AS 2809.3:2021

Australian STANDARD®

STANDARDS Australia

# Road tank vehicles for dangerous goods

## Part 3: Road tank vehicles for compressed liquefied gases

This Australian Standard® was prepared by ME-057, Road Tankers For Hazardous Liquids And Gases. It was approved on behalf of the Council of Standards Australia on 14 May 2021.

This Standard was published on 28 May 2021.

The following are represented on Committee ME-057:

Australasian Convenience and Petroleum Marketers Association
Australasian Fire and Emergency Service Authorities Council
Australia New Zealand Industrial Gas Association
Australian Industry Group
Australian Institute of Petroleum
Australian Trucking Association
Chemistry Australia
Commercial Vehicle Industry Association of Australia
Department of Resources (Qld)
Department of Transport and Main Roads, Qld
Engineers Australia
EPA NSW
Gas Energy Australia
Heavy Vehicle Industry Australia
National Bulk Tanker Association
National Heavy Vehicle Regulator
SafeWork SA
Truck Industry Council
Victorian WorkCover Authority (WorkSafe Victoria)

This Standard was issued in draft form for comment as DR AS 2809.3:2020.

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ISBN 978 1 76113 353 4

# Road tank vehicles for dangerous goods

## Part 3: Road tank vehicles for compressed liquefied gases

Originated as part of AS 2090.2—1979 and AS 2090.3—1979.
Revised and redesignated as AS 2809.3—1985.
Previous edition 2017.
Fifth edition 2021.

# Preface

This Standard was prepared by the Standards Australia Committee ME-057, Road Tankers for Hazardous Liquids and Gases, to supersede AS 2809.3:2017.

This document specifies requirements for road tank vehicles transporting compressed liquefied gases. This document is to be used in conjunction with AS 2809.1 (which applies to all road tank vehicles) and any other Part of AS 2809 where more than one hazardous property applies to the dangerous goods being transported.

This document is Part 3 of the AS 2809 series, which comprises six Parts. Part 1 specifies general requirements for all road tank vehicles and Parts 2 to 6 provide specific requirements applicable to particular road tank vehicles. The series is as follows:

AS 2809.1, *Road tank vehicles for dangerous goods, Part 1: General requirements for all road tank vehicles*

AS 2809.2, *Road tank vehicles for dangerous goods, Part 2: Road tank vehicles for flammable liquids*

AS 2809.3, *Road tank vehicles for dangerous goods, Part 3: Road tank vehicles for compressed liquefied gases* (this Standard)

AS 2809.4, *Road tank vehicles for dangerous goods, Part 4: Tankers for toxic and corrosive cargoes*

AS 2809.5, *Road tank vehicles for dangerous goods, Part 5: Tankers for bitumen-based products*

AS 2809.6, *Road tank vehicles for dangerous goods, Part 6: Tankers for cryogenic liquids*

The major changes in this edition are as follows:

(a) Requirements that were duplications of items addressed in other codes, such as baffle requirements in AS 1210, Pressure vessels, were removed.

(b) Section 2 was restructured so that all the requirements for a type of component were grouped together and the requirements for valve systems clarified.

(c) Self-sealing low product loss couplings as an alternate to ACME screwed couplings have been included for flammable gases.

(d) Appendix B has been included to explain the requirements for electrical components and wiring in hazardous zones and highlight the requirements of the AS 60079 series of standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

# Contents

# Australian Standard®

# Road tank vehicles for dangerous goods

## Part 3: Road tank vehicles for compressed liquefied gases

## 1 Scope and general

### 1.1 Scope

This Standard specifies requirements for the design, construction, and inspection and testing of road tank vehicles for the transport of compressed liquefied gases by road. This Standard is complementary to AS 2809.1.

### 1.2 Objective

The objective of this Standard is to provide designers, planners, operators and regulators with technical requirements for road tank vehicles transporting compressed liquefied gases.

### 1.3 Application

In addition to this Standard, road tank vehicles for the transport of compressed liquefied gas shall also conform to AS 2809.1. Where any requirement of this Standard differs from a similar requirement in AS 2809.1, this Standard shall take precedence.

### 1.4 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

AS 1210, *Pressure vessels*

AS 1271, *Safety valves, other valves, liquid level gauges and other fittings for boilers and unfired pressure vessels*

AS 1349, *Bourdon tube pressure and vacuum gauges*

AS 2809.1, *Road tank vehicles for dangerous goods, Part 1: General requirements for all road tank vehicles*

AS 4041, *Pressure piping*

AS D26, *Tube fittings with Dryseal American standard taper pipe and unified threads for automotive and industrial use*

AS/NZS 1596, *The storage and handling of LP Gas*

AS/NZS 1869, *Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas*

AS/NZS 60079.29.2, *Explosive atmospheres, Part 29.2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

ISO 5771, *Rubber hoses and hose assemblies for transferring anhydrous ammonia — Specification*

ISO 10497, *Testing of valves — Fire type-testing requirements*

ANSI/CGA G-2.1-2014, *Requirements For The Storage And Handling Of Anhydrous Ammonia (An American National Standard)*

API 607, *Fire test for quarter-turn valves and valves equipped with non-metallic seats*

EN 13175, *LPG Equipment and accessories — Specification and testing for Liquid Petroleum Gas (LPG) pressure vessel valves and fittings*

UL 125, *Standard for Flow Control Valves for Anhydrous Ammonia and LP-Gas*

UL 132, *Standard for Safety Relief Valves for Anhydrous Ammonia and LP-Gas*

### 1.5 Terms and definitions

For the purpose of this Standard, the definitions given in AS 2809.1 apply.

### 1.6 New designs and innovations

This Standard does not prevent the use of designs, equipment, materials, methods of assembly, procedures and the like that do not conform with the specific requirements of this Standard, or are not mentioned in it, provided the performance requirements specified herein are met.

Where a specific section does not state a performance requirement, use of components which by assessment and design achieve the same level of safety may be used.

## 2 Tanks, accessories and components

### 2.1 General

#### 2.1.1 Tank design

The tank, its supports and connections, shall conform to AS 1210 and with any applicable Standard for the particular cargo, with the following qualifications:

(a) The design pressure shall be not less than the equilibrium vapour pressure for the cargo at a temperature of 46 °C, or not less than 700 kPa. An LP Gas tank shall be designed for propane unless it is dedicated to butane service exclusively.

NOTE 1 For those cargoes whose vapour pressure can be below atmospheric pressure at winter temperatures, care should be taken to account for the possibility of a negative pressure in the tank.

NOTE 2 AS 1210 references AS 2872 which sets out a method for calculating the temperatures and corresponding pressures of fluids in vessels subject to atmospheric and solar heating in the hottest month of the year in various locations in Australia.

(b) The cargo load and static head for calculation of the dynamic loading shall be calculated on the basis of the mass fill ratio specified in Table 2.1.

(c) Except where otherwise approved, the materials of construction shall be steel alloy that is suitable for and compatible with the cargo.

(d) Screwed connections to the tank shall not exceed 50 mm nominal bore, except for fully internal safety valves.

(e) Safety valves shall be protected so that, in the event of overturn onto a hard surface, their opening will not be prevented and their discharge not restricted.

(f) Each tank shall have a reflective bright metal or gloss white painted surface, except that another colour or finish may be used provided that the design service temperature has been adjusted in accordance with the maximum service temperature requirements of AS 1210.

NOTE An absorptivity of 0.3 should be used for a typical white paint finish.

### 2.1.2 Components required

Each tank shall be provided with the following components:

(a) A filling connection.

(b) A discharge connection(s), one of which may also be the filling connection.

(c) An additional dedicated discharge connection of not less than 32 mm nominal bore, which may only be used for maintenance or emergency discharge.

A plugged or capped manual valve may be installed directly on this emergency discharge connection. This connection does not require brake interlock drive away protection.

For existing vessels without a dedicated additional plugged or capped discharge connection, the emergency discharge provision may be provided in piping.

(d) One or more safety valves.

(e) A vapour return connection.

(f) Contents gauging provisions (variable and fixed level).

(g) A pressure gauge.

A liquid-temperature-indicating gauge may be required in certain circumstances.

**Table 2.1 — Tank design data**

| Cargo | Vapour pressure at 46 °C MPa (see Note 2) | Mass fill ratio | | Standard fill level, percent (SFL) | |
|---|---|---|---|---|---|
| | | Tanks less than 5 000 L | Tanks of 5 000 L and over | Tanks less than 5 000 L | Tanks of 5 000 L and over |
| LP Gas of a density at 15 °C: | | | | | |
| 0.5 to 0.52 | | | | | |
| (Commercial propane) | 1.75 | 0.42 | 0.45 | 80 | 85 |
| (Propylene, pure) | | 0.44 | 0.47 | | |
| 0.52 to 0.56 | | | | | |
| LP Gas mixtures (Auto Gas) | 1.75 | 0.46 | 0.49 | 83 | 87 |
| 0.56 to 0.6 | | | | | |
| (Commercial butane) | 0.62 | 0.51 | 0.53 | 87 | 89 |
| Anhydrous ammonia | 1.73 | 0.538 | 0.553 | 85 | 87 |
| Vinyl chloride | 0.62 | 0.82 | 0.84 | — | — |
| Butadiene | 0.41 | 0.56 | 0.58 | 88 | 90 |
| Ethyl chloride | 0.21 | 0.81 | 0.83 | 89 | 91 |
| Anhydrous methylamine | 0.58 | 0.59 | 0.60 | — | — |
| Anhydrous dimethylamine | 0.30 | 0.58 | 0.59 | — | — |
| Anhydrous trimethylamine | 0.31 | 0.56 | 0.57 | — | — |

NOTE 1 The standard fill level is determined from the following equation:

$$SFL = \frac{100 \times \text{mass fill ratio}}{\text{Density of liquid at 5 °C}} \qquad 2$$

NOTE 2 The values of mass fill ratio and the standard fill level for butane are slightly lower than values given in other Standards as the latter have been found to result in an undesirably high liquid level.

### 2.1.3 Suitability

Valves, fittings, components, piping and accessories in contact with the tank's contents shall —

(a) have a design pressure of at least the tank design pressure or hydrostatic relief valve set pressure; and

(b) be manufactured from materials compatible with the cargo.

### 2.1.4 Valves

Valves shall conform to AS 1271 or UL 132 or UL 125 or equivalent for the intended cargo.

All valve bodies directly attached to the pressure vessel shall be of steel, malleable iron or ductile iron, and conform to the following requirements:

(a) Steel, malleable iron and ductile iron shall have a minimum elongation of 15 % in a gauge length of 50 mm.

(b) The wheel or handle of the valve shall be of a material compatible with the valve body.

(c) Seatings used in safety valves shall not be subject to self-adhesion.

(d) Lubricants shall be compatible with the cargo.

(e) Soft seats, seals, gaskets and diaphragms shall be compatible with the product(s) being handled.

### 2.1.5 Tanker loading connections

Tanker loading connections shall be clearly identified indicating their function.

### 2.1.6 Tank identification

An identification plate or plates conforming to information as required by AS 1210 shall be provided on each tanker together with the following:

(a) The tank design approval number as issued by the relevant authority.

(b) The number of this Australian Standard, i.e. AS 2809.3.

These details may be added to one of the other name plates required.

NOTE The Australian Dangerous Goods (ADG) Code contains further requirements for compliance plates.

## 2.2 Protection against escape of cargo

### 2.2.1 Valve systems

#### 2.2.1.1 General

All openings, except those provided for safety valves and those openings not larger than 1.4 mm in diameter used for pressure gauges and liquid level gauges, shall be fitted with valves in accordance with one of the opening types specified in Clauses 2.2.1.2 to 2.2.1.4.

In all cases, the internal shut-off valve seat, excess flow or non-return shall be located inside the tank or within the tank flange or its companion flange. The internal shut-off valve shall remain intact to minimize loss of cargo in the event of accidental damage to any associated external fittings.

An internal safety control (ISC) valve may be substituted with an internal valve incorporating an Integrated Emergency Shut-down system. Where this alternative is employed it shall use a control source such as gas detectors or measurement of differential pressure, pressure or flow to detect uncontrolled release and be provided with a control mechanism in accordance with Clause 2.2.4. Where used, gas detectors shall be selected, installed and maintained according to AS/NZS 60079.29.2.

#### 2.2.1.2 Liquid in/out flow opening

Where the opening is larger than that of a 25 mm nominal bore pipe, an internal excess-flow valve and a quick-closing internal valve, or an air actuated (ISC) valve, shall be fitted.

Where the ISC valve option is chosen, the opening shall be provided with a minimum of one independently operated positive shut-off valve in addition to the ISC valve, to shut off the line in the event of ISC valve failure. This shut-off valve shall be located as close as practicable to the tank and may be manually operated.

Where the opening is not larger than that of a 25 mm nominal bore pipe, an internal excess-flow valve shall be fitted, together with an external air actuated positive shut-off valve located as close as practicable to the tank.

For dedicated drain connections, an ISC valve plus a manually operated shut-off valve shall be fitted and be located as close as practicable to the tank. The manual valve shall be plugged or capped.

NOTE For pump suction outlets, due to access constraints and the torque required to operate the secondary positive shut-off valve, consideration should be given to installing an air actuator.

#### 2.2.1.3 Liquid in flow only opening; pump bypass return or top fill connection

These connections shall be fitted with openings in accordance with Clause 2.2.1.2 or an internal non-return valve and an air actuated flanged shut-off valve, provided the opening conforms to the following:

(a) It is in the bottom of the tank.

(b) It provides both an internal thread and flange connection.

#### 2.2.1.4 Vapour connections opening

These connections shall be fitted with openings in accordance with Clause 2.2.1.2 or an internal excess flow valve and an air actuated flanged valve, provided the opening conforms to the following:

(a) It is in the bottom of the tank.

(b) It provides both an internal thread and flange connection.

(c) The size does not exceed 50 mm nominal bore pipe.

#### 2.2.1.5 Tubing supplying air actuated valves

Any valve that is actuated pneumatically shall be supplied by polyamide (nylon) tubing that has a rated temperature of not more than 120 °C, arranged to respond to a fire near the tank outlets.

### 2.2.2 Pipeline shut-off valve

A shut-off valve shall be provided at the end of every liquid and vapour transfer pipe including at the end of piping which supplies a hose. Where a hose is not drained of liquid on completion of the transfer operation, it shall be fitted with a manual shut-off valve or lever actuated self-sealing nozzle at the discharge end.

### 2.2.3 Outlet protection

Each connection shall be provided with a protective closure secured by a chain. A bleed system shall be provided between the valve and the closure, see also Clause 2.7.5.

### 2.2.4 Control of tank quick-closing valves

The control mechanism for quick-closing valves shall incorporate at least two remote means of closing. Such remote means of closing shall be either:

(a) provided with a heat sensitive device which will operate to close the valve at a temperature not exceeding 120 °C; or

(b) actuated pneumatically in accordance with Clause 2.2.1.5.

The remote means of closing should be installed at each end of the tank and diagonally opposite each other.

### 2.2.5 Excess-flow valves

Excess-flow valves shall close automatically at a rate of flow of vapour or liquid not exceeding 150 % of the design flow rate of the system and —

(a) incorporate a bypass having an opening not greater than 1.0 mm diameter to allow equalization of pressure; or

(b) have manual means of equalization of pressure.

NOTE It is recognized that certain types of cargo may cause malfunction of excess-flow valves and non-return valves. Any proposal to omit such valves for this reason should be referred to the relevant authority for specific approval.

### 2.2.6 Installation of excess-flow valves

Excess flow valves shall be installed in piping in the following locations:

(a) In the piping on the tanker side of the isolation valve at bulk transfer and vapour return connections outboard of any interconnecting pipework or component such as a pump or a meter.

(b) Adjacent to isolation valves in piping supplying hoses (preferably downstream of the isolation valve).

Any excess flow valve shall be installed so that any liquid or vapour line downstream from it has a flow capacity greater than the rated closing flow of the valve.

NOTE To achieve this flow capacity, the line should normally be not less in diameter than the nominal diameter of the excess-flow valve connection.

## 2.3 Safety valves

### 2.3.1 Provision of safety valves

Safety valves shall be provided as required in AS 1210 with the following qualifications:

(a) A safety valve shall communicate with the vapour space of the tank when the tank is at rest in its normal operating position.

(b) The aggregate discharge capacity of safety valves shall be not less than that determined in accordance with Appendix A.

NOTE Appendix A has been derived from the more general equation given in AS 1210, simplified to treat this specific case.

### 2.3.2 Installation

A safety valve shall be installed in accordance with the following requirements:

(a) The direction of discharge shall be substantially vertical.

(b) The safety valve shall be of an internal design unless the cargo is a potential cause of malfunction of any internal components. In such a case, an external valve may be mounted on the end of the tank, provided that the external components are guarded from possible damage as specified in AS 1210.

(c) Except for any measures necessary to prevent ingress of rainwater, venting shall be direct to atmosphere., The escaping vapour shall not impinge on the tank.

(d) Where a recess is provided, protection against water ingress shall be provided.

NOTE Packing with grease is not recommended as the grease may affect the valve elastomers.

### 2.3.3 Hydrostatic relief valves

A relief valve shall be installed between each pair of shut-off valves on liquid piping, to relieve hydrostatic pressure to atmosphere. The start-to-discharge pressure of such valves shall be not less than 1.3 times and not more than twice the tank design pressure. The direction of discharge shall be arranged to avoid impingement on tanks, pipes or fittings, and potential injury to personnel. An orifice of 3 mm maximum size shall be provided at the inlet of any hydrostatic pressure-relief valve to limit the discharge in the event of valve failure. Where it is not desirable to discharge the product to atmosphere, especially for safety or environmental reasons, the hydrostatic pressure may be relieved directly into the supply tank, with the proviso that the hydrostatic relief valve shall be of a constant-differential pressure type.

## 2.4 Contents gauges

### 2.4.1 General

Each tank shall be fitted with a fixed liquid level gauge to indicate the standard fill level as specified for the particular gas in Table 2.1. A variable liquid level gauge shall also be provided on every tank to indicate the contents of the tank at varying levels. The variable liquid level gauge shall not be used as the determination of standard filling level.

Electronic gauges may be used so long as the above is achieved.

NOTE 1 Storage and handling codes for specific cargo materials, e.g. AS/NZS 1596 or AS/NZS 2022, describe the various procedures available for the control of filling and the prevention of overfilling.

NOTE 2 Gauges are available which are marked so that the liquid temperature can readily be taken into account to determine the actual filling level, based on the maximum permitted filling ratio.

### 2.4.2 Fixed liquid level gauges

Where the fixed liquid level gauge requires an internal product level-sensing point to determine the maximum filling limit, this shall be located so that error in the indicated contents level is the minimum possible.

### 2.4.3 Variable contents gauges

Variable contents gauges shall be designed for transportable applications. Where the fixed liquid level gauge requires an internal product level-sensing point this shall be located so that error in the indicated contents level is the minimum possible.

### 2.4.4 Gauge bleed hole

The bleed hole for a contents gauge shall be not larger than 1.4 mm diameter. The bleed control valve spindle shall be such that it cannot be completely disengaged in normal operation.

### 2.4.5 Marking

A marking shall be provided on or near each fixed-level gauge to indicate the standard permitted filling level shown by that gauge, and reading “SFL ... %”. The numerical value quoted shall be that given in Table 2.1 for the particular cargo.

## 2.5 Other Gauges

### 2.5.1 Pressure gauge

Each tank shall be provided with at least one pressure gauge conforming to AS 1349 and arranged to indicate the pressure in the vapour space. The operating pressure shall fall within the middle third of the graduated range of the gauge. The connection between the gauge and the tank shall not exceed 1.4 mm diameter unless fitted with an excess-flow valve.

NOTE Particular care should be taken to ensure that materials used internally in a pressure gauge are compatible with the cargo.

### 2.5.2 Temperature gauge

Tanks that may be filled with the aid of a variable-level gauge to a level above that of the fixed-level gauge shall be provided with a temperature gauge having a scale range of at least –20 °C to +50 °C. The sensing device of the temperature gauge shall be installed in a pocket welded in place. The sensing device should be located at approximately the half-full level.

## 2.6 Manual shut-off valves

Manual shut-off valves shall be provided with a handwheel or lever, fixed to the valve.

Where a quarter turn, lever operated valve is fitted, the arrangement of the lever shall be such that the valve is open when the lever aligns with the axis of the pipe.

Where a lever operated valve is fitted it shall not be possible to release cargo inadvertently.

## 2.7 Pipework and pipe fittings

### 2.7.1 Design

The design of pipework shall conform to AS 4041 and with the following qualifications:

(a) The design pressure shall be not less than the greatest of —

  (i) the design pressure of the tank;

  (ii) the maximum pressure imposed from other sources, e.g. the pump; and

(iii) the operating pressure of the hydrostatic relief valve.

(b) Pipework shall be designed to allow for expansion, contraction and vibration.

(c) Where stress corrosion cracking may occur in service because of the particular pipe material or pipe contents, heat treatment shall be carried out in accordance with AS 4041.

NOTE AS/NZS 2022 includes a discussion of the suitability of materials for use with anhydrous ammonia.

(d) Screwed pipes shall be at least schedule 80 or equivalent.

(e) Welded pipes shall be at least schedule 40 or equivalent.

### 2.7.2 Joints

Joints in rigid pipework shall be welded, screwed taper-to-taper, flanged, or made with a ground-face union, provided that —

(a) where the nominal bore of the pipe exceeds 50 mm, screwed joints shall not be used unless unavoidable, e.g. for the mounting of essential auxiliary equipment having screwed connections; and

(b) pipe-jointing compounds and gaskets shall be compatible with and suitable for use with cargo, e.g. —

(i) such joint or compound for use with a flammable gas shall be capable of withstanding a temperature of 600°C; and

(ii) copper-bearing materials shall not be used for anhydrous ammonia service.

NOTE Statutory regulations in some states permit only those welders who have been certificated in accordance with AS 1796 to weld pressure piping.

### 2.7.3 Testing of pipework

Pipework shall be tested for leaks as follows:

(a) Prefabricated pipework shall be tested hydrostatically at 1.5 times the pipework design pressure before assembly to the tanker.

(b) Pipework shall be tested, after assembly to the tanker, with air or inert gas at 700 kPa.

(c) Following the air test, a pre-delivery pressure test shall be made in a safe open-air location, using the vapour of the intended cargo, at a pressure not less than the equilibrium pressure at 15 °C.

(d) A final check for leakage shall be made when the tanker is initially being filled with the cargo for which it is intended.

### 2.7.4 Flexible pipe connections

Flexible connections in piping shall be used only where necessary to absorb vibration, or where rigid connections are impracticable, and be either metal flexible connections or rubber hoses. Individual lengths shall not exceed 1 m and be of a maximum bore 50 mm. Rubber hoses shall conform to Clause 2.9.

### 2.7.5 Bleed valves

Any bleed valve used for venting pressure in pipelines shall have an opening not greater than 6 mm diameter. The direction of discharge shall be arranged to avoid impingement on tanks, pipework or fittings, and potential injury to personnel.

## 2.8 Pumps and compressors

### 2.8.1 Suitability

Pumps and compressors intended for handling the tanker's cargo shall be suitable for use with the cargo.

### 2.8.2 Pressure limitation

In addition to the specific requirements of Clauses 2.8.3 and 2.8.4, pump and compressor installations shall incorporate an automatic means to prevent the design pressure of the tank from being exceeded.

### 2.8.3 Pumps

Pump installations shall incorporate the following:

(a) A pressure gauge conforming to Clause 2.5.1 and provided with a similar flow restriction, located on the discharge side of the pump before any piping external pressure relief or shut-off valve.

NOTE The gauge should be liquid-damped.

(b) A constant-differential bypass valve installed in the pump discharge of any pump which can generate a pressure in excess of any downstream component's pressure rating and delivering to the pump's supply tank or to the suction side of the pump through a line of sufficient size to carry the full capacity of the pump, but allowing for the flow restrictions through the bypass valve.

(c) Where both an internal bypass valve is fitted in the pump and an external bypass valve is fitted returning flow to the tank. The external bypass valve shall have the lower set point.

### 2.8.4 Compressors

Compressor installations shall conform to the following requirements:

(a) The compressor shall draw from and discharge to a vapour space.

(b) Means shall be provided to prevent liquid from entering the compressor suction. Where such provision is not integral with the compressor, a liquid trap shall be installed as close as possible to the compressor in the suction line.

(c) Pressure gauges conforming to Clause 2.5.1 and provided with a similar flow restriction shall be installed on both the suction and the discharge side of a compressor.

NOTE 1 The effect of pipe stress induced by vibration should be considered.

NOTE 2 Gauges should be liquid-damped.

### 2.8.5 Location of controls

Power driven pumps and compressors shall be provided with controls that conform to the following requirements:

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

(b) A clearly marked and easily accessible emergency stop for the engine or motor shall be provided at the discharge side of the vehicle.

## 2.9 Transfer hoses and hose couplings

### 2.9.1 Transfer hose

Transfer hoses provided with the tanker for cargo deliveries shall be compatible with the cargo.

### 2.9.2 Hose assembly testing

Transfer hoses shall be periodically inspected and tested as follows:

(a) Visually inspected for damage over the entire length at intervals not exceeding one month.

(b) For LPG hoses, tested or replaced in accordance with AS/NZS 1596.

NOTE Requirements for all hoses are to be found in the ADG code.

### 2.9.3 Protection of hoses

The tanker shall incorporate provision for the stowage and protection of transfer hoses during transit.

### 2.9.4 Cargo transfer protection

For LP gas, provision shall be made to ensure that all flow is shut off at the tanker in conjunction with the cargo transfer protection requirements of AS/NZS 1596.

For cargo other than LP gas where an emergency shut down system exists on the storage installation, provision shall be made to ensure that flow is shut off at the tanker and storage under emergency shut down.

# 3 Flammable gases

## 3.1 Valves

Any ball valve for flammable gas duty shall be of a “fire-safe” type determined in accordance with ISO 10497, API 607 or equivalent for the intended cargo. Other types of valves should conform to UL 125 or equivalent for the intended cargo.

## 3.2 Pumps

For details of pump-driving mechanisms refer to AS 2809.1.

Pumps which have been tested under no flow and dry running and the temperature obtained at 60 °C ambient that do not exceed the temperature class for cargo are deemed to conform to the requirements of AS 2809.1 for pump pressure and controls.

NOTE Refer to AS/NZS 80079.20.1 for the temperature class of gases.

## 3.3 Transfer hose

Hoses used as transfer hoses for LP Gas shall conform to AS/NZS 1869 or other equivalent Standard together with the requirements for maximum allowable extractables specified in AS/NZS 1869.

## 3.4 Transfer hose couplings

Transfer hose couplings for LP Gas service shall be either an ACME screw thread type or conform to EN 13175 or other international standard for low loss (dry-brake) couplings.

Where an ACME screw thread is used for a transfer hose coupling the thread sizes shall be as follows:

(a) For liquids: $3^1/_4$ or $1^3/_4$ inches.

(b) For vapour: $2^1/_4$ or $1^1/_4$ inches.

Where non ACME couplings are used, suitable adapters to ACME thread shall be available for emergency response purposes.

NOTE Industry emergency response vehicles carry suitable adapters.

## 3.5 Electrical bonding and earthing

### 3.5.1 Electrical bonding

The electrical resistance between the tank and the tanker chassis, prime mover chassis, or trailer undercarriage, and between the tank and the connection of the tanker pipework to the delivery hose, shall not exceed 10 Ω.

### 3.5.2 Earthing point

At least one non-corrodible bare metal lug shall be welded to an integral part of the tank for use as an earthing point, unless the tanker incorporates an earth wire reel system. The lug shall be in a position convenient for the operator.

## 3.6 Hazardous area classification

See Appendix B for information on hazardous area classification.

# 4 Anhydrous ammonia road tank vehicles

## 4.1 Valve material

Non-ferrous metallic material may be used for the body of a valve for ammonia service provided that the material is compatible with ammonia and is not subject to corrosion or other forms of deterioration.

NOTE AS 2022 discusses the suitability of materials. Copper, silver, zinc, and their alloys, do not meet the criteria for suitability.

## 4.2 Transfer hose

Hose used as a transfer hose for anhydrous ammonia shall conform to ISO 5771 or ANSI/CGA G-2.1-2014.

## 4.3 Transfer hose coupling

Transfer hose couplings shall have an ACME screw thread.

NOTE The following ACME thread sizes are recommended:

(a) For liquid: 3 ¼ or 1 ¾ inches.

(b) For vapour: 2 ¼ or 1 ¼ inches.

## 4.4 Temperature gauge

Each tank shall be fitted with a temperature gauge irrespective of the intended method of checking filling.

## 5 Inspection and maintenance

For hose inspection and testing requirements refer to the ADG code. For all other inspection and maintenance requirements refer to AS 2809.1.

## 6 Chlorine road tank vehicles

All connections and pipework shall be contained in recesses that fall within the outline of the pressure envelope.

Road tank vehicles designed for the transportation of liquid chlorine shall conform to the requirements of this Standard with the exception of —

(a) the requirements for contents gauges in Clauses 2.1.2(f) and 2.8;

(b) the requirements for pressure and temperature gauges in Clause 2.7; and

(c) the requirements for a secondary discharge provision in Clause 2.1.2(c).

Due to the lethal nature of chlorine the number and size of any connections shall be kept to the minimum practicable.

# Appendix A
(normative)

# Calculation of aggregate discharge capacity for safety valves

This Appendix is derived from the requirements of AS 1210 and provides equations for some common applications. For applications that are not covered below, the requirements of AS 1210 shall apply. In case of conflict, AS 1210 shall take precedence.

The aggregate discharge capacity in cubic metres per minute of air at 121 % of the set pressure for safety valves to be used on uninsulated tanks, shall be calculated from the following equation:

$$q_v = GA^{0.82} \quad \text{A.1}$$

where

$q_v$ = required flow capacity of the valves, in cubic metres per minute of air at 15 °C and 101.5 kPa (absolute)

$G$ = factor for the particular gas [see items (i) to (ix)]

$A$ = total outside surface area of tank, in square metres

Where the surface area is not stamped on the nameplate or where the marking is not legible, the area shall be calculated from one of the following equations:

(a) Cylindrical vessel with hemispherical heads —

Area = overall length × outside diameter × 3.1416 A.2

(b) Cylindrical vessel with semi-ellipsoidal heads —

Area = (overall length + 0.3 outside diameter) × outside diameter × 3.1416 A.3

The value of $G$ for tanks for the following gases, for the design pressure shown, is as follows:

(i) Propane, propylene and LP Gas mixtures — 10.66 (1.75 MPa).

(ii) Butane — 8.98 (0.70 MPa).

(iii) Anhydrous ammonia — 4.39 (1.73 MPa).

(iv) Vinyl chloride — 10.41 (0.70 MPa).

(v) Butadiene 1:3 — 8.40 (0.70 MPa).

(vi) Ethyl chloride — 9.03 (0.70 MPa).

(vii) Anhydrous methylamine — 5.10 (0.70 MPa).

(viii) Anhydrous dimethylamine — 6.26 (0.70 MPa).

(ix) Anhydrous trimethylamine — 8.62 (0.70 MPa).

# Appendix B
(informative)

# Hazardous area classification

## B.1 General

The hazardous area classification for a tanker may vary based on a number of factors some of which are outlined below:

(a) Type of cargo(s) the tanker will carry — Tankers with heavier than air cargos such as LP gas will have different hazardous zones than those with lighter than air cargos such as ammonia.

(b) Nature of operations — Classification may vary for cargo loading, cargo unloading and in transit. Procedures should include provisions to limit release quantities and rates of release during normal operations including during connection, product transfer and disconnection.

Procedures may establish exclusion zones in which ignition sources are to be controlled.

(c) Features on the tanker — Tankers with cargo pumps or low loss fill system may have different zones to tankers without these features.

## B.2 Classifications

Variances in product carried and tanker design features will lead to different hazardous area classifications for different tankers. Therefore, hazardous area classifications are not defined in this Standard.

Relevant properties of gases are available in AS/NZS 80079.20.1.

Requirements for hazardous area classification can be found in AS/NZS 60079.10.1.

The annexes and supplements of AS/NZS 60079.10.1 contain numerous examples of area classification which might be applicable. Particular aspects of the hazardous area classification such as the applicable equipment group and temperature class also need to be defined based on both the cargo being transported and the areas the tanker may be exposed to during loading and unloading operations.

AS/NZS 60079.14 also provides for electrical equipment that is not suitable for the classified hazardous area to be isolated during periods of product transfer/release where appropriate conditions of control are applied.

The common features that generate a hazardous area and should be considered in an assessment are:

(a) Relief valves including hydrostatic relief valves

(b) Vessel and pipe joints including flanges and screwed joints. In some cases the extent of the zone may vary with the pressure of the contents.

(c) Pump and compressor seals.

(d) Valve glands.

(e) Vent points including fixed level gauges.

(f) Fill connections, the extent of the area may vary on the quantity of product released and rate of release during disconnection.

The following features do not generate a hazardous area:

(i) Within tanks — Non hazardous, as there should never be both a flammable gas and air present simultaneously.

NOTE Adequate purging procedures need to be in place during de-commissioning and commissioning to avoid a flammable atmosphere.

(ii) The vessel wall and fully welded pipe sections.

The location of the hazardous area may be modified by the use of pipeways and vapour barriers.

# Bibliography

AS 1796, *Certification of welders and welding supervisors*

AS/NZS 2022, *Anhydrous ammonia — Storage and handling*

AS/NZS 60079.10.1, *Explosive atmospheres, Part 10.1: Classification of areas — Explosive gas atmospheres (IEC 60079-10-1, Ed.1.0 (2008) MOD)*

AS/NZS 80079.20.1, *Explosive atmospheres, Part 20.1: Material characteristics for gas and vapour classification — Test methods and data*

NATIONAL TRANSPORT COMMISSION. *Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)*

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GPO Box 476 Sydney NSW 2001
Phone (02) 9237 6000
mail@standards.org.au
www.standards.org.au

Printed in Australia

ISBN 978 1 76113 353 4