



FEEDLOT DESIGN AND CONSTRUCTION

# 38. Fuel and gas storage

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*Diesel tank with a good paint coating, free from rust and damage. A more reflective colour (silver or white) would be preferable.*

*Impervious bunding around fuel storage tanks must be large enough to contain the combined capacity of the tanks plus 20 minutes of fire-control water.*


*LPG tanks with bollard protection from potential vehicle impacts.*

## Introduction

Large quantities of fuels including diesel, petrol, LPG, natural gas and butane are used on feedlots and must be stored safely to protect against environmental harm and to provide a safe working environment. This section provides an overview of the requirements for fuel and gas storage. However, because there are many particular requirements, expert advice should be sought and can often be provided by the fuel supplier.

## Design objectives

Suitable fuel and gas storage should

- protect against any environmental harm
- provide a safe working environment for people
- maintain the integrity of the fuel being stored
- provide adequate supply of fuel for operational requirements
- have adequate access for safe delivery of fuels
- protect against fire hazards.

## Mandatory requirements

Compliance with

- National Guidelines for Beef Cattle Feedlots in Australia (MLA, 2012a).
- National Beef Cattle Feedlot Environmental Code of Practice (MLA, 2012b).
- relevant Commonwealth, state and local authority codes, regulations and relevant Australian standards as applicable to feedlot development. These include
  - Steel tanks for fuel storage need to meet AS 1692-2006 Steel tanks for flammable and combustible liquids. Most tanks used at feedlots fall under Category 2 of these standards: vertical or horizontal tanks of up to 2,500 L capacity, for above ground use, and intended for use on farms and other open space locations.
  - Storage of fuel on land that has an area exceeding 5 ha and is intended for agricultural, horticultural, floricultural or pastoral purposes, and not for resale, is considered a minor storage. Minor storage requirements are dealt with in *AS 1940-2004 – The storage and handling of flammable and combustible liquids*. While full compliance with this standard is not mandatory, if storage tanks are separated by at least 100 metres and each storage tank holds no more than 5000 litres of flammable liquids (petrol) and 10,000 litres of combustible liquids (diesel) compliance is recommended for safety reasons.
  - AS/NZS 1596-2008: The storage and handling of LP gas covers both cylinder and tank storage of LP gas. In many cases, minor storage will apply for cylinders that comply with section 2 of this standard.
  - AS / NZS 1200-2000: Pressure equipment includes the pressure vessel design code for LP gas tanks.

- AS 5601.1-2010: Gas installations – general installations specifies requirements for gas pipelines (under 200 kPa).
- AS / NZS 1869: 2012 – Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas specifies requirements for hose and hose assemblies for LP gas.
- The Work Health and Safety Act (2011) (WHS Act) and the Work Health and Safety Regulations (2011) (WHS Regulations) address worker safety issues associated with fuel storage.

*Four legs on support structure with braces close to their base, legs and bracing straight, in good condition and securely attached. Ladder sound and secure, all rungs present, suitable hand holds near ladder.*

# Design choices

## Protection against environmental harm

The main environmental risk posed by fuel storage is the leakage or spillage of fuel contaminating soil and/or water. To guard against this risk, bunding or other methods of containment of any leakage or spillage from the storage should be provided. While bunding is not compulsory for minor storage on farms, it is strongly recommended and may be required if quantities exceed the minor storage thresholds or if there is a risk of environmental harm in the event of leakage or seepage. The limits for minor storages on open land are 5000 L for flammable liquids (petrol) and 10,000 L for combustible liquids (diesel).

For above ground fuel tanks, the containment must be able to hold the capacity of the largest tank plus the amount of fire-control water that would be discharged in 20 minutes. If two or more tanks operate as a single unit, the combined capacity of these should be used to calculate the bund capacity. The containment should be impervious so that it can hold a spill and allow for fuel recovery.

Bunds need to be structurally stable, including in the event of a fire. Earthen bunds need to be well compacted to minimise seepage. Moderately high bunds are preferred as this minimises the area of fuel burning in the event of a fire.

If earthen bunds are 1 m or more in height, they should have a flat top at least 600 mm wide. Any bund more than 1.5 m high must provide a means for safe and rapid entry and exit. Any pipe that passes through a bund must be designed to prevent excessive stresses as a result of settlement, or expansion in the event of fire exposure. The joint between the pipe and the bund must be sealed to prevent leakage.

The distance between the tank and the top inside edge of the bund should be at least half the height of the tank. Access for emergency vehicles should be provided around and between bunded areas.

Basic spill kits should be kept where minor spillage or leakage from the fuel tank could result in the contents flowing into a watercourse. Fuel suppliers can provide information on commercial spill kits.

*Feet pads above ground and secured to concrete pad with well-braced legs.*

## Provision of a safe working environment

Above ground fuel tanks are often mounted on stands to provide for gravity feed. Safety hazards include the risk of the tank toppling or the tank support collapsing. The support structure for an above ground tank must have suitable, stable foundations considering

*Fuel hose in good condition, with fuel filter and meter to record fuel usage.*

*Fittings, pumps and hoses – fuel dispenser hoses must be of an approved type for the fuel, with an internal bonding wire for dissipating any static electricity charge generated during dispensing.*

the weight of the full tank. The legs of the support must have large enough pads or feet to distribute the weight of the full tank without undue ground settlement. The tank must be soundly attached to the support so that there is no risk of the tank falling off. If the legs of the support fit into a sleeve on the tank, they should be pinned or bolted into position. The structural integrity of the support is enhanced through bracing.

Risk to personnel falling applies mostly to drivers delivering fuel, and employees checking fuel levels and dispensing fuel.

Risks can be lowered by installing a bottom-loading facility, fitting a sight gauge or locating fuel tanks at ground level and dispensing fuel with a pump.

Where a fixed ladder is needed, it should meet the requirements of Australian Standard AS 1657. The ladder needs to be firmly attached to the tank, be at least 300 mm wide, have adequate handrails, provide a platform at the top, start within 300 mm of the ground, and be at an angle of 70–75 degrees. A worker should not need to leave the ladder or over-reach to access dip and fill points.

There is also a risk of the fuel igniting and the associated risk of tank explosion with any fuel storage vessel.

All fuel storage tanks should be constructed in accordance with the Australian Standard AS1692 Tanks for Flammable and Combustible Liquids.

Dispenser hoses must be approved for use with the applicable fuel, have an internal bonding wire that can dissipate static electricity generated during dispensing, and be fitted with an approved fuel dispensing nozzle with a trigger valve.

A lockable, steel isolation valve should be fitted between the tank outlet and the dispensing hose. Any pumps must be of a type approved for use with fuel.

All LP gas storage tanks and infrastructure must comply with AS/NZS 1596-2008. LP gas tanks must be made from steel and comply with the pressure vessel design code provided in the Australia / New Zealand standard AS/NZ 1200 Pressure Equipment.

Every opening through the shell of a gas tank must be fitted with a means of preventing accidental or uncontrolled releases. Piping must comply with the appropriate standard (AS 5601 or AS 4645).

LP gas pipelines must be clearly marked with printing, stencilling or labelling at critical locations (adjacent to connections, emergency shut-down systems and isolation valves) and/or by painting liquid lines in Raffia No. X31, vapour lines in Aqua No. B25 or pipelines white with tracer colour (as above) at the critical locations.

If unodourised LP gas is to be used, the tank must be fitted with a gas detector and an emergency shut-down system that operates if gas is detected. The gas detector should also set off an audible alarm if a leak is detected. In most cases, the gas tank(s) will be supplied and installed by the gas supplier who will be well versed in the statutory requirements for such installations.

Fit each fuel or gas tank with a suitable vent or relief valve. The vent must be sized taking into account changes in pressure resulting from filling, emptying, or atmospheric temperature change.

All fuel storage tanks must be clearly labelled with the contents of the tank. This labelling should be easily read from ground level. Prominent 'NO SMOKING OR OPEN FLAME' or equivalent signage is recommended near the outlet of all fuel storages.

Petrol and diesel storage tanks should be located at least 15 m and 8 m respectively from any ignition source. They should be at least 15 metres from the property boundary and any protected works (e.g. dwellings, workshop and accumulated combustible materials), 3 metres from combustible vegetation and 5 metres from overhead wires.

Sources of ignition are not permitted within the hazardous area around an LP gas tank and associated infrastructure. The distance between LP gas tanks and public places and railway lines, or protected places depends on the size of the tank. Refer to AS /NZS 1596 for more details.

Above ground LP gas storage tanks need to be at least 6 m from any other above ground tank, package store or filling area for flammable or combustible materials; at least 3 m from the top of a bund used to contain flammable liquids; and at least 2 m from the vent outlet of a flammable liquid storage. They must be separated from other LP gas tanks by at least the diameter of the largest tank.

Underground LP gas storage tanks must be at least 3 m from underground tanks used to store flammable and combustible liquids although this can be reduced to 1 m if a specifically designed, compatible corrosion protection system that caters for the area between the tanks is provided. Other separation distances also apply (see AS /NZS 1596).

Above ground LP gas tanks must be outside with free cross-ventilation around the tank. They must not be installed in, or above, a significant ground depression where a spill or leak could accumulate LP gas.

Consider the location of overhead powerlines when positioning the storage. LP gas tanks cannot be installed within the shadow area of an aerial power line (see Table 6.2 of AS / NZS 1596 for details).

All fuel storages should be secured against access by unauthorised persons. LP gas tanks and infrastructure must also be protected from possible impact by moving vehicles. Options could include

- 75 mm steel pipes filled with, and set into, concrete. These should be at least 1.5 m from the tank or infrastructure being protected, at least 1.2 m high (unless they are positioned 4 m or more from the item being protected when they can be 0.5 m high) and spaced no more than 1.3 m apart; or
- highway crash barriers at least 700 mm high, set into concrete or equivalent support, located 1.5 m from the item being protected; or
- fenced compounds with 1. 8 m high chain link fencing complete with tension wires and 50 mm diameter steel posts set in concrete.


*Fuel bowser with fuel-dispensing nozzle having a trigger valve mechanism, and product clearly identified.*

*Isolation valve on dispenser is kept turned off except when dispensing fuel. Rust on the tank and outlet pipe needs to be treated.*

*Rust – tanks should be protected against corrosion by a good paint coating.*

## Tank soundness

Tanks must be of sound construction and suitable for filling with petroleum products. This means that there are no signs of leaks, or major deformations of shape (cracks, dents). For tanks with supporting structures, these deformations will move the tank's centre of gravity and will also establish stress points where corrosion will occur more rapidly, or stress the supporting framework.

All fittings on the tank must be in good condition and free from leaks. If a dispensing hose and nozzle is fitted, it should have an isolation valve at the tank outlet.

There must be no corrosion that could materially affect the tank's integrity. As with supporting structures, rust can have a major impact on the soundness of a fuel tank. The degree of damage caused by rust is dependent on the thickness of the steel used in the tank's manufacture, and the depth of the rust has penetrated. AS1692 outlines the minimum thickness of plate used in tank construction with which current manufacturers of fuel tanks comply.

Areas at particular risk of rust damage are

- top of tanks, especially if they are cylindrical tanks mounted vertically (on end)
- underside of tanks
- fill point, outlet and drain plug
- welded seams
- surfaces and joints between the tank and the support structure.

## Maintaining the integrity of the fuel being stored

Small particles, water, microbes (which may be present if water is) and the by-products of the fuel aging process can all reduce fuel quality and cause problems with equipment using the fuel.

A well fitting, fine filter on the inlet will prevent small particles from entering the tank. Avoid galvanised tanks as the zinc and zinc alloys may react with diesel to form particles. Microbial action can also produce particles.

To keep water out of the tank, install a desiccant breather to remove moisture and airborne debris from air drawn into the tank as fuel is removed. Turning over fuel frequently minimises moisture problems and microbes. Hence, tanks should be sized to meet the needs and contingency requirements of the feedlot. Minimising temperature extremes also minimises condensation (and microbial growth).

To maintain fuel quality and reduce losses, install fuel storages out of direct sunlight (but not under trees) and paint them a light colour if possible. Installing storage tanks on a slight gradient allows water and sediment to collection at the low end and be removed.

## Provide adequate fuel supply

The required storage volume for each type of fuel depends on the equipment used on the feedlot and how frequently it can be delivered. Tanks need to be large enough to meet the needs and contingency requirements of the feedlot.

Delivery drivers are required to ascertain and document the liquid level before and after filling the tank. This means that the tank needs to be equipped with suitable measuring equipment which could be a

- mechanical level gauge
- dip stick, calibrated in litres; or
- sight glass with adjacent calibration in litres.

Any gauge needs to show the safe maximum fill level.


*Fuel type identification and easily accessible fill point*

## Provide adequate access for safe fuel delivery

Access to the tank must be safe for the fuel delivery vehicle. Providing turnarounds so that the delivery vehicle does not have to reverse to the site of the fuel tank will minimise the necessity for difficult or dangerous manoeuvring. Adequate area should be provided for turning and straightening near the fuel storage to prevent accidental contact while positioning the delivery vehicle close enough to fill the tanks. See *Section 13 – Access and internal roads* for further information.

The area between the delivery vehicle and the filling point of the fuel storage must have adequate clearway and should be free of all rubbish, obstacles, machinery or junk within 3 m of tank legs. The area beneath the fuel storage tank is not to be used as a storage area for equipment or obsolete machinery.

## Tank signage

Tanks used for the storage of fuel and gas should have appropriate signage, including Hazchem signage when appropriate, 'No Smoking' warnings and identification of the product contained in the tank.

# Further reading

Standards Australia (2004). The storage and handling of flammable and combustible liquids. (AS 1940-2004). Sydney, NSW, Standards Australia.

National Road Transport Commission (2007). Transport of Dangerous Goods, AGPS, Canberra.

Standards Australia (1998). Steel tanks for flammable and combustible liquids. (AS 1692-2006). Sydney, NSW, Standards Australia.

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Standards Australia/Standards New Zealand (2001). Fuel containers – portable plastic and metal. (AS/NZS 2906:2001), Standards Australia International Ltd., Strathfield NSW and Standards New Zealand, Wellington.

Standards Australia (1994). Safety Signs for the Occupational Environment. (AS 1319:1994). Sydney, NSW, Standards Australia.

Safe Work Australia (2011). Code of practice: Preparation of safety data sheets for hazardous chemicals.

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Standards Australia (2008). The design, installation and operation of underground petroleum storage systems. (AS 4897:2008). Sydney, NSW, Standards Australia.

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Standards Australia/Standards New Zealand (2010). Safety, protective and occupational footwear - Guide to selection, care and use. (AS/NZS 2210.1:2010). Standards Australia International Ltd., Strathfield NSW and Standards New Zealand, Wellington, Standards Australia.

Standards Australia/Standards New Zealand (2000). Occupational Protective Gloves - Selection, Use and Maintenance. (AS/NZS 2161.1:2000). Standards Australia International Ltd., Strathfield NSW and Standards New Zealand, Wellington, Standards Australia/Standards New Zealand.

Safe Work Australia standards and codes of practice National standards and codes of practice for the safe storage and handling of hazardous substances and dangerous goods are used as model legislation by the states and territories, and are useful guidance material. The National Code of Practice for the preparation of MSDS provides guidance for suppliers of hazardous substances. WHS legislation also has requirements for matters such as employer/employee consultation, first aid and amenities.
http://www.safeworkaustralia.gov.au/sites/SWA