

Australian Standard[®]

Working areas for gas-fuelled vehicles



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The following are represented on Committee ME-046:

- Australian Automobile Association
- Australian Chamber of Commerce and Industry
- Australian Industrial Truck Association
- Department for Administrative and Information Services, SA
- Department for Transport, Energy and Infrastructure, SA
- Department of Natural Resources and Mines, Qld
- Energy Safety, WA
- Federal Chamber of Automotive Industries
- Gas Association of New Zealand
- International Association for Natural Gas Vehicles
- Land Transport Safety Authority, New Zealand
- LPG Association of New Zealand
- LPG Australia
- Motor Trade Association, New Zealand
- Motor Traders Association of NSW
- Motor Trades Association of Australia
- Roads and Traffic Authority of NSW
- TAFE NSW
- Victorian Police

Additional Interests:

- Auckland University
- Australian Bus and Coach Association
- Gas Utilities

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Working areas for gas-fuelled vehicles

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-046, Gas Fuel Systems for Vehicle Engines, to supersede AS 2746—1999, *Working areas for gas-fuelled vehicles*. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The principal change in this edition of the Standard is the introduction of workshop safety requirements when dealing with Liquefied Natural Gas (LNG) fuelled engines. The layout and content have been restructured to facilitate the introduction of requirements for working areas containing LNG fuelled vehicles.

This edition introduces a new Appendix E that exclusively deals with LNG fuel unloading methods as an addition to the requirements for CNG and LP Gas. This edition also includes a new requirement for the correct disposal and destruction of Gas Compliance Plates once a vehicle is scrapped.

The Foreword sets out certain fundamental considerations that are the basis from which this Standard was developed.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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FOREWORD

PRESUMPTIONS

This Standard is based on the following presumptions:

- (a) The gas fuel system of a vehicle, provided that it is in good repair and leak free, is considered not to constitute any special hazard in a normal garage or working area. Where repair work is carried out on items excluding the gas fuel system the vehicle can be treated in the same manner as any other vehicle.
- (b) Because of the sequence prescribed for installation procedures and intermediate checks, gas escapes in an installation premises will be relatively minor, both in rate and duration. Standards such as AS 1668.2 and various occupational health regulations, specify ventilation rates for automotive workshops that are considerably higher than for basic human comfort. This higher rate is considered to be adequate to disperse and dilute any normal escapes of gas, and is the rate specified in this Standard.
- (c) The different densities of NG and LP Gas are considered to have no effect on the required airflow rates for adequate ventilation, but where LP Gas is present the positioning of the ventilation provisions requires care, having regard to gas density being heavier than air which may gravitate to low areas. NG as a vapour is lighter than air and will rise; however, if the origin of the release is LNG, which is stored under cryogenic conditions, this may be heavier than air for a brief period, due to the extremely low temperature at which it is stored.
- (d) At times it may be necessary to unload gas from a fuel container, e.g. to replace a service valve or fitting, in which case the potential for a considerable gas escape is much greater. Care is necessary to ensure safe dispersal, not only in regard to procedures, but also to the general operating area. In no circumstances is this procedure to be attempted inside a workshop.
- (e) Where a vehicle that has been in service is found to have a gas escape, it cannot be allowed indoors while the escape continues.

FIRE SAFETY

Fire safety is a critical aspect of this Standard and as such incorporates a section detailing requirements for firefighting equipment.

The fire characteristics of gases, particularly LNG, differ radically from those of solids and liquids, so that conventional firefighting methods and equipment may not be useful and in some situations be counter-productive. The provision of inappropriate equipment not only represents a misdirection of effort, but more seriously a false sense of security can be generated, leading personnel to place themselves in danger.

Essential to the consideration of safety in a gaseous fire is that uncontrolled drifting vapour is very mobile; unlike liquids or solids it may travel to an ignition source. Once gas has escaped, dissipation before reaching an ignition source is essential for safety.

Separation distances and the control and elimination of possible ignition sources are vital.

Nearby fires that radiate heat are not important considerations for LNG containers. The insulation of the container will provide adequate protection for anything but the most intense fire. An LP Gas container can tolerate a certain amount of radiated heat influx, but the level is not high. Heating the container will result in an initial discharge through a safety valve or total failure of the container in extreme circumstances.

STANDARDS AUSTRALIA

Australian Standard**Working areas for gas-fuelled vehicles**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for the premises, and procedures for the following types of work or activity associated with gas-fuelled vehicles:

- (a) Converting and equipping vehicles to use gas such as liquefied petroleum gas (LP Gas), or natural gas (CNG and LNG) as an engine fuel.
- (b) Maintenance, servicing and repairs to the gas fuel system, e.g. adjustment, maintenance and replacement of gas system componentry.
- (c) Routine motor vehicle maintenance not involving the gas fuel system, e.g. lubrication, brake repair or wheel alignment, body or windscreen repairs, engine tuning.

NOTE: The operations described in Items (a) or (b) above are undertaken in a specialist gas working area, whereas Item (c) would apply to general service workshops not having any specific requirements for working with gaseous engine fuels.

1.2 OBJECTIVE

The objective of this Standard is to provide constructors, installers, servicing personnel and regulators with the requirements for working areas for gas-fuelled vehicles in order to ensure work on the vehicles is carried out in a safe manner.

1.3 NEW DESIGNS AND INNOVATIONS

Any alternative materials, equipment, designs, methods of assembly or procedures, which do not comply with specific requirements of this Standard or are not mentioned in it but which give equivalent results to those specified, may be acceptable to the Regulatory Authority.

NOTE: Regulatory Authority information is provided in Appendix A.

1.4 REFERENCED DOCUMENTS

The following Standards are referred to in this Standard:

AS	
1210	Pressure vessels
1319	Safety signs for the occupational environment
1668	The use of ventilation and airconditioning in buildings
1668.2	Part 2: Ventilation design for indoor air contaminant control
1851	Maintenance of fire protection systems and equipment
2337	Gas cylinder test stations
2337.1	Part 1: General requirements, inspections and tests—Gas cylinders
2441	Installation of fire hose reels

AS	
2444	Portable fire extinguishers and fire blankets—Selection and location
4265	Wheeled fire extinguishers
4332	The storage and handling of gases in cylinders
AS/NZS	
1221	Fire hose reels
1425	LP Gas fuel systems for vehicle engines
1596	Storage and handling of LP Gas
1841	Portable fire extinguishers
1841.1	Part 1: General requirements
1841.5	Part 5: Specific requirements for powder type extinguishers
1841.6	Part 6: Specific requirements for carbon dioxide type extinguishers
1850	Portable fire extinguishers—Classification, rating and performance testing
1869	Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas
2430	Classification of hazardous areas
2430.3.2	Part 3.2: Examples of area classification—Vehicle workshops, vehicle parking, fuel dispensing stations and aircraft hangers.
2739	Natural gas (CNG) fuel systems for vehicle engines
60079	Electrical apparatus for explosive gas atmospheres
60079.10	Part 10: Classification of hazardous areas (IEC 60079-10:2002, MOD)
ISO	
15500	Road vehicles—Compressed natural gas (CNG) fuel system components
15500-17	Part 17: Flexible fuel line
21012	Cryogenic vessels—Hoses
AGA	
AG807	Approval Requirements for Natural Gas Flexible Hose and Hose Assemblies for Pressures above 2.6 MPa
ASME	Boiler and Pressure Vessel Code, Section VIII, Division 1
ECE R110	Uniform agreement concerning the approval of: - I Specific components of motor vehicles using compressed natural gas (CNG) in their propulsion system - II Vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) in their propulsion system

1.5 DEFINITIONS

For the purpose of this Standard, the definitions given, and the component terms used, in AS/NZS 1425 and AS/NZS 2739, and the following apply.

1.5.1 Container

A pressure vessel, cylinder or tank for the storage of LP Gas/CNG/LNG to be used as fuel for the internal combustion engine.

1.5.2 CNG

Compressed natural gas.

1.5.3 Gas fuel system

A system including the cylinder or container together with all gas components and fittings from the fill connection through to the connection to the air induction system where the gas and air mix. It also includes all of the specialist electrical equipment and wiring necessary for gas operation.

1.5.4 Hazardous area

An area defined and classified in AS/NZS 60079.10 and AS 2430.3.2.

1.5.5 Hold time

The time that will elapse before the LNG fuel pressure inside a container will rise to a pressure at which the safety valve will commence to operate.

1.5.6 Ignition source

A source of energy sufficient to ignite a flammable atmosphere, including naked flames, exposed incandescent material, sparks, electric welding arcs, and electrical or mechanical equipment not approved for use in hazardous locations.

1.5.7 LNG

Liquefied natural gas.

1.5.8 May

Indicates the existence of an option.

1.5.9 NGV

Natural gas vehicle.

1.5.10 Service pit

A pit providing standing access to the underside of a vehicle.

1.5.11 Shall

Indicates that a statement is mandatory.

1.5.12 Should

Indicates a recommendation.

1.5.13 Working area

An area within a specialist gas workshop designated for equipping or conversion of a gas-fuelled vehicle.

SECTION 2 GENERAL SERVICE WORKING AREAS

2.1 APPLICATION

This Section applies to general or specialist automotive working areas and servicing workshops which may be required to do work on the vehicle but not on the gas fuel system, e.g. service station and lubrication bays, premises specializing in engine tuning, suspension, tyres or brakes, body repairs, and the like.

NOTE: Where the gas fuel system of a vehicle is leak free, the vehicle presents no special hazard and may be treated in the same manner as any other vehicle.

2.2 PREMISES

The presence of a normally operating gas-fuelled vehicle within the workshop shall not require any special extension of the normal ventilation, working space, and access to open space outside.

Ventilation rates shall be as set out for garages and workshops in AS 1668.2.

2.3 PREVENTION OF OVERHEATING

When a leak-free condition has been confirmed vehicles undergoing repairs involving welding or the application of heat to any part within 1 m of a gas fuel system component, the component shall be removed or shielded from the source of heat.

Such shielding shall prevent heat transfer to the component and welding arcs or weld splatter coming in contact with the component.

NOTE: When arc welding, a non-conducting shield should be employed to prevent welding currents passing through the fuel system components.

SECTION 3 GAS LEAKAGE PROCEDURES

3.1 APPLICATION

This Section applies to vehicles with a known or suspected gas escape from their gas fuel system.

3.2 PROCEDURES

3.2.1 Known or suspected gas escape

Where a gas escape is known to exist, or is suspected because of odour or some other reason, the service valve(s) or container valve(s) shall be turned off and the owner shall be advised to have the fault rectified at a specialist gas vehicle workshop before any other work can be done. The vehicle shall not be taken indoors, and if indoors shall be removed to an open and well-ventilated area by towing or pushing. No ignition source shall be activated, i.e. the engine shall not be started, no electric switch shall be operated, either to turn it on or off.

NOTES:

- 1 Considerable care is necessary to ensure that every possible source of ignition has been identified before any attempt is made to open up the vehicle. Sparks may be caused by courtesy light switches, boot lights, or by the action of disconnecting the battery, or may be introduced by the towing vehicle.
- 2 Where any attempt is made to isolate a liquid gas escape, there is potential for a cold-burn injury. The person attempting to isolate the leak should wear appropriate personal protection equipment and use tools suitable for the application.

3.2.2 Damaged vehicles

Where a vehicle has suspected damage to the gas fuel system the vehicle shall be left outside the workshop with the service or container valve(s) closed. The vehicle shall be inspected and if necessary made safe by an authorized person.

NOTE: For an LNG fuel system, product remaining in the fuel containers will require prompt removal (unloading) as the increase in temperature over time will result in a vapour release from the pressure relief valve once the product hold time has been exceeded.

SECTION 4 SPECIALIST GAS WORKING AREAS — LP GAS

4.1 APPLICATION

This Section applies to working areas when the equipping or conversion of vehicles to operate on LP Gas, or the maintenance of LP Gas-fuelled vehicle equipment is specifically intended.

Where the vehicle fuel system is totally free of LP Gas, or where it contains only vapour at a pressure less than 100 kPa, special procedures or precautions beyond those normal to a general workshop area shall not be required.

4.2 PERSONNEL

The licensing/accreditation, qualifications, and responsibilities of all persons associated with the installation or servicing of LP Gas equipment or both on motor vehicles shall be in accordance with the relevant statutory regulations.

4.3 EQUIPMENT

The working area shall be provided with sufficient equipment, including personal protective equipment, to ensure a safe working environment and to ensure that the vehicle will be safe when completed. (See Appendix B for an equipment list.)

4.4 PREMISES

The LP Gas working area shall be designated and comply with the following requirements:

- (a) The floor area shall be not less than the maximum vehicle size plus 1.5 m on all sides.
- (b) If the working area does not encompass the entire workshop, the boundary of the designated working area(s) shall be clearly marked on the workshop floor.
- (c) The floor level relative to the surrounding ground contours and levels shall be such that the floor does not constitute a depression in which heavier-than-air vapours could accumulate.
- (d) Any area within 3 m of the working area shall not include any depressions, sumps, basements, unventilated pits, descending stairs or ramps or openings into drainage systems, and the ground shall not be filled with aggregate having a high percentage of voids. The 3 m area shall not extend beyond the property boundary or encompass an opening or doorway into another building.

NOTE: The 3 m distance may be measured around a vapour barrier of 1 m height.

- (e) The working area shall not be above any occupiable space other than a service pit.

NOTE: The use of a service pit or other depression within the LP Gas working area is not recommended.

4.5 VENTILATION

The working area shall be provided with ventilation in accordance with Clause 2.2.

The following general requirements shall also apply:

- (a) The ventilation system shall be started before work commences and left operating during the entire working period.

- (b) Where a service pit is used, the pit shall be provided with a mechanical dilution ventilation system providing in excess of 60 air changes per hour with the air flow sourced from the pit bottom and with the whole of the pit bottom being evenly air swept and without significant dead spots.
- (c) The location and direction of entry and discharge of airstreams for fans and duct systems shall be selected to minimize contamination and hazard.

The power supply to the working area or service pit shall be configured such that power is only available when the ventilation system is operational.

4.6 INCREASED HAZARD

An increased hazard exists if the vehicle fuel system contains gas and any of the following circumstances apply:

- (a) A new gas installation has not been tested for leakage and confirmed to be leak free.
- (b) Fuel system fittings have been disturbed and not tested and confirmed to be leak free.
- (c) Any gas leak is suspected.

Where an increased hazard exists the following general requirements shall apply to a gas working area:

- (i) Ignition sources and air compressor intakes shall be kept out of the working area.
- (ii) The container service valve shall be turned off at all times except when gas is specifically required to be available for checking and testing purposes.
- (iii) Under no circumstances shall heating, welding, or flame cutting be carried out within 1 m of a gas fuel system component unless an appropriate thermal barrier is in place.
- (iv) Work practices shall ensure that hot work activities close to the container do not cause the container temperature to rise more than 10°C above the ambient temperature.
- (v) A sign in accordance with AS 1319 shall be prominently displayed indicating: DANGER—NO SMOKING OR NAKED FLAMES.

Signage shall be displayed at all workshop areas outlining appropriate first aid response in accordance with the Material Safety Data Sheet (MSDS) for the specific product which is handled on site.

4.7 WORK ON THE CONTAINER AND FITTINGS

Any work on the container or its fittings, or both, that may result in an escape of LP Gas shall be conducted in an open area. Any joints or connections shall be leak-tested in accordance with AS/NZS 1425 before the container is returned to service. The vehicle doors, boot lid or the like should be left open after completion of the work until the interior of the vehicle has been determined to be leak free.

4.8 WORK ON THE GAS FUEL SYSTEM

Before any work on any component other than the container is commenced, the service valve shall be turned off and the fuel shall be drained from the service line preferably by running the engine until the fuel is consumed.

Where a connection for piping or a component has been disturbed, the testing procedures of AS/NZS 1425 shall be applied before the installation is returned to service.

4.9 FUEL UNLOADING

The container shall be unloaded of all gas fuel when—

- (a) a leak exists which cannot be stopped by operating the service valve;
- (b) a container component is removed for service or replacement; or
- (c) the fuel container is taken out of service.

NOTE: It must not be assumed that because the contents gauge shows empty or there is no indication of gas pressure in the container, that no fuel is present. Refrigeration effects from rapid blowing-down can leave a residue of unvaporized cold liquid LP Gas in the container.

The method of unloading fuel shall be one of those described in Appendix C as appropriate.

4.10 CONTAINER PURGING

When the fuel container is to be inspected by an inspection station, or scrapped, the container shall be purged with inert gas.

4.11 PURGING INTO SERVICE

At the time of commissioning or repair, and prior to filling with LP Gas, containers shall be evacuated of air.

The required quantity of air shall be evacuated from the container by means of a vacuum pump. An achieved pressure reduction of 68 kPa below atmospheric (510 mm mercury vacuum) would be satisfactory and this vacuum initially held until the LP Gas is filled very slowly to take up the space previously occupied by the evacuated air and thereafter filling is continued to the maximum 80% of container volume level.

NOTE: Not all safety pressure relief valves are designed to withstand the force in the opposite direction created by atmospheric pressure on the outside of the valve when the tank is significantly evacuated.

4.12 STORAGE OF UNPURGED CONTAINERS

Where a container has been removed from a vehicle and has not been purged of all fuel, the container shall be stored in accordance with the following:

- (a) In accordance with the provisions of AS/NZS 1596 for heavier than air flammable gas.
- (b) In the normal attitude as it would be installed in a vehicle, with the safety valve in communication with the vapour space and with the service valve or automatic fuel shut off-device capped with a pressure-proof fitting.
- (c) The safety valve shall not be capped or plugged with a device that will affect the performance of the valve.

NOTE: It is recommended a plastic cap is inserted into the relief valve to stop the ingress of water and/or dirt.

4.13 DECOMMISSIONING AND SCRAPPING

4.13.1 Vehicles

Where a vehicle is to be scrapped, any container and the gas compliance plate fitted to it shall be removed before disposal of the vehicle. Gas compliance plates shall be destroyed.

For decommissioning of LP Gas fuel systems, refer to the method specified in AS/NZS 1425.