Approved Document for New Zealand Building Code Industrial Liquid Waste Clause G14

Prepared by the Building Industry Authority
This Approved Document is prepared by the Building Industry Authority, which is a statutory body established by the Building Act 1991.

Building Industry Authority

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Status of Approved Documents

Approved Documents are prepared by the Building Industry Authority in accordance with section 49 of the Building Act 1991. They are non-mandatory guidance documents offering only one method of compliance with specific performance criteria of the New Zealand Building Code.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Approved Documents and explains alternative methods of achieving compliance.

Classified uses and defined words which are italicised in the text are explained in clauses A1 and A2 of the New Zealand Building Code.

G14: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	pp. vi – viii, References	
Amendment 2	1 December 1995	pp. i and ii, Document History	p. iv, G14.3.2 (d)

Note:
Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Building Industry Authority. It is effective from 1 December 1995 and supercedes all previous versions of this document.

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New Zealand Building Code Clause G14 Industrial Liquid Waste

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE–*continued*

Clause G14–INDUSTRIAL LIQUID WASTE

Provisions	Limits on application
OBJECTIVE **G14.1** The objective of this provision is to safeguard people from injury or illness caused by infection or contamination resulting from industrial liquid waste.	
FUNCTIONAL REQUIREMENT **G14.2** *Buildings* in which industrial liquid waste is generated shall be provided with *adequate* spaces and facilities for the safe and hygienic collection, holding, treatment and disposal of the waste.	
PERFORMANCE **G14.3.1** Industrial liquid waste shall be conveyed to storage containers and within disposal systems in a way which will: (a) Transfer wastes from *buildings* safely and hygienically, (b) Avoid the likelihood of blockage and leakage, (c) Avoid the likelihood of foul air and gases entering *buildings*, and (d) Provides reasonable access for clearing of blockages. **G14.3.2** Facilities for the storage, treatment, and disposal of industrial liquid waste shall be constructed: (a) With *adequate* capacity for the volume of waste and the frequency of disposal, (b) With *adequate* vehicle access for collection if required, (c) To avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 "Water Supplies",	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(d) To avoid the likelihood of contamination of soils, ground water and waterways except as permitted under the Resource Management Act 1991.	
(e) From materials which are impervious both to the waste for which disposal is required, and to water,	
(f) To avoid the likelihood of foul air and gases accumulating within or entering into *buildings*,	
(g) To avoid the likelihood of unauthorised access by people, and	
(h) To permit easy cleaning and maintenance.	

Amend 2
Dec 1995

Contents

References

Amend 1 Sep 1993

For the purposes of New Zealand Building Code compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below.

		Where quoted
Standards New Zealand		
NZS/BS 21: 1985	Pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)	VM1 Table 2
NZS/BS 143 and 1256: 1986	Specification for malleable cast iron and cast copper alloy threaded pipe fittings	VM1 Table 2
NZS 202: 1966	Specification for steel pipes and joints for hydraulic purposes	VM1 Table 2
NZS/BS 1387: 1985	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads	VM1 Table 2
NZS/BS 1560:-	Circular flanges for pipes, valves and fittings (class designated)	
Part 3:-	Steel, cast iron and copper alloy flanges	
Section 3.1: 1989	Specification for steel flanges	VM1 Table 2
NZS/BS 1740:-	Specification for wrought steel pipe fittings (screwed BS 21 R-series thread)	VM1 Table 2
Part 1: 1971	Metric units *Amend: 1, 2, 3*	
NZS/BS 2494: 1990	Specification for elastomeric seals for joints for pipework and pipelines	VM1 Table 2
NZS/BS 2654: 1989	Specification for manufacture of vertical steel welded non-refrigerated storage tanks with butt-welded shells for the petroleum industry	VM1 Table 3
NZS/BS 2971: 1982	Specification for Class II arc welding of carbon steel pipework for carrying fluids	VM1 Table 2
NZS 3106: 1986	Code of practice for concrete structures for the storage of liquids	VM1 Table 3
NZS 3107: 1978	Specification for precast concrete drainage and pressure pipes	VM1 Table 2
NZS 3302: 1983	Specification for ceramic pipes, fittings and joints	VM1 Table 2
NZS/BS 3601: 1987	Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes	VM1 Table 2
NZS 4219: 1983	Specification for seismic resistance of engineering systems in buildings	VM1 2.3.2
NZS/BS 4504:-	Circular flanges for pipes, valves and fittings (PN designated)	
Part 3:-	Steel, cast iron and copper alloy flanges	
Section 3.2: 1989	Specification for cast iron flanges	VM1 Table 2

		Where quoted
NZS 4442: 1988	Welded steel pipes and fittings for water, sewage and medium pressure gas	VM1 Table 2
NZS 4452: 1986	Code of practice for the construction of underground pipe sewers and drains	VM1 Table 2
NZS/BS 5500: 1991	Specification for unfired fusion welded pressure vessels	VM1 Table 3
NZS/BS 5556: 1978	Specification for general requirements for dimensions and pressure ratings for pipe of thermoplastics materials (metric series)	VM1 Table 2
NZS 7601: 1978	Specification for polyethylene pipe (Type 3) for cold water services	VM1 Table 2
NZS 7602: 1977	Specification for polyethylene pipe (Type 5) for cold water services	VM1 Table 2
NZS 7604: 1981	Specification for high density polyethylene drain and sewer pipe and fittings	VM1 Table 2
NZS 7609:-	Acrylonitrile butadiene styrene (ABS) pipes and fittings for pressure applications	VM1 Table 2
Part 1: 1990	Pipes	
Part 2: 1990	Solvent cement fittings	
NZS 7610: 1991	Blue polyethylene pipes up to nominal size 63 for below ground use for potable water	VM1 Table 2
NZS 7641: 1978	Specification for unplasticized PVC waste and ventilating pipe, fittings and accessories. 32 mm, 40 mm, and 50 mm	VM1 Table 2
NZS 7642: 1971	Specification for unplasticized PVC soil and ventilating pipe, fittings and accessories	VM1 Table 2
NZS 7643: 1979	Code of practice for the installation of unplasticized PVC pipe systems	VM1 Table 2
NZS 7648: 1987	Unplasticized PVC pipe and fittings for pressure applications	VM1 Table 2
NZS 7649: 1988	Unplasticized PVC sewer and drain pipe and fittings	VM1 Table 2
NZS 7652: 1976	Specification for plastics waste traps	VM1 Table 2
British Standards Institution		
BS 1600: 1992	Specification for dimensions of steel pipe for the petroleum industry	VM1 Table 2
BS 1640:-	Specification for steel butt-welding pipe fittings for the petroleum industry	VM1 Table 2
Part 3: 1968	Wrought carbon and ferritic alloy steel fittings. Metric units *Amend: 905*	
Part 4: 1968	Wrought and cast austenitic chromium-nickel steel fittings. Metric units	

Amend 1
Sep 1993

		Where quoted
BS 1965:-	Specification for butt-welding pipe fittings for pressure purposes	VM1 Table 2
Part 1: 1963	Carbon steel *Amend: 5474, 4169*	
BS 2594: 1975	Specification for carbon steel welded horizontal cylindrical storage tanks	VM1 Table 3
BS 2598:-	Glass plant, pipeline and fittings	VM1 Table 2
Part 1: 1980	Specification for properties of borosilicate glass 3.3	
Part 2: 1980	Specification for testing, handling and use	
Part 3: 1980	Specification for pipeline and fittings of nominal bore 15 to 150 mm: compatibility and interchangeability	
Part 4: 1980	Specification for glass plan components	
BS 2640: 1982	Specification for Class II oxy-acetylene welding of carbon steel pipework for carrying fluids	VM1 Table 2
BS 3799: 1974	Specification for steel pipe fittings, screwed and socket-welding for the petroleum industry	VM1 Table 2
BS 4741:1971	Specification for vertical cylindrical welded steel storage tanks for low-temperature service: single wall tanks for temperatures down to 50°C	VM1 Table 3
BS 4991: 1974	Specification for propylene copolymer pressure pipe	VM1 Table 2
BS 4994: 1987	Specification for design and construction of vessels and tanks in reinforced plastics	VM1 Table 3
BS 6374:-	Lining of equipment with polymeric materials for the process industries	VM1 Table 3
Part 1: 1985	Specification for lining with sheet thermoplastics	
Part 2: 1984	Specification for lining with non-sheet applied thermoplastics	
Part 3: 1984	Specification for lining with stoved thermosetting resins	
Part 4: 1984	Specification for lining with cold curing thermosetting resins	
Part 5: 1985	Specification for linings with rubbers	
BS 6464: 1984	Specification for reinforced plastics pipes, fittings and joints for process plants	VM1 Table 2
BS 7159: 1989	Code of practice for design and construction of glass reinforced plastics (GRP) piping systems for individual plants or sites	VM1 Table 2
Standards Association of Australia		
AS 1159:-	Polyethylene pipes for pressure applications	VM1 Table 2
AS 1460:-	Fittings for use with polyethylene pipes	
Part 1: 1989	Mechanica jointing fittings	VM1 Table 2
Part 2: 1989	Electrofusion fittings	VM1 Table 2

Amend 1 Sep 1993

		Where quoted
AS 1727: 1975	Tank containers (international sizes)	VM1 Table 3
AS 2033: 1980	Installation of polyethylene pipe systems	VM1 Table 2
American National Standards Institute and American Society of Mechanical Engineers		
ANSI/ASME		
B16.3-1985	Malleable-iron threaded fittings, Classes 150 and 300	VM1 Table 2
B16.5-1988	Pipe flanges and flanged fittings, steel-nickel alloy and other special alloys	VM1 Table 2
B16.9-1990	Factory-made wrought steel butt-welding fittings	VM1 Table 2
B31.3-1990	Chemical plant and petroleum refinery piping	VM1 Table 2
ANSI		
B2.1-1968	Screwing and socketing	VM1 Table 2
B16.11-1980	Forged steel fittings, socket-welding and threaded	VM1 Table 2
ASME	Boiler and pressure vessel code – VIII pressure vessels	VM1 Table 3
American Petroleum Institute		
API SPEC 5L-1990	Specification for line pipe	VM1 Table 2
API STD 620-1990	Design and construction of large, welded, low-pressure storage tanks	VM1 Table 3
API STD 650-1988	Welded steel tanks for oil storage	VM1 Table 3
API STD 1104-1988	Welding of pipelines and related facilities	VM1 Table 2
American Society for Testing and Materials		
ASTM A53-90a	Specification for pipe, steel, black and hot-dipped, zinc coated welded and seamless	VM1 Table 2

Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Approved Document. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Adequate *Adequate* to achieve the objectives of the *building code*.

Building has the meaning ascribed to it by the Building Act 1991.

Grease trap A device designed to intercept grease in a *foul water discharge*.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Interceptor trap A device which will separate and retain desired liquids and solids from a liquid stream and which will provide a water barrier to prevent foul air or gas from entering any downstream system.

Network utility operator means a person who:

a) Undertakes the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy; or

b) Is an electricity operator or electrical supply authority as defined by the Electricity Act 1968 for the purpose of an electric line as defined by that Act; or

c) Undertakes the piped distribution of *potable* water for supply; or

d) Is the operator of a sewerage system or a stormwater drainage system.

Piping system An assembly of pipes, pipe fittings, gaskets, bolting and pipe supports.

Sewer A *drain* that is under the control of, or maintained by, a *network utility operator*.

Verification Method G14/VM1

1.0 General

1.1 Scope

1.1.1 This document describes the requirements to be satisfied by specific design for systems used for the collection, storage, treatment and disposal of industrial liquid waste.

1.2 Treatment and disposal

1.2.1 The method of treatment and disposal (see Figure 1) may include:

a) Discharge to a *sewer* either with or without pre-treatment, as permitted by the *network utility operator.*

b) Discharge to a natural waterway either with or without treatment, in accordance with the Resource Management Act 1991, or

c) Storage within the *building* site and later removal for disposal elsewhere.

1.2.2 Table 1 gives examples of industrial liquid wastes and typical treatment and disposal methods.

1.3 Related documents

1.3.1 Where the *network utility operator* accepts the discharge of industrial liquid waste to a *sewer*, the waste shall be conveyed in a plumbing and drainage disposal system complying with NZBC G13 "Foul Water".

1.3.2 Where wastes are *hazardous*, the storage facilities shall also comply with NZBC F3 "Hazardous Substances and Processes".

1.4 Location of collection, storage and treatment facilities and disposal systems

1.4.1 Collection, storage and treatment facilities and disposal systems shall be located:

a) In areas that will not create health or safety hazards,

b) To ensure that spillage from storage tanks or ponds can be safely contained, and

COMMENT:
Large areas may be required if liquid wastes are stored in oxidation ponds or lagoons.

c) In areas with sufficient access for cleaning, clearing of blockages, and maintenance.

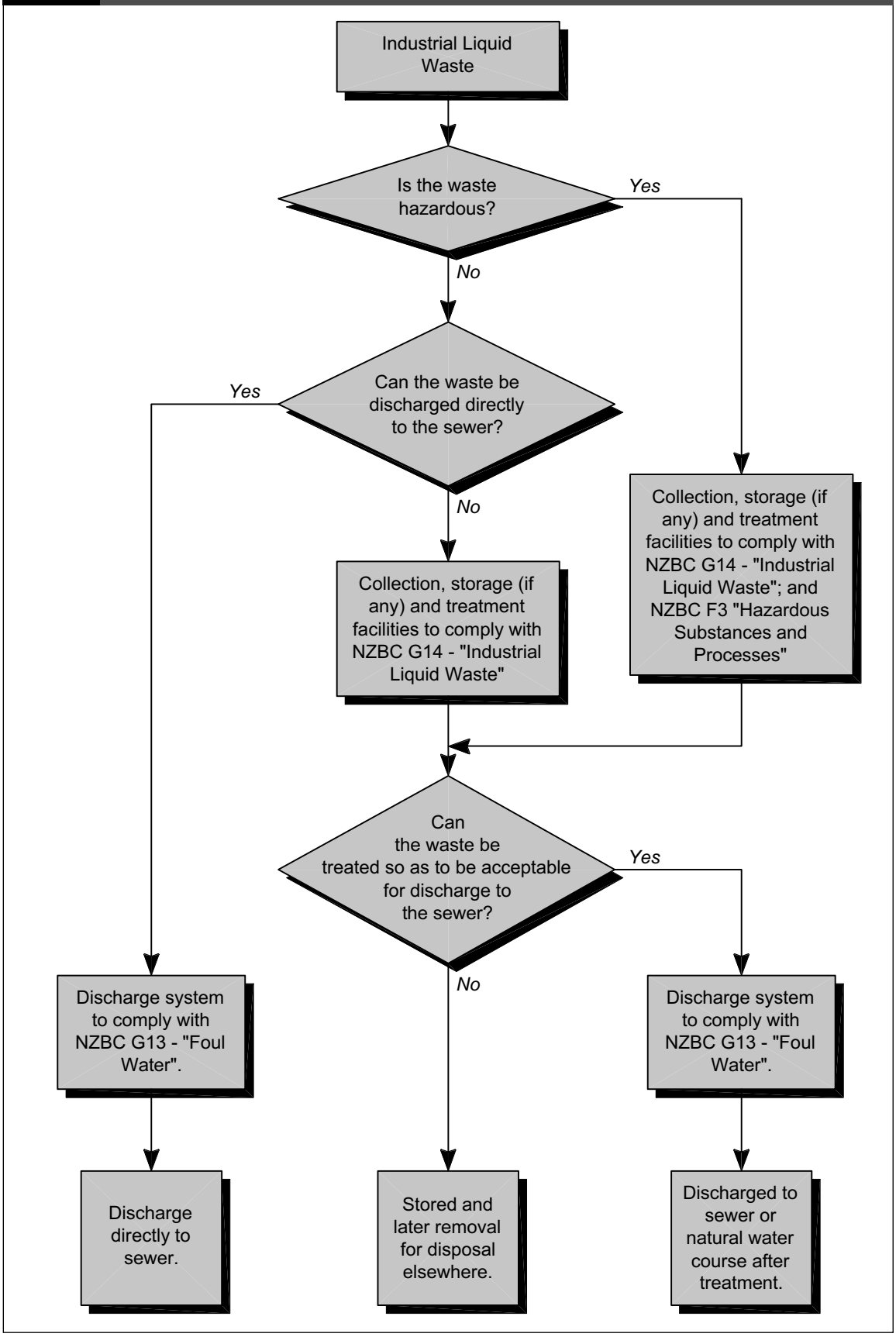
1.4.3 Where for any reason it is not practical to install a storage tank above ground, storage tanks may be placed below ground provided that precautions are taken to avoid health or safety hazards or undue corrosion of the tank or associated plant.

1.5 Materials of construction

1.5.1 All materials in contact with industrial liquid waste shall be resistant to corrosion, chemical attack, and any abrasion or physical abuse that can be reasonably expected.

1.5.2 Any corrosion allowance provided in the design of equipment handling liquid waste shall be *adequate* for the *intended life* of the facilities.

Figure 1: **Treatment and Disposal Methods**
Paragraph 1.2.1



1.6 Avoidance of uncontrolled contamination

1.6.1 The area containing waste storage facilities shall be impervious and contained so as to avoid uncontrolled contamination of any soil, ground water or waterways through run-off from washing down, rain, accidental overflows or other causes.

1.6.2 Industrial liquid waste facilities shall be installed to avoid contamination of any potable water supply, as required by NZBC G12 "Water Supply".

1.7 Separation of wastes

1.7.1 Separate systems shall be provided to convey and store liquid wastes which require different treatment and/or disposal methods, or where the liquid wastes are incompatible.

Table 1: Examples of Industrial Liquid Waste and Typical Treatment and Disposal Methods
Paragraph 1.2.2

Type of industrial waste	Industry source	Typical contaminants	Typical treatment and disposal methods
Waste containing organic compounds:			
1) Natural organic waste from food and drink manufacture.	Meat processing. Dairy processing. Cannery. Poultry processing. Brewery. Vegetable processing. Winery. Sugar refining.	Soluble and suspended solids. Carbohydrates. Proteins. Fat and grease. Alkalis.	Neutralisation. Grease recovery. Sedimentation flotation. Biological. Land application. Discharge to sewer.
2) Other organic waste from processing animal and vegetable matter.	Pulp and paper. Tannery & leather processing. Wool scouring. Textile & carpet manufacture. Timber treatment. Hospitals.	Carbohydrates. Proteins. Acids, alkalis. Tannins. Inorganic salts. Dyes, bleaches. Latex. Suspended solids. Viruses. Fat and grease.	Neutralisation. Screening. Sedimentation flotation. Chemical precipitation. Cooling towers. Disinfection. Heat.
Waste containing metals and cyanides.	Mineral processing. Steel mills. Foundries. Plating operations. Metal fabrication. Electrical manufacturing.	Acids, alkalis. Oil. Heavy metals. Chromium. Cyanides. Solvents. Suspended solids.	Neutralisation. Sedimentation, flotation. Chemical precipitation. Ion exchange. Filtration. Distillation & stream stripping. Cooling towers. Heat.
Other chemical waste.	Fertiliser works. Paint manufacture. Pharmaceutical. Petrochemical. Agrochemical production. Plastics manufacture.	Organic chemicals. Solvents. Acids, alkalis. Suspended solids. Inorganic salts. Viruses.	Neutralisation. Screening. Sedimentation flotation. Chemical treatment. Absorption and ion exchange. Distillation & steam stripping. Membrane separation. Biological. Incineration. Secure landfill. Disinfection.

1.8 Vehicle access

1.8.1 Vehicle access areas for the collection of industrial liquid waste shall:

a) Comply with NZBC, D1 "Access". Where possible, access layout shall provide sufficient space for vehicles to drive in and out of the facility without reversing or interference with other activities on the site, and

b) Drain any spilled waste to a kerbed area sloped so that the waste does not collect under the vehicle, or drain in an uncontrolled manner to other areas of the plant.

1.9 Security

1.9.1 Where unauthorised access to storage and treatment facilities may be *hazardous*, security shall be provided by:

a) Locating the facilities in a lockable enclosed space within a *building*, or

b) An external security fence with lockable gates if located in the open.

2.0 Conveyance of Liquid Wastes

2.1 Layout

2.1.1 Screens, grit chambers, *grease traps* or similar appropriate equipment should be installed at the head of piping systems which, without them, might cause blockage of the *piping system*.

2.1.2 Wherever possible, *piping systems* shall convey liquid waste using gravity flow.

2.1.3 Gravity flow pipelines should have sufficient gradient to provide flow velocities which prevent the settlement of entrained solids and grit.

2.1.4 Pipework containing *hazardous* liquid wastes shall not be buried except where this is unavoidable.

2.1.5 Piping above access areas shall have a ground clearance of no less than 4.5 m. In vehicle access areas signs shall be displayed indicating the amount of clearance.

2.1.6 Valves shall be readily accessible. The distance between operating floor level and the centreline of any valve handwheels located above floor level shall be no more than 2.2 m unless extension operating gear is provided. Valve stems shall not slope downwards in a way that allows solids to enter the gland.

2.1.7 Pipework flanges shall not be located over roads, walkways or cable trays or places where leakage could cause damage or a hazard.

2.2 Drainage

2.2.1 Floor surfaces which are used to drain free flowing liquid should slope towards waste collection systems:

a) For non-*hazardous* wastes: – no less than 1 in 80 for a travel distance of no more than 12 m, or

b) For *hazardous* wastes: – no less than 1 in 40 for a travel distance of no more than 6.0 m.

COMMENT:
Drainage valleys should not coincide with access ways. Kerbs may be required to prevent *hazardous* liquid wastes contaminating access areas or mixing with other fluids.

2.2.2 Liquid waste shall be prevented from polluting adjacent property.

2.2.3 *Interceptor traps* shall be installed at the exit points of areas containing flammable liquid wastes which are immiscible in water, to prevent the spread of fire.

2.2.4 Liquid-sealed traps shall be provided at any branch connections to contain *hazardous* gases within parts of the conveyance system. Traps shall be vented to a safe location no less than 3.0 m above ground level.

2.3 Piping

2.3.1 The piping system shall comply with the standards applicable to the material used and wastes being conveyed. Related standards are listed in Table 2.

2.3.2 Seismic restraint – NZBC B1 requires tanks to be secured against earthquake forces. The methods given in NZS 4219 are acceptable.

2.3.3 Joints, fittings and valves – The number of joints, fittings and valves in the *piping system* shall be kept to a practical minimum.

COMMENT:
This reduces the likelihood of blockage and leakage.

2.3.4 Bends shall have a centreline radius of no less than 1.5 times the nominal pipe diameter.

2.3.5 Pipe wall thickness shall be designed to avoid failure, paying due regard to:

a) Operating temperature and pressure,

b) Corrosion and erosion allowances, and

c) Manufacturing tolerances.

2.3.6 Thermal movement – Piping layouts shall allow for expansion and contraction due to temperature change, without placing excessive stresses on piping materials, or excessive forces and moments on equipment anchors. Methods of accommodating thermal movement in piping may include:

a) Positioning of connected equipment to take advantage of the inherent flexibility of pipework,

b) Expansion loops or offset legs,

c) Expansion bellows units,

d) Expansion joints, and

e) Accommodation of stresses by control of expansion direction via supports, anchors and guides.

COMMENT:
Threaded joints weaken the pipe, are particularly prone to leakage, and perform poorly in corrosive service. When leakage around the valve stem cannot be tolerated, valves with double packing boxes or with a bellows seal should be used.

2.3.7 Piping systems for *hazardous* liquid wastes shall have:

a) Flanged or butt-welded joints,

b) Fail-safe control valves, normally closed,

c) Protection against temperature both from the fluid conveyed or the occurrence of *fire*,

d) Metal reinforced, spiral wound and ring jointed gaskets of a material suitable for the temperature and the waste being handled, and

e) Protection against over-pressure.

2.4 Pumps

2.4.1 Pumps shall be designed with regard to:

a) The required capacity and flow rate,

b) Maximum internal or external coincident pressure,

c) Minimum or maximum temperatures expected in service,

d) The suspended solids likely to be present in the liquid waste,

e) Protection against leakage, by the selection of an appropriate chemically-resistant seal packing material,

f) Minimising the length of suction lines, and providing the required net positive suction head,

g) Ensuring that any spillage is conducted away from the pump and motor, and

h) Providing a means of isolation for maintenance purposes.

Table 2: Standards Relevant to Piping Systems
Paragraph 2.3.1

Material	System	Standards	Special conditions
Steel	Piping	NZS 202	
		NZS 4442	Welded pipe 100 to 1000 mm nominal diameter.
		NZS/BS 1387	Tube suitable for screwing to BS 21.
		BS 1600: Pt 2	
		NZS/BS 3601	
		ASTM A53	All black pipe should be protected against internal and external corrosion.
		API 5L	
		NZS 4452	Installation of underground pipe of specified materials up to 350 mm diameter.
		ANSI/ASME B31.3	Systems subject to pressure or vacuum.
	Fittings	NZS/BS 143 & 1256	Screwed pipe fittings, malleable cast iron.
		ANSI/ASME B16.3	Screwed pipe fittings, malleable cast iron.
		NZS/BS 1740: Pt 1	Screwed pipe fittings, wrought steel.
		ANSI B16.11	Screwed pipe fittings, wrought steel and socket welded pipe fittings.
		BS 3799	Socket welded pipe fittings.
		BS 1640	Butt-welding fittings.
		BS 1965: Pt 1	Butt-welding fittings.
		ANSI/ASME B16.9	Butt-welding fittings.
		NZS/BS 1560: Pt 2	Flanges.
		NZS/BS 4504: Pt 3	Flanges.
		ANSI/ASME B16.5	Flanges.
	Jointing	NZS/BS 21	Screwed/socketed.
		ANSI B2.1	Screwed/socketed.
		BS 2640	Welded.
		NZS/BS 2971	Welded.
		API 1104	Welded.
Concrete	Piping	NZS 3107	Precast concrete.
		NZS 4452	Installation of underground pipe of specified materials up to 350 mm diameter.
		ANSI/ASME B31.3	Systems subject to pressure or vacuum.
	Joints	NZS/BS 2494	Elastomeric joint rings.
Plastic (Note 1)	ABS	NZS 7609	ABS pipes up to 200 mm diameter.
	Polyethylene piping	NZS 7601	Maximum working pressure up to 0.9 MPa.
		NZS 7602	Maximum working pressure up to 1.2 MPa.
		AS 1159	Maximum working pressure up to 1.5 MPa.
		AS 1460	Maximum working pressure up to 1.5 MPa.
		NZS 7604	For nominal pipe diameters of 80 mm to 225 mm.
		NZS 7610	Blue polyethylene for below ground use.
		AS 2033	Installation and jointing techniques for above and below ground.
	Polypropylene Copolymer piping	BS 4991	For temperatures up to 100ºC.
	PVC piping	NZS 7641	UPVC pipe diameter 32 mm, 40 mm and 50 mm for use above ground.
		NZS 7642	For above-ground system.
		NZS 7643	Installation of UPVC pipe above and below ground.
		NZS 7648	Pressure pipe between 10 mm and 575 mm nominal bore.
		NZS 7649	Non-pressure pipe between 90 mm and 630 mm outside diameter.
		NZS/BS 5556	Dimensions and pressure ratings.
	Reinforced piping	BS 6464	For glass reinforced piping system and fittings.
		BS 7159	
	Waste traps	NZS 7652	For connecting to 32 mm, 38 mm and 51 mm wastes.
Ceramic	Piping	NZS 3302	Glazed and non-glazed non-pressure pipe.
Glass	Piping	BS 2598	For borosilicate glass pipe and fittings of nominal bore 15 mm to 150 mm.
		ANSI/ASME B31.3	Systems subject to pressure or vacuum.

Note:

1. The pressure resistance of plastic piping and fittings is significantly reduced at elevated temperatures. Manufacturers data should be consulted for working temperatures above 20ºC.

2.4.2 Where suspended solids are likely to cause blockages, centrifugal pumps having a suction inlet diameter of no less than 100 mm shall be used.

2.4.3 Typical pump installation layouts are shown in Figure 2.

2.4.4 When *hazardous* liquid waste is to be conveyed, pumps shall:

a) Be sealless or glandless pumps, and

b) Include a remotely or automatically actuated shut-off valve in the pump inlet line.

3.0 Storage Tanks

3.1.1 Standards appropriate to the design and construction of storage tanks are given in Table 3.

3.1.2 Storage tanks shall be fitted with an accurate liquid level indicator which can be easily removed from the tank for maintenance purposes, without the need to empty the tank.

3.1.3 Tanks for the storage of toxic or corrosive *hazardous* wastes, or wastes producing foul air, shall be fitted with sealed covers and be provided with a pressure relief system which vents to a safe outdoor location.

3.1.4 Within the immediate vicinity of any toxic and corrosive wastes, a safety shower, eyewash unit and a wash down hose complying with G12/AS1 and G13/AS1 shall be provided, and be clearly identified.

3.1.5 A typical tank storage facility for corrosive liquid waste is shown in Figure 3.

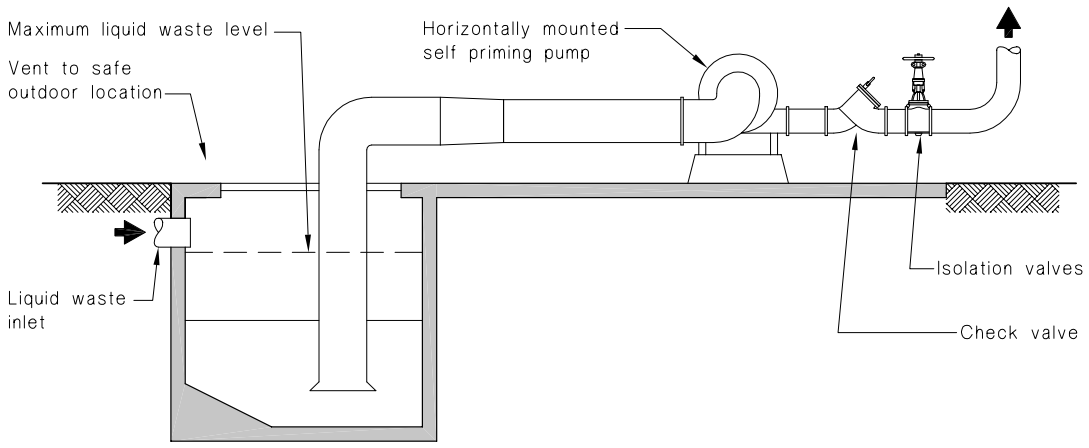
Table 3: Standards Used for the Design of Acceptable Tank Storage Systems (note 1)
Paragraph 3.1.1

Material	Standards	Special Conditions
Steel	API 650	Maximum pressure 17 kPa – Not for refrigerated service.
	API 620	Maximum pressure 103 kPa – Temperatures down to –60°F.
	ASME VIII	For pressures above 103 kPa.
	AS 1727	–
	BS 2594	Horizontal cylindrical vessels.
	NZS/BS 2654	Maximum pressure 56 kPa – Vertical vessels.
	BS 4741	Maximum pressure 14 kPa – Temperatures down to –50°C.
	NZS/BS 5500	Not for vessels for transport or atmospheric storage.
Concrete	NZS 3106	–
Plastic	BS 4994	Maximum pressure 500 kPa – Temperatures between 0 – 100°C.
	BS 6374	For tank linings.

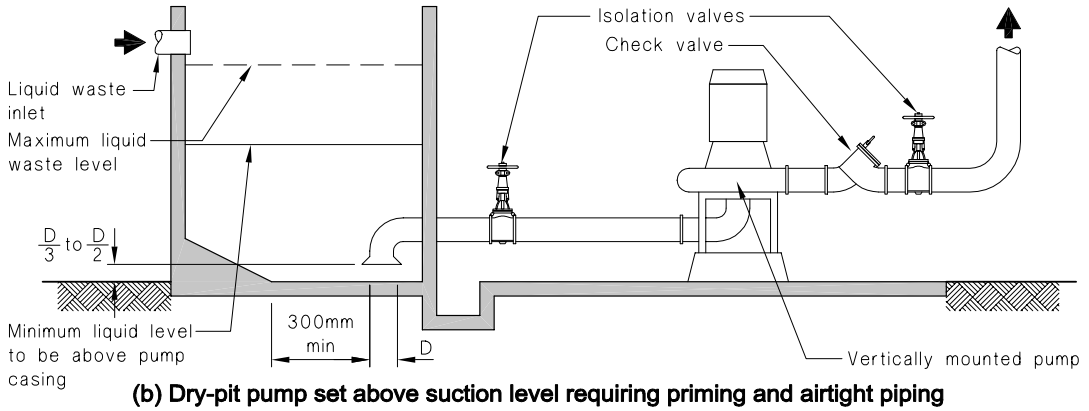
Note:

1. In all cases Standards must be used only for applications appropriate to the liquid waste being stored.

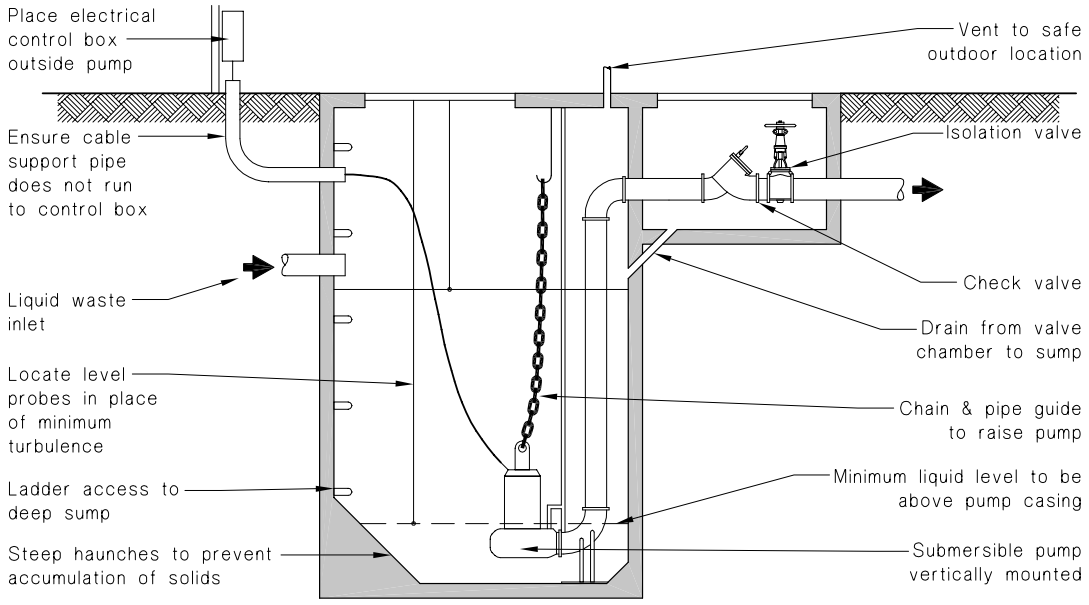
Figure 2: **Typical Pump Layout Arrangements to Convey Liquid Waste**
Paragraph 2.4.3



(a) Dry-pit pump set for solids handling with flooded suction

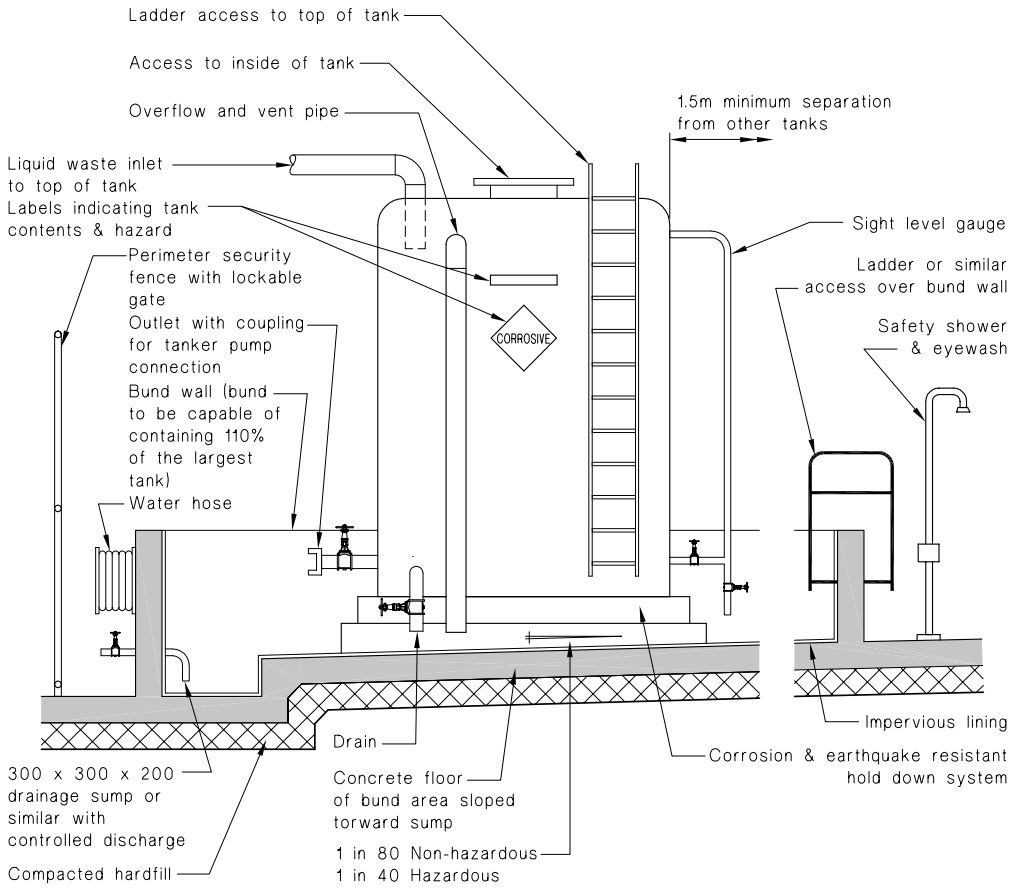


(b) Dry-pit pump set above suction level requiring priming and airtight piping



(c) Wet-pit pump set for solids handeling with flooded suction

Figure 3: **Typical Tank Storage Facility for a Corrosive Liquid Waste**
Paragraph 3.1.5



Acceptable Solution G14/AS1

1.1 Security

1.1.1 A fence erected to ensure security against unauthorised access to storage and treatment facilities, shall comply with F5/AS1 "Construction and Demolition Hazards".

1.2 Acceptable disposal systems

1.2.1 Discharge to the sewer without pre-treatment – Where the *network utility operator* accepts the discharge of an industrial liquid waste to a *sewer* without pre-treatment, the disposal system shall comply with G13/AS1 "Foul Water".

1.2.2 Discharge to the sewer after pre-treatment – Where the *network utility operator* accepts the discharge of an industrial liquid waste to a *sewer* with pre-treatment, that part of the discharge system used to convey the waste after treatment shall comply with G13/AS1 "Foul Water".

Index G14/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.