AS 3961—2005

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Australian Standard™

The storage and handling of liquefied natural gas

STANDARDS AUSTRALIA

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Department of Employment, Education and Training, N.T.
The Australian Gas Association

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The storage and handling of liquefied natural gas

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PREFACE

This Standard was prepared by the Standards Australia Committee ME-070, Liquefied Natural Gas—Storage and Handling in response to requests from authorities and industries to review and supersede AS 3961—1991.

The objective of this Standard is to provide requirements for the design, construction and operation of installations for the storage and handling of liquefied natural gas (LNG), covering installations of atmospheric-type tanks for supplying marine terminals, pipeline peak saving, and pressure tanks.

This edition is technically equivalent to that published in 1991. However, referenced documents have been revised and updated, and minor editorial changes have been made to reflect the style of more recent Australian Standards for the storage and handling of dangerous goods.

This Standard has been modelled on two other Australian Standards. AS/NZS 1596, *The storage and handling of LP Gas,* was used because of the similarities between LP Gas and LNG. AS 1940, *The storage and handling of flammable and combustible liquids*, was also used, as atmospheric LNG storage has similarities with flammable liquids storage. Expertise from the cryogenics industry has also been valuable. Liquefied natural gas has many unique properties requiring specific safety measures. This Standard is therefore based on an amalgamation of requirements drawn from various sources, but tailored to suit the particular safety issues of LNG.

The Standard has been arranged to cater for the distinctions between the two basic types of LNG storage and handling systems, being pressure tanks and road or rail tankers, and atmospheric tanks for marine and pipeline transport systems.

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 provides information and guidance only.

The series of Standards covering the storage and handling of dangerous goods presently comprises the following Standards:

AS

1894 The storage and handling of non-flammable cryogenic and refrigerated liquids

1940 The storage and handling of flammable and combustible liquids

2507 The storage and handling of agricultural and veterinary chemicals

2714 The storage and handling of hazardous chemical materials—Class 5.2 substances (organic peroxides)

3780 The storage and handling of corrosive substances

3846 The handling and transport of dangerous cargoes in port areas

4326 The storage and handling of oxidizing agents

4332 The storage and handling of gases in cylinders

AS/NZS

1596 The storage and handling of LP Gas

2022 Anhydrous ammonia—Storage and handling

2927 The storage and handling of liquefied chlorine gas

AS/NZS

3833 The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers

4081 The storage and handling of liquid and liquefied polyfunctional isocyanates

4452 The storage and handling of toxic substances

4681 The storage and handling of Class 9 (miscellaneous) dangerous goods and articles

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FOREWORD

FIRE SAFETY

General considerations

Fire safety is a critical aspect of any Standard that deals with the safe handling of flammable materials, and such a Standard usually incorporates a comprehensive section that requires the traditional firefighting implements, e.g. hoses, hydrants, extinguishers, and the like. Habit and instinct tend to lead the thinking towards the provision of the same equipment for LNG, on the grounds that if a fire is possible, one must provide means for fighting it, and this is the way it is done.

However, the fire characteristics of gases, particularly LNG, differ radically from those of solids and liquids, so that conventional firefighting methods and equipment are not often useful and can 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 the only hope of safety. Separation distances, and the control and elimination of possible ignition sources, are aimed at this aspect.

If escaped gas ignites, there are two problems. Water streams will not readily extinguish such a fire, and in any case to extinguish the flame while leaving the escape flowing sets up a very considerable risk of potential re-ignition.

The only satisfactory means of stopping a gaseous fire is to shut off the fuel supply, so the design must incorporate sufficient isolating facilities to cope with any predictable event. However such facilities merely represent a cure after the event, and the principal objective must be prevention, i.e. the intent should be that escapes never happen and the escape-control measures never have to be used.

Thus the engineering of the whole installation becomes the critical fire safety provision. The first precautionary element in the design is the engineering of all the components to minimize the possibility that any failure may lead to an escape. The next element is a system of valves to control all outflow of LNG (whether liquid or vapour). These valves should be capable of shutting off flow, preferably automatically, should an incident occur.

Catchments are provided for certain types of tank to hold any possible spillage of liquid. Any substantial spill of liquid will form a pool, but the liquid has a fairly high evaporation rate, so that it is desirable to keep the surface area of the pool as small as possible to minimize the rate of vapour generation.

It is traditional to spread foam on petrol spillages to blanket the surface and inhibit evaporation, thus reducing the vapour cloud and reducing the possibility of ignition. Foam is not as effective on LNG, because of the interface between the warm foam and the cryogenic LNG, increasing evaporation and breaking through the foam. Thus a further reason for keeping the surface areas of spillage catchments as small as possible is to optimize the thickness of the foam blanket, so that the barrier to heat radiated into the pool, and the general insulating effect on the pool, is as effective as possible.

Should a compound catch fire, little can be done to fight it. Foam is ineffective and water streams will increase the problem by increasing the evaporation rate. All that can be done is protect nearby installations and property from the high level of radiated heat.