

Australian/New Zealand Standard™

The storage and handling of liquid and liquefied polyfunctional isocyanates



Standards Australia



AS/NZS 4081:2001

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CH-009, Safe Handling of Chemicals. It was approved on behalf of the Council of Standards Australia on 16 February 2001 and on behalf of the Council of Standards New Zealand on 16 February 2001. It was published on 6 March 2001.

The following interests are represented on Committee CH-009:

Air Conditioning and Refrigeration Wholesalers Association
Agsafe
Australasian Fire Authorities Council
Australasian Railway Association
Australian Chemical Specialties Manufacturers Association
Australian Institute of Petroleum
Australian Paint Manufacturers Federation
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National Occupational Health and Safety Commission, Australia
New Zealand Chemical Industry Council
New Zealand Fire Service
Plastics and Chemicals Industries Association
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Manufacturers and industrial users of polyfunctional isocyanates
Consultants to the chemicals industry

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Australian/New Zealand Standard™

The storage and handling of liquid and liquefied polyfunctional isocyanates

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PREFACE

This Standard was prepared by Joint Standards Australia/New Zealand Committee CH-009, Safe Handling of Chemicals, in response to a request from the Plastics and Chemicals Industry Association (PACIA) to update AS 4081—1993. The review has come about as a result of changes in technology, the development of other Standards that overlapped sections of the previous edition, and changes to regulatory requirements.

This new edition is a result of a comprehensive review of practices relating to the storage and handling of polyfunctional isocyanates (PFIs). The continued importance of polyfunctional isocyanates in industry (especially in the polyurethane foam industry), and their reactivity and toxicology, make it necessary to provide responsible guidance on safe and proven methods for their storage, loading and discharge. Requirements for ship discharge and transport have been removed from this revision of the Standard, as these are covered in other documents.

This Standard provides general requirements for the safe storage and handling of all polyfunctional isocyanates, with a particular emphasis on requirements for toluene diisocyanate (TDI), which is the most common polyfunctional isocyanate in industrial use.

The series of Standards covering the storage and handling of dangerous goods and other chemicals 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
- 2022 Anhydrous ammonia—Storage and handling (known as the SAA Anhydrous Ammonia Code)
- 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)
- 2927 The storage and handling of liquefied chlorine gas
- 3780 The storage and handling of corrosive substances
- 3846 The handling and transport of dangerous cargoes in port areas
- 3961 Liquefied natural gas — Storage and handling
- 4326 The storage and handling of oxidizing agents
- 4332 The storage and handling of gases in cylinders

AS/NZS

- 1596 Storage and handling of LP Gas
- 3833 The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers
- 4452 The storage and handling of toxic substances
- 4681 The storage and handling of Class 9 (miscellaneous) dangerous goods and articles

The requirements of this Standard have been aligned with the current requirements of regulatory authorities, emergency services, environmental authorities, and National Occupational Health and Safety Commission (NOHSC) publications.

Australian and New Zealand references are separated by a slash (/).

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.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**The storage and handling of liquid and liquefied polyfunctional isocyanates**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements and recommendations for the safe storage and handling of liquid and liquefied polyfunctional isocyanates (PFIs) (as defined in Clause 1.4.38), in packages, intermediate bulk containers (IBCs) and bulk. It applies to PFIs that are dangerous goods, as well as to PFIs that are not classified as dangerous goods.

NOTES:

- 1 Appendix A provides examples of common PFIs and the various designations that are applied to them.
- 2 Appendix B outlines the hazards of PFIs.
- 3 PFIs are usually imported in bulk and may be packaged into smaller quantities for use by processors. PFIs are also imported as packages, usually with a nominal capacity of 205 L, but smaller packages are available.

1.2 APPLICATION

This Standard applies in locations that are generally industrial or commercial in nature, including laboratories where the provisions of this Standard are additional to those of AS 2243.10.

This Standard does not apply to —

- (a) the land transport of PFIs, which is covered by the ADG Code/NZS 5433 if they are dangerous goods; or
- (b) storage in port areas.

The requirements of this Standard apply in conjunction with, but do not take precedence over, any government regulations that apply in any area.

NOTES:

- 1 An installation may come under the regulatory control of several authorities having different areas of responsibility, and an approval from one authority does not necessarily constitute an approval from others.
- 2 The *Building Code of Australia* (BCA)/*New Zealand Building Code* (NZBC) provides minimum requirements for all matters pertaining to building work.

1.3 REFERENCED DOCUMENTS

A list of the documents referred to in this Standard is provided in Appendix C.

1.4 DEFINITIONS

For the purposes of this Standard the definitions given below apply.

1.4.1 Access

A means by which a person or vehicle can approach or leave a specific location. The term includes walkways, platforms, stairways, ladders, roads and all provisions for safe entry and exit.

1.4.2 ADG Code

The *Australian Dangerous Goods Code*, which comprises—

- (a) the *Australian Code for the Transport of Dangerous Goods by Road and Rail*, 6th edition;
- (b) the *Rail (Dangerous Goods) Rules*;
- (c) the *Road Transport Reform (Dangerous Goods) Regulations*; and
- (d) technical appendices.

1.4.3 Articulated loading arm

A system of two or more rigid pipes, interconnected with swivel joints that enable it to be positioned and connected to a compartment of a tanker or a transport tank.

NOTE: An articulated loading arm may be used to transfer product either into or from a compartment of a tanker or transport tank.

1.4.4 Authority

The authority having statutory (legal) control of a particular matter.

1.4.5 Boundary

The perimeter of the whole of the site under the same occupancy as the storage area.

1.4.6 Bulk

(Australia) Dangerous goods which are not in packagings (see Clause 1.4.36).

(New Zealand) as follows:

- (a) Dangerous goods in the form of a gas, in a container in an undivided quantity exceeding 250 L.
- (b) Dangerous goods in the form of a liquid, in a container in an undivided quantity exceeding 450 L.
- (c) Dangerous goods in the form of solids, in a container in an undivided quantity exceeding 400 kg.

1.4.7 Bund

An embankment or wall which may form part or all of the perimeter of a compound.

1.4.8 Combustible liquid

Any liquid, other than a flammable liquid that has a flash point, and a fire point lower than its boiling point. For the purpose of this Standard, combustible liquids are divided into two classes as follows:

- (a) *Class C1*—combustible liquid which has a flash point of 150°C or less.
- (b) *Class C2*—a combustible liquid which has a flash point exceeding 150°C.

NOTE: The boiling point is taken to mean that point at which it is no longer possible to achieve the rate of temperature rise required by ASTM D92 for the fire point test.

1.4.9 Combustible materials

Materials deemed to be combustible when tested in accordance with AS 1530.1.

1.4.10 Compound

An area bounded by natural ground contours, or by a bund, and intended to retain spillage or leakage.

NOTE: A containment vessel, pit or tank may be used to serve the same purpose.

1.4.11 Confined space

A space of any volume as defined by AS 2865.

1.4.12 Connector

A quick-release, self-sealing (dry break) coupling of stainless steel fitted with vinylidene fluoride/hexafluoropropane copolymer encapsulated O-rings for liquid lines and open flow Camlock-type fittings fitted with compatible seals for vapour lines.

1.4.13 Container

Anything in or by which dangerous goods are wholly or partly encased, covered, contained or packed and includes any components or materials necessary for a container to perform its containment function.

1.4.14 Dangerous goods

(Australia) Substances and articles that are determined to be dangerous goods under Regulation 2.2 of the *Road Transport Reform (Dangerous Goods) Regulations*.

(New Zealand) Substances having properties described in Table A of NZS 5433:1999, and includes packaging and empty containers that have not been cleaned after containing dangerous goods.

NOTES:

- 1 Tests and criteria for determining dangerous goods are specified in the UN *Manual of Tests and Criteria* and the UN *Recommendations on the Transport of Dangerous Goods — Model Regulations*.
- 2 The *Road Transport Reform (Dangerous Goods) Regulations* are part of the ADG Code.

1.4.15 Decant

To transfer from one container into another.

1.4.16 Drum

Any package defined as a drum in AS 2905.

1.4.17 Dwelling

A place of residence or abode.

1.4.18 Exposure standard

The airborne concentration of a particular substance in the person's breathing zone, as established by NOHSC:1003, exposure to which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all persons. The exposure standard can be of three forms: time-weighted average (TWA), short-term exposure limit (STEL), or peak limitation.

NOTES:

- 1 NOHSC:1003 sets out values for exposure standards, and NOHSC:3008 provides guidelines on their interpretation.
- 2 Values cited for exposure standards do not represent fine lines between safe and dangerous concentrations and should not be interpreted by anyone untrained in the discipline of occupational hygiene.

1.4.19 Fire point

The temperature at which a liquid, when tested according to IP 36 or ASTM D92, first evolves a vapour at a sufficient rate to sustain burning for at least 5 s after application of the test flame.

1.4.20 Fire resistance level (FRL)/fire resistance rating (FRR)

The grading period, in minutes, determined in accordance with AS 1530.4 for—

- (a) structural adequacy;
- (b) integrity; and
- (c) insulation;

and expressed in that order.

NOTES:

- 1 Where an FRL/FRR is required, reference should be made to the *Building Code of Australia* (BCA)/*New Zealand Building Code* (NZBC) for guidance.
- 2 In New Zealand the term 'fire resistance rating' is used and has the same meaning as fire resistance level.

1.4.21 Fire wall

A wall or other barrier having a specified fire resistance level, constructed and placed with the objective of preventing the spread of fire.

1.4.22 Flash point

The temperature at which a liquid, when tested according to the AS/NZS 2106 series or other equivalent method, first evolves vapour in a sufficient quantity to be ignited by the test flame specified in the method.

1.4.23 Hazardous area

An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation or use of potential ignition sources.

NOTE: A classification system for hazardous areas is given in the AS/NZS 2430 series.

1.4.24 Hazardous substance

A substance which —

- (a) is listed in NOHSC:10005; or
- (b) has been classified as a hazardous substance by the manufacturer or importer in accordance with NOHSC:1008.

1.4.25 Hot work

The use or operation of any of the following:

- (a) Welding or flame cutting equipment.
- (b) Grinders, electric drills or other non-flameproof electric equipment.
- (c) Hot tapping equipment.
- (d) Spark ignition engines or non-approved compression engines.
- (e) Matches, naked lights, cigarettes, cigarette lighters, flames or sparks.
- (f) Hand tools that might create a spark.
- (g) Non-flameproof electric cables, cords, switches, lights, connectors or fittings.
- (h) Any other thing which is likely to produce a source of ignition or be an ignition source.

1.4.26 Ignition source

A source of energy sufficient to ignite a flammable or explosive atmosphere, and which may include naked flames, hot surfaces, exposed incandescent material, electrical welding arcs, mechanical or static sparks, hot particles, electrical discharge, and electrical or mechanical equipment not approved for use in hazardous locations.

NOTE: A vehicle may not be regarded as being an ignition source while it enters or leaves the hazardous zone outside a package storage area for the purposes of leading or unloading packages providing the hazardous zone is not enclosed or forms part of the package storage area.

1.4.27 Incompatible

1.4.27.1 In relation to other goods

Goods which are —

- (a) likely to interact with the PFIs so as to increase the hazard when mixed or otherwise brought into contact with the PFIs;
- (b) determined to be incompatible under Regulation 2.6 of the *Road Transport Reform (Dangerous Goods) Regulations*; or
- (c) declared by the regulatory authority to be incompatible.

1.4.27.2 In relation to packaging or transfer equipment

A container or item of equipment which is constructed of material likely to interact with the PFIs to the extent that it is weakened or damaged, and risk is increased.

1.4.28 Installation

All the facilities on a site used that are used for storing or handling dangerous goods.

1.4.29 Intermediate bulk container (IBC)

A rigid or flexible portable packaging for the transport of dangerous goods that—

- (a) has a capacity of not more than—
 - (i) for solids of Packing Group I packed in a composite, fibreboard, flexible, wooden or rigid plastics or wooden container — 1500L;
 - (ii) for solids of Packing Group I packed in a metal container—3000 L;
 - (iii) for solids or liquids of Packing Groups II and III—3000 L.
- (b) is designed for mechanical handling;
- (c) is resistant to the stresses produced in usual handling and transport; and

NOTE: *Specifications for Intermediate Bulk Containers for the Transport of Dangerous Goods* is published as a supplement to the ADG Code.

For the purposes of this Standard, the capacity of an IBC is limited to 1.5 m³.

1.4.30 Material safety data sheet (MSDS)

A document that provides information on the identification, health hazards, precautions for use and safe handling of a specific chemical product, and which complies with NOHSC:2011 or, in New Zealand, *OSH Guidelines for the preparation of MSDS*.

1.4.31 May

The use of the term ‘may’ indicates an option.

1.4.32 Non-combustible

Material that does not support combustion or is deemed to be non-combustible when tested in accordance with AS 1530.1 (NZS/AS 1530.1).

NOTE: For the purposes of this Standard, hardwood is deemed to be non-combustible.

1.4.33 On-site facility

A building where people are employed within the property boundary, including offices, warehouses, manufacturing areas and amenities.

1.4.34 Package

(Australia) The complete product of the packaging operation, consisting of the packaging and its contents prepared for transport.

(New Zealand) The substance and the packaging in which it is contained.

1.4.35 Packaged dangerous goods

These are —

- (a) dangerous goods of Class 2 in a container with a capacity of not more than 500 L; or
- (b) dangerous goods of another Class in —
 - (i) a container with a capacity of not more than 450 L; and
 - (ii) a container with a net mass of not more than 400 kg.

1.4.36 Packaging

(Australia) The container in which the goods are received or held for transport, and includes anything that enables the container to receive or hold the goods or to be closed.

(New Zealand) Any receptacle, container or other material in which a substance may be encased, covered, enclosed, contained or packed, which performs part of the containment function; but does not include a freight container, a skip, a vehicle, a pallet or other article of transport equipment.

1.4.37 Packing Group (PG)

One of the three hazard groups into which dangerous goods (of other than Classes 1, 2, 6.2 and 7) are designated in the ADG Code, in decreasing order of hazard, by the Roman numerals 'I' (great danger), 'II' (medium danger) and 'III' (minor danger).

NOTE: The UN *Manual of Tests and Criteria* provides criteria for assigning Packing Groups. A list of those already assigned is given in the ADG Code/NZS 5433. Criteria for assigning Packing Groups are also given in the ADG Code/NZS 5433.

1.4.38 Polyfunctional isocyanate (PFI)

A compound containing isocyanate ($-N=C=O$) groups, that can combine with itself or with other compounds to form macromolecular products including polyurethanes, polyisocyanates, polycarbamides and polyureas.

1.4.39 Port area

The land and sea area established by legislation.

NOTE: Some port areas may overlap and legal requirements should take account of this possibility.

1.4.40 Positive pressure breathing apparatus

A positive pressure, air supplied respirator complying with AS/NZS 1716.

1.4.41 Primary (onshore) bulk storage installation

The storage tank system located adjacent to a wharf facility at which a marine tanker is berthed while discharging of bulk liquid.

1.4.42 Protected place

Any of the following:

- (a) A dwelling, place of worship, public building, school or college, hospital, aged persons' accommodation, childcare facility or theatre.
- (b) A factory, workshop, office, store, warehouse, shop, or building where persons are employed, which is outside the property boundary of the installation.
- (c) An accumulation of combustible materials, other than flammable and combustible liquids, of a type and quantity sufficient to constitute a significant heat radiation hazard to the installation in the event of fire in those materials.
- (d) A ship lying at permanent berthing facilities.
- (e) Any storage facility for dangerous goods outside the property boundary of the installation.

1.4.43 Purge gas

Either oil-free air that has a dew point of less than -40°C , or a dry inert gas such as nitrogen.

1.4.44 Restricted area

An area to which access is limited to specific or authorized persons, and usually under specified conditions. It may be an area within the boundaries of the premises used for the storage and handling of PFIs, or an area designated for that specific purpose and used for other purposes, but it excludes any area that has been designated as a safe area.

1.4.45 Separation

The isolation of stores of PFIs from protected places, on-site facilities, boundaries, other dangerous goods stores and stores containing incompatible materials.

1.4.46 Shall

Use of the word 'shall' indicates that a statement is mandatory.

1.4.47 Should

Use of the word 'should' indicates a recommendation.

1.4.48 Supplier

An importer, manufacturer, wholesaler or distributor, but not a retail distribution centre or retail outlet.

1.4.49 Tank

A container, other than an IBC, having a capacity greater than 450 L.

1.4.50 Tanker

Either a rail tank vehicle or a road tank vehicle as defined in AS 2809.1 and used or intended to be used for the transport of dangerous goods in bulk, other than a bulk container.

NOTE: Such a vehicle may have its own discharge pump.

1.4.51 Transfer point

The end of the pipework of a storage tank, at which connection is made with the pipework of a road tank vehicle, rail tank vehicle, demountable tank, portable tank or bulk container.

1.4.52 Transport tank

A tank, other than a tanker, used for the transport of PFIs and being one of the following:

- (a) *Demountable tank*—a tank that complies with the section of the ADG Code dealing with transport in bulk, and designed to be carried on vehicle without a permanent attachment to the vehicle chassis.
- (b) *Portable tank*—a tank within the scope of the requirements for a ‘portable tank’ in the General Introduction to the IMDG Code.
- (c) *Tank container*—a portable tank within the scope of the requirements for ‘container’ in the International Convention for Safe Containers (CSC).

1.4.53 UN Number

The four-digit substance identification serial number assigned to dangerous goods by the United Nations Committee of Experts on the Transport of Dangerous Goods and listed for each substance or article in the ADG Code/NZS 5433.

1.4.54 Vapour barrier

A wall or other barrier constructed and placed with the object of preventing the passage of vapour from any one place to another.

1.4.55 Work permit

A written document that specifies the conditions under which work in a restricted area can be carried out.

1.5 PACKAGING

A packaging that is to be filled with dangerous goods shall—

- (a) for use other than at the premises at which it is to be filled, meet the requirements of the ADG Code for the packaging of dangerous goods; or
- (b) for use at the premises at which it is to be filled, be constructed—
 - (i) with sufficient strength and durability for its proposed purpose; and
 - (ii) such that all components of the packaging that might be directly in contact with the contents are compatible with the contents and will not be softened or weakened by the contents.

1.6 MARKING (LABELLING)

Packages containing PFIs shall be marked (labelled) in accordance with appropriate Australian State or Territory or New Zealand legislation.

NOTE: Marking in compliance with the ADG Code/NZS 5433 and NOHSC:2012 may be required under such legislation.

1.7 SECURITY OF STORAGE AREAS

All storage areas shall be appropriately secured against access by unauthorized persons at all times.

SECTION 2 REQUIREMENTS FOR THE STORAGE AND HANDLING OF PACKAGES

2.1 SCOPE OF SECTION

This Section sets out requirements and recommendations on the storage and handling of PFIs in packages and intermediate bulk containers (IBCs) having a maximum capacity of 1.5 m³.

NOTE: Sealed intermediate bulk containers (IBCs) having a maximum capacity of 1.5 m³ may be stored in accordance with the requirements of this Section in the same manner as packages.

2.2 LOCATION OF STORE

2.2.1 General

All package stores and transfer systems for PFIs shall be separated from protected places in accordance with Table 2.1, and from boundaries and ignition sources in accordance with Table 2.2.

2.2.2 Measurement of separation distances

Separation distances may be measured in a horizontal plane around an intervening fire-rated wall, provided that the following requirements are met:

- (a) Where the height of the store is greater than or equal to the height of the protected place, the wall shall extend at least 1 m above the highest container in the store.
- (b) Where the height of the store is less than that of the protected place, the wall shall extend at least 1 m above the protected place, or shall extend as a roof above the store.
- (c) The wall shall be marked so as to indicate the maximum permissible storage height.
- (d) The wall and the roof, if any, shall have a fire resistance level (FRL)/fire resistance rating (FRR) as specified in Clause 2.3.

2.3 USE OF FIRE WALLS AND VAPOUR BARRIERS

2.3.1 Conditions of use

Separation distances may be measured around a vapour barrier, provided that the following conditions are met:

- (a) Where separation from protected places is required, such a vapour barrier shall also be a fire wall.
- (b) Building walls may be treated as fire walls or vapour barriers if they meet the relevant requirements.

2.3.2 Construction of fire walls

Fire walls shall comply with the following requirements:

- (a) The wall shall have an FRL/FRR of at least 240/240/240.
- (b) The wall shall be impervious to vapour except around approved fire doors.
- (c) Any free-standing fire wall shall be self-supporting and shall have adequate foundations.
- (d) The height of the fire wall shall be sufficient to shield a protected place from heat radiation in the event of a storage fire, and vice versa.

2.4 GENERAL REQUIREMENTS FOR PACKAGE STORES

Package stores for PFIs shall comply with the following general requirements:

- (a) Stores shall be designed to preclude the ingress of water.
- (b) Packages shall be stored so that they are protected from the weather.
- (c) The store shall be provided with either natural or mechanical ventilation, in accordance with Clause 2.5.2.
- (d) The store shall be provided with a means of either containing a spill or diverting it to a compound within the boundaries of the premises (see also Clause 3.4). The net capacity of such a compound shall be —
 - (i) for PG I liquids, 100% of the aggregate volume kept; and
 - (ii) for PG II and PG III liquids and PFIs that are not dangerous goods, 25% of the aggregate volume kept, or as required by relevant local regulations.
- (e) The filling and emptying of packages shall be carried out in a dedicated area.
- (f) The temperature of the store shall be controlled to within the limits recommended by the manufacturers of the PFIs being stored.

2.5 EQUIPMENT AND SYSTEMS FOR FILLING AND EMPTYING PACKAGES

2.5.1 Filling equipment

The filling equipment used shall be appropriate to the scale of the operation. It shall be selected with consideration of the need to avoid spills, minimize vapour emissions and prevent personal contact with the PFI.

NOTE: Atmospheric concentrations of PFI need to be kept below occupational health and safety exposure limits.

To minimize physical contact with the PFIs, the preferred package-filling equipment is an automatic or semi-automatic closed system, positive displacement volumetric filling machine.

All filling equipment and pipework shall be fitted with emergency secondary shut-off facilities, readily accessible to the operator.

NOTE: Appendix D outlines procedures for filling and emptying packages.

2.5.2 Ventilation system

The following requirements apply to ventilation in areas where packages are emptied or filled:

- (a) The concentration of vapour at the filling equipment shall be controlled by either or both of the following methods:
 - (i) Total enclosure at below atmospheric pressure.
 - (ii) Local exhaust ventilation at the filling point, having a capture velocity of between 0.5 m/s and 1.0 m/s.
- (b) Vents exhausting from any of the above systems shall be controlled so that the emission of PFIs to the environment meets regulatory requirements.
- (c) An interlock shall be installed so that the filling systems cannot work unless the ventilation specified above is working.
- (d) General ventilation shall also be provided where the filling or emptying operation is carried out in an enclosed space.
- (e) Any ventilation system shall maintain atmospheric contaminants in work areas below the occupational exposure limit.

2.6 HANDLING PRECAUTIONS

2.6.1 General

The following precautions shall be observed when handling packaged PFIs:

- (a) Packages shall be handled in a manner that will reduce the likelihood of spills and leaks.
- (b) Appropriate personal protective equipment, as specified in the appropriate material safety data sheet (MSDS), shall be available for use.
- (c) Where packages are palletized, they shall be protected from the possibility of punctures or tears caused by splinters or nails in the pallets.
- (d) All movement of the goods shall be subject to appropriate manual handling risk controls for the packages concerned.

NOTE: Procedures for filling and emptying packages are outlined in Appendix D.

2.6.2 Opening of packages

Sole or inner packagings shall not be opened inside the package store unless for the purposes of sampling, testing or inspection. Any package that has been opened shall not be returned to the store unless it is securely closed, and its contents have not been contaminated.

2.6.3 Housekeeping procedures

The following housekeeping procedures shall be established and maintained:

- (a) The aisles of the store shall be kept clear.
- (b) In order to prevent accumulation of old material that could deteriorate and become a hazard, stock movement shall be monitored.
- (c) All packages shall be handled so that the possibility of leaks is minimized.
- (d) Packages shall regularly be inspected and, when any signs of a leak, spill or deterioration are observed, the suspect package shall be removed and rendered safe.
- (e) Minor spills or leaks shall be dealt with in accordance with Clause 6.5.
- (f) Packages that are not of a reusable type, and whose contents have been fully used, shall be treated in accordance with Section 8.
- (g) The store shall be kept clear of all incompatible materials.

Labels shall be retained on empty containers until the containers have been decontaminated, at which time the labels shall be removed or obscured.

TABLE 2.1
MINIMUM SEPARATION DISTANCES FROM
PACKAGE STORES TO PROTECTED PLACES

Maximum capacity of store m ³		Minimum distance m
C1	C2	
0.2	1	Unrestricted
>0.2 ≤5	>1 ≤25	6
>5 ≤50	>25 ≤250	15
>50 <500	>250 <2500	30
≥500	≥2500	50

NOTES:

- 1 The distance which applies for any intermediate capacity may be obtained by linear interpolation.
- 2 Separation distances may be measured around fire walls and vapour barriers (see Clause 2.3).

TABLE 2.2
MINIMUM SEPARATION DISTANCES FROM PACKAGE
STORES TO BOUNDARIES AND IGNITION SOURCES

Separation from:	Distance, m	
	C1	C2
Storage area for closed packages	2	1
Storage area where packages are opened (e.g. for decanting, mixing, filling)	2	1

SECTION 3 REQUIREMENTS FOR PRIMARY BULK STORAGE INSTALLATIONS

3.1 SCOPE OF SECTION

This Section sets out requirements for the design of installations for the bulk storage and handling of PFIs at primary bulk storage installations and the transfer of PFIs from a bulk storage tank into transport tanks or tankers.

3.2 BULK STORAGE SYSTEMS

3.2.1 General requirements

A bulk storage system shall consist of the following:

- (a) One or more storage tanks, which may be fitted with a heating system.
- (b) Liquid or vapour piping systems.
- (c) Auxiliary systems, such as—
 - (i) vacuum relief;
 - (ii) vapour scrubbing control, including pressure relief;
 - (iii) a nitrogen blanketing system or dry air blanketing system;
 - (iv) a supply of purge gas;
 - (v) the facility to circulate the PFI; and
 - (vi) a liquid transfer metering system with an automatic cut-off device.

3.2.2 Tank design and construction

Tanks shall be designed and constructed in compliance with AS 1692, API 650, API 620 or other equivalent Standard. The following requirements also apply:

- (a) Tanks shall be constructed of stainless steel or carbon steel.

NOTES:

- 1 For TDI, tanks fabricated from carbon steel may be lined to prevent contamination with rust or iron. A high-temperature baked phenolic lining is preferred.
- 2 For pure or modified MDI, stainless steel is the preferred material of construction. For polymeric MDI, carbon steel or stainless steel may be used.

- (b) Tanks shall be provided with a means of temperature indication.
- (c) Each tank shall be fitted with a means of indicating the level of its contents. The level-indicating device shall have no moving mechanical parts in contact with the liquid or vapour of the PFI. Glass or plastic sight-tubes shall not be used.

NOTES:

- 1 Mechanical parts can be affected by crystals of the PFI or a polyurea encrustation, and thus be rendered mechanically ineffective. Suitable lubricants for mechanical parts include paraffin oil, phthalate ester, or an alkyl sulfonic ester of phenol and cresol (e.g. 'Mesamoll').
- 2 Glass or plastics tubing is too fragile.

- (d) Each tank shall be provided with a high-level audible alarm. Two stages of level shall be monitored: a high level at 80% of tank capacity, and an extra-high level at 95% of tank capacity.

- (e) Tanks shall not vent directly to atmosphere, except through a vapour emission control system.
- (f) Vacuum relief shall be provided in accordance with Clause 3.2.5.
- (g) If the temperature of the contents of the tank can drop below the freezing point, the tank shall be insulated and heated externally to maintain the PFI above its freezing point.
- (h) A suitable means of maintaining uniform consistency of the tank contents shall be provided by—
 - (i) mechanical agitation;
 - (ii) liquid recirculation; or
 - (iii) a combination of both (i) and (ii).

3.2.3 Pipework

Pipework shall comply with AS 4041 or equivalent, and be of either steel or stainless steel. The following additional requirements apply:

- (a) Valves shall be of steel or stainless steel construction. Full-bore, quick-acting valves having stainless steel balls are preferred. Valve packing shall be suitable for use with the PFI being handled.
- (b) All pipework shall be designed and installed to allow for expansion and contraction of the pipework and tank. Such pipework shall not cause stress to the tank, tank fittings or itself.
- (c) Joints in pipework shall be either welded or flanged. Where flanged, gaskets shall be of suitable materials.
NOTE: Recommended gasket materials are polypropylene, polytetrafluoroethylene or vinylidene fluoride/hexafluoropropene copolymer.
- (d) Flexible hose shall not be used, except at transfer points.

3.2.4 Control of emissions

The following requirements apply to the control of emissions of vapours from PFIs:

- (a) Each tank shall be provided with a dedicated vent line, which shall be connected to a vapour removal system before the vent gas discharges to atmosphere.
- (b) Where a wet absorption system is used, a reliable method of maintaining and verifying the relieving pressure shall be installed.

3.2.5 Vacuum relief system

A vacuum relief system shall be designed and installed in order to prevent collapse of the storage tank, by maintaining internal pressure at a predetermined level consistent with the design characteristics of the tank.

Where the vacuum relief system uses purge gas, the following provisions apply:

- (a) The purge gas system to each tank shall have a flow capacity equal to or greater than the vacuum relief capacity.
NOTE: AS 1940 provides calculations for vacuum relief capacity.
- (b) The purge gas system shall incorporate fail-safe provisions in the event of either a pressure sensor failure or power failure.
- (c) An audible alarm shall be installed, to be activated if the purge gas supply fails.
- (d) A soft-seated non-return valve shall be provided to prevent back-flow of vapour into the purge gas system.

A tank may be equipped with a vacuum relief valve that will be activated if the automatic relief system fails. Such a vacuum relief valve shall be set at a pressure consistent with the design criteria of the tank and shall be connected to a dry air source.

3.3 LOCATION AND SEPARATION OF TANKS

3.3.1 Separation

Tanks shall be separated so that the following minimum separation distances are maintained:

- (a) To off-site protected places, in accordance with Table 3.1.
- (b) To security fences, boundaries and on-site facilities, in accordance with Table 3.2.

3.3.2 Distances between tanks

3.3.2.1 Distances between vertical tanks

The distance between any two adjacent vertical tanks shall be as follows:

- (a) For C1 liquids, the minimum distance shall be either 1/6 of the sum of their diameters, or 1 m, whichever is the greater.
- (b) For C2 liquids, at least 1 m.

3.3.2.2 Distances between horizontal tanks

The distance between horizontal tanks shall be at least 1 m. Where horizontal tanks are adjacent to vertical tanks, the distances for vertical tanks shall apply.

TABLE 3.1
MINIMUM SEPARATION DISTANCES FROM TANKS
TO PROTECTED PLACES

Maximum tank capacity, m ³		Minimum distance m
C1	C2	
2.5	5	Unrestricted
10	20	3
20	40	4
40	80	5
70	140	6
100	200	7
140	280	8
200	400	9
260	520	10
340	680	11
420	840	12
520	1040	13
640	1280	14
770	>1540	20
1700		
>3100	—	25

NOTE: For distances greater than 3 m, distances applicable for any intermediate capacity may be obtained by linear interpolation.

TABLE 3.2
MINIMUM SEPARATION DISTANCES TO SECURITY FENCES,
BOUNDARIES AND ON-SITE FACILITIES

Separation from tank to:	Minimum distance, m	
	C1	C2
Fill points, platforms or packages stores (see Note)	Diameter of tank or 7.5 m, whichever is the lesser, but at least 3 m	
Office buildings, warehouses, manufacturing areas, workshops or amenities blocks on the same premises	Distance required by Table 3.1, but not more than 7.5 m	Unrestricted, determined by the compound
Security fence or boundary	Diameter of tank or 7.5 m, whichever is the lesser, but at least 3 m	

NOTE: The fill point referred to is the point for filling packages, drums or tank vehicles, and not the fill point into the storage. Where the liquid being transferred and the liquid in storage are of different flash points, the separation distance shall be determined as if both were of the lower flash point of the two.

3.4 BUNDS AND COMPOUNDS

3.4.1 General

All tanks shall be installed within a compound, the net capacity of which shall be at least the capacity of the largest tank, or as required by relevant local regulations. The total cross-sectional area of all tanks within a common compound shall not exceed 320 m².

NOTE: In order to facilitate the management of emergencies, it is recommended that the compound capacity be about 10% greater than the minimum value specified above.

If tanks are interconnected, and leakage from one could lead to the emptying of others, their entire contents shall be safely contained.

3.4.2 Design and construction

A compound shall comply with the following requirements:

- (a) The materials of construction shall be substantially resistant to attack by the PFI that it might be required to contain.
- (b) It shall be sufficiently impervious to retain and enable the recovery of any spillage.
NOTE: Earth by itself without a lining does not satisfy the impermeability criteria given in Items (a) and (b).
- (c) Any bund shall be designed to withstand the hydrostatic head when full.
- (d) Any earthen wall 1 m or more in height shall have a flat top section at least 600 mm wide.
- (e) The slope of any earthen bund shall be consistent with the angle of repose of the material from which the wall is constructed.
- (f) Any pipe which passes through the bund wall shall not be subject to excessive stresses due to settlement or expansion. The point at which any pipe passes through the bund wall shall be sealed to prevent leakage.