to a trailing unit the front axle, of which is steered by the towbar, means the greater of the following distances:

- (i) From the front axle of the trailing unit to the point of attachment of the towbar to the towing vehicle;
- (ii) From the rear axis of the trailing unit to the front axle;

(c) In relation to any other trailing unit to the point of attachment to the towing vehicle.



FORWARD LENGTH (VEHICLE COMBINATIONS)

48 (10) No person shall operate any combination of vehicles if the forward length of that vehicle in the combination with the greatest forward length -

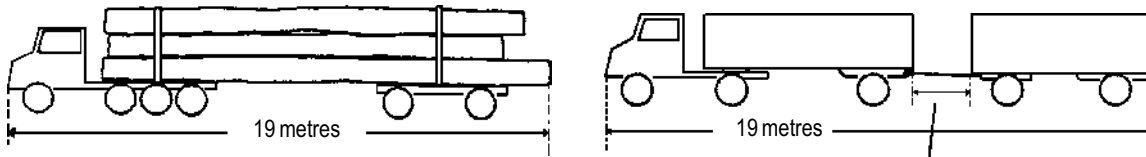
- (a) exceeds 7.4 metres; or
- (b) exceeds 6.8 metres if the combination includes another vehicle with a forward length exceeding 4.7 metres; or
- (c) exceeds 6.2 metres if the combination includes another vehicle with a forward length exceeding 5.5 metres.

ACCEPTABLE COMBINATIONS FOR FORWARD LENGTH

- 7.4 metres with 4.7 metres
- 6.8 metres with 5.5 metres
- 6.2 metres with 6.2 metres

OVERALL LENGTH

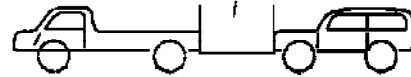
48 (11) No person shall operate any combination of vehicles if the total length of the combination together with its load exceeds 19 metres.



LENGTH BETWEEN VEHICLES BEING TOWED

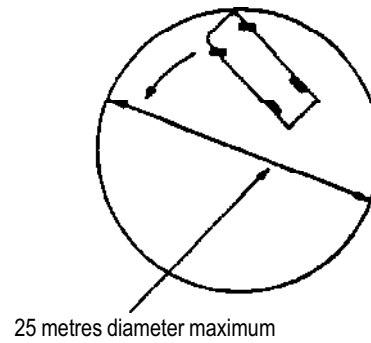
48 (12) No person shall operate any combination of vehicles if the space between any two vehicles in the combination exceeds 4 metres. For the purposes of this subclause, any towbar, rope, wire, or chain used to connect two vehicles together shall be deemed not to part of either vehicle.

Provided that this subclause shall not apply to two vehicles which are designed or being used to support a common load.



TURNING CIRCLE

48 (13) Except in the case of a vehicle first registered before the 1st day of January 1971, no person shall operate any motor vehicle or combination of motor vehicles if the vehicle or combination is not capable of completing a 360° turn without projecting outside the circumference of a circle of 25 metres diameter.



OVERDIMENSION VEHICLES AND LOADS

Vehicles or loads which exceed these dimensions may not travel on New Zealand roads unless they have a permit from the Secretary for Transport, Chief Traffic Officer or other authorised person and unless they abide strictly by all the conditions on the permit.

APPENDIX B: MAXIMUM VEHICLE AND AXLE WEIGHTS

AXLES		WHEELS	
Class I	Class II	(S) and (T)	(S) and (T)
5400	5000	(S) - half axle limit + 500 kg	(S) - half axle limit + 500 kg
8200	7300	(4) - quarter axle limit + 250 kg	(4) - quarter axle limit + 250 kg
9500	8200		

Single-tyred axle - two single tyres
 Twin-tyred axle - four tyres or two tyres larger than 1300 x 24 or 1400 x 20
 Oscillating axle - four separate wheels

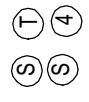
GROSS and maxima for any grouping of axles

Distance from first to last axle of any group (Metres)	Maximum sum of axle weights	
	Class I	Class II
16.0 or more	39 000	39 000
14.4 or more	38 000	39 000
13.0 or more	37 000	37 000
11.8 or more	36 000	36 000
10.8 or more	35 000	35 000
10.0 or more	34 000	34 000
9.4 or more	33 000	33 000
8.8 or more	32 000	32 000
8.2 or more	31 000	31 000
7.6 or more	30 000	30 000
7.0 or more	29 000	29 000
6.4 or more	28 000	28 000
5.2 or more	26 000	26 000
3.6 or more	21 500	19 000
2.4 or more	17 500	15 000
1.6 or more	15 500	13 500
1.0* or more	14 500*	12 500*
Less than 1.0	Limits as for 1 axle	

BRIDGE LIMITS (Gross and maxima for any grouping of axles)

	Percentage of Class I						
	90%	80%	70%	60%	50%	40%	30%
35 100	32 300	27 300	23 400	19 500	15 600	11 700	
34 200	30 400	26 600	22 800	19 000	15 200	11 400	
33 300	29 600	25 900	22 200	18 500	14 800	11 100	
32 400	28 800	25 200	21 600	18 000	14 400	10 800	
31 500	28 000	24 500	21 000	17 500	14 000	10 500	
30 600	27 200	23 800	20 400	17 000	13 600	10 200	
29 700	26 400	23 100	19 800	16 500	13 200	9 900	
28 800	25 600	22 400	19 200	16 000	12 800	9 600	
27 900	24 800	21 700	18 600	15 500	12 400	9 300	
27 000	24 000	21 000	18 000	15 000	12 000	9 000	
26 100	23 200	20 300	17 400	14 500	11 600	8 700	
25 200	22 400	19 600	16 800	14 000	11 200	8 400	
23 400	20 800	18 200	15 600	13 000	10 400	7 800	
19 400	17 200	15 100	12 900	10 800	8 600	6 500	
15 800	14 000	12 300	10 500	8 800	7 000	5 300	
14 000	12 400	10 900	9 300	7 800	6 200	4 700	
13 100	11 600	10 200	8 700	7 300	5 800	4 400	

NOTE: If axles in this distance include a single-tyred axle paired with twin-tyred or oscillating axle, special limits apply:
 (Also, the maximum weight permitted on a pair of single-tyred axles within this distance is the sum of the individual weights allowed on each axle.)



Class I	Class II
12 000	11 000
13 000	12 000

APPENDIX C:



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

Colour: Black lettering and symbol on red background or alternatively white lettering and symbol on red background.

In all other aspects the label shall comply with the requirements of NZS 5417:1980 or NZS 5417:1986

APPENDIX D: **MEANS OF COMPLIANCE WITH THE CODE**

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

1. The design of any new tank wagon, or the assessment of any existing vehicle, for use under this code is to be carried out by a registered engineer or a registered engineer's associate with relevant experience in the road transport industry. Completed designs and assessments are to be forwarded, via District Inspectors of Dangerous Goods, to the Chief Inspector of Dangerous Goods who will rule on the acceptability of the design and determine the types of operations that the vehicle may be used in.
The person seeking the approval of the Chief Inspector will be expected to provide the following information.
 - (a) Two copies of the general assembly drawing of the tank wagon for which approval is sought including, where appropriate, the anticipated prime mover to be used. This drawing shall show at least:
 - (i) all vehicle dimensions;
 - (ii) axle weights for the fully laden vehicle;
 - (iii) tyre types and sizes for each axle;
 - (iv) the gross vehicle mass and/or gross train mass as declared by the vehicle's manufacturer.
 - (v) flow diagram or pipework schematic of layout of tank, pipework, valves, etc.
 - (b) 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 drawings showing any modifications to be made before the tank wagon enters service.
 - (c) The design calculations for the rear bumper.
 - (d) The design calculations for the tank mounting arrangements.
 - (e) The roll stability criteria assessment.
 - (f) The Ministry of Transport, Marine Division tank design approval number(s) for the tank(s) that the tank wagon has been designed to carry.
 - (g) If available, the registration number of chassis number of the vehicle concerned.
 - (h) The identification of the registered engineer or the registered engineer's associate responsible for the design or assessments.
 - (i) The identification of the registered engineer or registered engineer's associate to be responsible for the supervision of construction of the tank wagon.
2. After the Chief Inspector of Dangerous Goods has indicated his acceptance of the

design, or modification. construction may proceed under the supervision of a registered engineer or registered engineer's associate. Upon completion of the tank wagon, the Chief Inspector shall be notified of the registered number of the vehicle and the Marine Division, Ministry of Transport, official tank number(s) which the vehicle has been designed to carry. This information will be noted on the Ministry of Transport Automotive Survey Section field card for the vehicle concerned.

Before the tank wagon enters service it will be inspected by Dangerous Goods Inspectors for compliance with the Dangerous Goods (Class 2 - Gases) Regulations 1980 and with the requirements of this code. This inspection will include:

- (a) The obtaining of a written declaration from the registered engineer or registered engineer's associate responsible for the supervision of construction of the tank wagon that the tank wagon has been constructed according to the approved design and drawings and in accordance with this code;
- (b) The registration number of the tank wagon;
- (c) A check for compliance with Dangerous Goods Regulations, including:
 - (i) diesel engine prime mover;
 - (ii) wired glass or other approved glazing in the rear windows of the cab;
 - (iii) fuel tank protection and fuel pick up arrangements;
 - (iv) exhaust system location and discharge;
 - (v) battery security and cover;
 - (vi) battery isolation switch;
 - (vii) position of generator, switches and fuses;
 - (viii) wiring insulation;
 - (ix) flame-proof torch;
 - (x) fire extinguishers;
 - (xi) service and product transfer arrangements;
 - (xii) tank markings.
- (d) A check for compliance with this code including:
 - (i) windscreen wiping, washing and demisting arrangements;
 - (ii) brake system arrangements;
 - (iii) fifth wheel type and rating.

NOTE: These checks may also form part of the Ministry of Transport certificate of fitness inspection of the vehicle. At the vehicle's first and all subsequent certificate of fitness inspections particular attention will be paid to:

- (i) cab rear window glazing;
- (ii) battery security and cover;
- (iii) operation of the battery isolation switch;
- (iv) wiring insulation;
- (v) windscreen wiping, washing and demisting;

- (vi) brake system arrangements;
- (vii) fifth wheel type and mountings;
- (viii) tank mounting integrity.

3. The vehicle shall be operated and inspected in accordance with the requirements of this code, and all records of inspection required by this code shall be kept by the vehicle owner or owner's agent for inspection as a requirement by the Chief Inspector of Dangerous Goods. The inspections required are:

- (a) Each month — the tank wagon operator shall:
 - (i) inspect any flexible hose used in the transfer system for damage and wear and for electrical conductivity (if applicable);
 - (ii) inspect any earthing straps for continuity and serviceability;
- (b) Every three months — the tank wagon shall be inspected by a tradesman automotive engineer for continued compliance with this code. Particular attention should be paid to those items mentioned in section 2 of this appendix;
- (c) Every six months — present the vehicle to the Ministry of Transport Automotive Survey Section for its certificate of fitness inspection;
- (d) Pipework and flexible hoses shall be tested in accordance with paragraph 3.5.

NOTE: Following the hydrostatic tests specified in (iv) and (v) above, all joints in the LP gas transfer system shall be subjected to a soap bubble test with the system pressurised to 2350 kPa.

APPENDIX E: TRANSPORT OF UNODORISED LP GAS

In addition to the requirements of this code, the following are conditions for the transport of LPG without an odorant added to specifically indicate the presence of LP gas at all concentrations above 20% of the lower flammable limit.

Each case of transport of unodorised LP gas must be approved by the Chief Inspector, generally to conditions set out below, but subject also to further conditions as warrants each specific case.

1. Conspicuous signs are required on at least two sides of tank warning that the contents are unodorised. Sign to be of different colour to main LPG sign (i.e. red) or otherwise highlighted.
2. The tank wagon shall not be parked in a built-up or residential area or within 8 m of a source of ignition.
3. The tankwagon route to be most direct and suitable.
4. Road transport authorities and fire services in the areas where shipments are made, including loading and unloading locations, are to be notified of the identification of the vehicle, the route to be used, discharge locations, estimated times and frequency of trips to enable appropriate action in the event of emergencies.

APPENDIX F: **TRANSPORT OF CYLINDERS**

In general, there are two methods of transporting cylinders manifolded together in a cascade on a semi-trailer, truck or trailer. These are:

1. As individual cylinders under regulations 14 and 46 (for cylinders containing flammable gas of the Dangerous Goods (Class 2 - Gases) Regulations 1980. All cylinder valves to be closed except when charging or discharging (vehicle stationary). A quick acting shut-off valve may be fitted to the cylinder in addition to the normal cylinder valve. Cylinders are to be restrained and valves protected on a vehicle.
2. In bulk (total capacity over 250 L) — cylinders are manifolded together and individual valves left open. This is a tank wagon and the requirements of this code shall be followed.

Cylinders must be properly restrained (preferably individually) in such a manner that they cannot contact each other — cylinder mounts and any steel supporting framework (e.g. demountable systems) to withstand loads as in paragraph 2.9.3 of this code. (Separation distance shall be sufficient to prevent water pooling and corroding the steel.)

Cylinders, valves and pipework must be protected from roll over damage. All equipment must be contained within the envelope of the retaining structure or framework. Any enclosed spaces must be adequately ventilated.

Trailers (other than semi-trailers) require approval of the Chief Inspector for each application.

In both cases, the following requirements are to be met:

- (a) Cylinders (up to 250 L each) shall be approved under the Dangerous Goods (Class 2 - Gases) Regulations 1980 (see the *Guide to Gas Cylinders*). Cylinders or vessels over 250 L are to be approved by the Maritime Division, Ministry of Transport.
- (b) Trailers with total cylinder capacity below 250 L are to be of a good standard of design and condition, including protected wiring.
- (c) Fire extinguishers to be carried on tank wagons transporting flammable gas in accordance with clause 2.5 of this code.
- (d) Specific approval from the Chief Inspector is required if the trailer is to be parked and connected to the storage or supply. In this case, a breakaway coupling, non-return valve or similar is required in the connection line to prevent unacceptable gas loss if the line breaks. Alternatively, a break interlock shall be installed such that the vehicle cannot be moved if connected to static storage or pipework. The supply or discharge location is to be isolated and constructed in accordance with the Dangerous Goods (Class 2 - Gases) Regulations 1980.
- (e) Labelling to comply with Dangerous Goods (Labelling) Regulations 1978. Design approval is required for each proposal (information to be supplied as Appendix D of this code, including details of the cylinders) and the tank wagon is to be inspected and approved prior to entering service.

APPENDIX G: **TRANSPORT OF HIGH PRESSURE COMPRESSED GASES**

This appendix applies to the transport of dangerous goods (Class 2B - Flammable Permanent Gases), e.g. hydrogen, natural gas, in bulk (i.e. over 250 L at high pressure).

These are to meet the following requirements:

1. Tractor units will comply with section 2 of this code.
2. Cylinders with individual capacities below 250 L shall be approved under the Dangerous Goods (Class 2 - Gases) Regulations 1980 (see *Guide to Gas Cylinders*).
3. Tanks, tubes or cylinders (pressure vessels) with individual capacity over 250 L shall comply with the requirements of the Marine Division, Ministry of Transport.
4. Tank, tube or cylinder design shall comply as follows:
 - (a) Maximum permissible pressure is that attainable at 65°C (reference temperature);
 - (b) Filling pressure is at 15°C;
 - (c) Vessel shall be filled such that if it reaches 65°C, the pressure shall not exceed 85% of the hydrostatic test pressure.
5. Pressure vessel mountings and any supporting framework) e.g. for demountable systems) shall withstand loads as in paragraph 2.9.3 of this code.
6. Valves and pipework shall be protected from roll over damage.
7. Specific approval from the Chief Inspector is required if the trailer is to be left parked and connected to the storage or supply. A breakaway coupling, non-return valve or similar is required in the connection line to prevent unacceptable gas loss if the line breaks. Alternatively, a brake interlock shall be installed such that the vehicle cannot be moved if connected to static storage or pipework. The supply or discharge location shall be isolated and constructed in accordance with the Dangerous Goods (Class 2 - Gases) Regulations 1980.
8. A fire extinguisher to be carried in accordance with clause 2.5 of this code.
9. Labelling shall comply with the Dangerous Goods (labelling) Regulations 1978. In particular the tank wagon shall:
 - (a) Be clearly marked with either the technical or trade name of the contents;
 - (b) Be labelled on both sides and the rear with the dangerous goods “diamond”. See Appendix C.

Design approval is required for each proposal (information to be supplied as in Appendix D of this code) and include details of the pressure vessels. The tank wagon is to be inspected and approved prior to entering service.

APPENDIX H: **TRANSPORT OF CRYOGENIC LIQUIDS**

This appendix applies to the transport of Class 2 - Gases at cryogenic temperatures. A cryogenic liquid is generally defined as having a boiling point below 100°C.

Also refer the Dangerous Goods (Class 2 - Gases) Regulations 1980, regulations 104, 105 and 106 for liquid oxygen. These requirements are generally to be followed for other cryogenics (e.g. nitrogen and argon). Every vehicle shall be an approved type and constructed, equipped and maintained as follows:

1. Truck or tractor unit:
 - (a) For flammable gases, unit shall comply with section 2 of this code;
 - (b) For oxygen unit shall be of substantially incombustible construction and maintained in good condition;
 - (c) For inert gases, unit shall be maintained in good condition.

2. Tank:
 - (a) If maximum working pressure over 200 kPa shall comply with the requirements of the Marine Division Ministry of Transport;
 - (b) For maximum working pressure below 200 kPa tanks shall be designed and constructed to a code accepted by the Chief Inspector, e.g. CGA 341;
 - (c) Product filling ratio shall be as approved by the Chief Inspector (filling ratios from CGA 341 are acceptable);
 - (d) Thermal insulation shall be incombustible and compatible with the product carried.

3. Pipework, valves, fitting and equipment:
 - (a) Shall comply with an acceptable code, e.g. CG341;
 - (b) Shall be suitable for the service, the temperatures and pressures and compatible with the product;
 - (c) Shall be protected from roll-over damage;
 - (d) Safety relief devices shall be of an approved type to MOT requirements and fitted to relieve liquid trapped between valves.

4. Tank mounting, both inner and outer, shall withstands loads as stated in paragraph 2.9.3 of this code or as otherwise approved (mounting design to CGA 341 is acceptable).

5. A fire extinguisher to be carried on tank wagons transporting flammable gas in accordance with section 2.5 of this code.

6. Tank wagon labelling shall comply with the Dangerous Goods (Labelling) Regulations 1978, in particular the tank wagon shall:
 - (a) be clearly marked with either the technical or trade name of the contents;

- (b) Be labelled on both sides and the rear with the dangerous goods “diamond”. See First Schedule of Dangerous Goods (Labelling) Regulations 1978. For flammable liquids see Appendix C.

Design approval is required for each proposal (information to be supplied as in Appendix D of this code) and include details of the pressure vessels. The tank wagon is to be inspected and approved prior to entering service.

RELATED DOCUMENTS

Dangerous Goods (Class 2 - Gases) Regulations 1980 and Amendments.

Dangerous Goods (Labelling) Regulations 1978 and Amendments.

Electrical Wiring Regulations 1976.

Traffic Regulations 1976 and Amendments.

Heavy Motor Vehicle Regulations 1974 and Amendments.

Goods Service Vehicle Constructional Regulations 1936 and Amendments.

Part XI New Zealand Boiler Code *Pressure Vessels Used for Transportation on Land of Pressurised Fluids*.

New Zealand Standard NZS 4701 *Metal arc welding of steel structures*

New Zealand Standard NZS 4711 *Qualification tests for manual metal arc welders*.

New Zealand Standard NZS 5417 *Specification for transportation labels for hazardous substances*.

Tyre and Rim Association Australia — Annual Standards Manual.

Commonwealth of Australia Department of Transportation
— Australian Design Rule 15.

United States Department of Transportation
— Federal Motor Vehicle Safety Standard 103.

United States Department of Transportation
— Federal Motor Vehicle Safety Standard 104.