

Australian/New Zealand Standard™

On-site domestic wastewater treatment units

Part 1: Septic tanks



AS/NZS 1546.1:2008

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee WS-013, On-site Domestic Wastewater Management. It was approved on behalf of the Council of Standards Australia on 16 May 2008 and on behalf of the Council of Standards New Zealand on 18 April 2008. This Standard was published on 25 May 2008.

The following are represented on Committee WS-013:

Association of Accredited Certification Bodies (Australia)
Association of Rotational Moulders (Australasia)
Auckland Regional Council
Australian and New Zealand Clinical Waste Management Industry Group
Australian Industry Group
Australian Water Association, National On-site Systems Special Interest Group
Business New Zealand
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Department of Conservation, New Zealand
Department of Health and Community Services, Northern Territories
Department of Health, South Australia
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New South Wales Health Department
New Zealand Water and Wastes Association, Small Wastewater and Natural Systems Special Interest Group
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Australian/New Zealand Standard™

On-site domestic wastewater treatment units

Part 1: Septic tanks

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FOREWORD

This Standard is one of a series that has been revised by the Joint Standards Australia/Standards New Zealand Committee WS-013 on On-site Domestic Wastewater Management. It supersedes AS/NZS 1546.1:1998 On-site domestic wastewater treatment units Part 1: Septic tanks. The other Standards that have been revised by the committee are:

- AS/NZS 1547:2000 On-site domestic-wastewater management;
- AS/NZS 1546.2:2001 On-site domestic-wastewater treatment units Part 2: Waterless composting toilets; and
- AS/NZS 1546.3:2001 On-site domestic wastewater treatment units Part 3: Aerated wastewater treatment systems.

There is a twofold objective in this Standard. The first is to provide a set of performance statements which define the requirements of a septic tank against which any septic tank may be assessed. The second is to provide manufacturers of septic tanks and associated fittings with basic manufacturing and test specifications. These will enable certification bodies to check that a product conforms to the Standard.

In this revision some changes have been made for the testing of plastic tank materials. There are separate tests for injection moulded tanks and rotationally moulded tanks. The tests are a normative requirement. There has also been detail offered for the estimation of sidewall loading on tanks.

It is the intention of the committee that the next revision of the Standard will include performance criteria and test methods for control of total suspended solids (TSS) in the effluent from the septic tank. The committee recommends a total suspended solids discharge level of less than or equal to 100 g/m³ be met.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
On-site domestic wastewater management

Part 1: Septic tanks

1 GENERAL**1.1 Objective**

The objective of this Standard is to specify performance requirements and performance criteria for septic tanks, to specify technical means of compliance and to provide test specifications that will enable septic tanks to be manufactured to comply with the performance requirements and performance criteria.

1.2 Scope**1.2.1 General**

This Standard covers the manufacture of septic tanks and their associated fittings for the treatment of domestic wastewater only. This range of tanks typically is designed to cater for:

- (a) All-waste (Blackwater and Greywater);
- (b) Blackwater only;
- (c) Greywater (with or without kitchen waste included) only; and
- (d) Holding tanks (collection wells) and pump wells.

Septic tanks covered by this Standard are suitable for a flow of domestic wastewater of up to 14,000 litres per week.

C1.2.1

This flow limit represents a maximum daily flow of 2000 litres, being from up to 10 persons in a single residence, or an institutional or commercial facility which may have a varying 7-day or 5-day operation.

1.2.2 Structural design

This Standard provides guidance for consultants and designers of septic tank systems. Structural design provisions included in the document apply to conventional designs installed in standard situations. Specific structural design by a suitably qualified structural engineer, using appropriate design methodologies and relevant Standards, shall be carried out when any of the following conditions apply:

- (a) Capacity of the tank exceeds 6000 L;
- (b) Tank lid or wall is below ground level;
- (c) The internal diameter of the cylindrical tank and the internal width or internal height of a rectangular tank is greater than 1800 mm;
- (d) The internal length of a rectangular tank is greater than 2400 mm;
- (e) Tank lid plan area is greater than 4.5 m².

1.3 Interpretation

The word 'shall' identifies a mandatory requirement for compliance with the Standard. The word 'should' refers to practices, which are advised or recommended.

The illustrations used in this Standard are diagrammatic only and are chosen to illustrate principles of design or operation.

Clauses prefixed by 'C' and printed in italic and shaded are comments, explanations, and summaries of technical background, or recommended practice. They may also suggest approaches that satisfy the intent of the Standard, but are not to be taken as the only or complete interpretation.

The terms 'Normative' and 'Informative' have been used in this Standard to define the application of the Appendices to which they apply. A 'Normative' appendix is an integral part of the Standard, whereas an 'Informative' appendix is for information and guidance only.

1.4 Application

This Standard is intended for use by consultants, designers, manufacturers, certifying bodies, installers, and regulators.

Section 2 specifies the performance requirements and performance criteria for septic tanks.

Section 3 covers general design requirements which provide a means of compliance relevant to these criteria and common to all tanks.

Sections 4 to 8 provide material-specific means of compliance for the manufacture of tanks as a way of achieving some of the performance requirements and criteria.

Appendix A details requirements to be used for third party audit/certification purposes to demonstrate compliance with the performance requirements of this Standard.

All tanks manufactured to this Standard shall meet the performance requirements and performance criteria of Section 2. Means of compliance other than those in Sections 3 to 8 may be used for tanks manufactured from other materials or to other designs.

1.4.1 General

This Standard covers the purpose and requirements of septic tanks and associated fittings only. It does not cover the drainage systems leading to the tank, (refer to AS/NZS 3500.2), nor anything downstream of the tank (refer to AS/NZS 3500.2 or AS/NZS 1547 as appropriate).

1.4.2 Conventional designs and materials

Traditionally certain materials, designs, and techniques have been used and have become established. The materials and associated designs shown in Sections 4 to 8 of this Standard have been proven through use and are presented as examples of solutions that are a means of compliance with the provisions of this Standard.

1.4.3 Non-standard materials, installations, or designs

This Standard does not preclude the manufacture of septic tanks from any material, or in any unusual design, or installation in any non-standard fashion, provided that the completed product and its installation meets the performance requirements and performance criteria given in Section 2 of this Standard.

C1.4.3

It may be necessary to obtain and supply evidence of third party certification or opinion from people or organisations recognised as having the authority to do so before a regulatory authority will accept a new material or design.

1.4.4 Operation and Maintenance

Septic tank systems need maintenance and regular desludging. Operation and maintenance requirements are covered in AS/NZS 1547.

C1.4.4

In extreme cold climate areas because the anaerobic process within the septic tank will be considerably slower, consideration should be given to increasing the frequency of desludging and heating or insulation of the tank to maintain anaerobic activity.

1.5 Legislation

This Standard shall be read in conjunction with the bylaws and regulations of the regulatory authorities in Australia, and the New Zealand Building Code in New Zealand.

1.5.1 Australia

The control of the collection and treatment of domestic wastewater is the responsibility of the regulatory authority.

1.5.2 New Zealand**1.5.2.1 New Zealand Building Code**

Septic tank systems and associated land application areas come within the description of a building in section 8 of the Building Act 2004. The performance requirements of systems that store and treat domestic-type wastewater (foul water) are given in New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

Septic tanks constructed to this Standard meet the requirements of the New Zealand Building Code for:

Clause B1	Structure
Clause B2	Durability
Clause G14	Industrial Liquid Waste.

1.5.2.2 Resource Management Act

The Resource Management Act (RMA) is operated by local authorities (regional councils and territorial authorities) and, through regional plans, imposes environmental constraints on systems and the effluent produced.

Through the RMA, regional councils will have established regional plans which identify permitted, controlled, discretionary, and prohibited activities. Territorial authorities will give consent under the Building Act to install a system and will advise if resource consent under the RMA is required.

1.6 Referenced documents

The following documents are referred to in this Standard:

AUSTRALIAN

SA HB 18.28:2005	Conformity assessment – Guidance on a third-party certification system for products
AS 1012.8.1:2000	Methods of testing concrete – Method for making and curing concrete compression, indirect tensile and flexure test specimens, in the laboratory or in the field
AS 1012.8.2:2000	Methods of testing concrete – Method of making and curing concrete – Flexure test specimens
AS 1012.9:1999	Methods of testing concrete – Determination of the compressive strength of concrete specimens
AS 1012.14:1991	Methods of testing concrete – Method for securing and testing cores from concrete for compressive strength
AS 1379:2007	Specification and supply of concrete
AS 1478.1:2000	Chemical admixtures for concrete, mortar and grout – Admixtures for concrete
AS 1597.1:1974	Precast reinforced concrete box culverts – Small culverts (not exceeding 1200 mm width and 900 mm depth)
AS 2738:2000	Copper and copper alloys – Compositions and designations of refinery products, wrought products, ingots and castings
AS 2758.1:1998	Aggregates and rock for engineering purposes – Concrete aggregates
AS 3600:2001	Concrete structures
AS 3972:1997	Portland and blended cements
AS ISO/IEC 17025:2005	General requirements for the competence of testing and calibration laboratories.

JOINT AUSTRALIAN/NEW ZEALAND

AS/NZS 1546.2:2008	On-site domestic wastewater treatment units – Waterless composting toilets
AS/NZS 1546.3:2008	On-site domestic wastewater treatment units – Aerated wastewater treatment systems
AS/NZS 1547:2008	On-site domestic wastewater management
AS/NZS 3500.2:2003	Plumbing and drainage – Sanitary plumbing and drainage
AS/NZS 4671:2001	Steel reinforcing materials
AS/NZS 4766:2006	Polyethylene storage tanks for water and chemicals

NEW ZEALAND

NZS 3104:2003	Specification for concrete production
NZS 3106:1986	Code of practice for concrete structures for the storage of liquids
NZS 3109:1997	Concrete construction
NZS 3112.2:1986	Methods of test for concrete – Tests relating to the determination of strength of concrete
NZS 3113:2005	Specification for chemical admixtures for concrete
NZS 3121:1986	Specification for water and aggregate for concrete
NZS 3122:1995	Specification for Portland and blended cements (General and special purpose)
NZS ISO/IEC 17025:2005	General requirements for the competence of testing and calibration laboratories

INTERNATIONAL

ISO 62:2008	Plastics – Determination of water absorption
ISO 75-2:2004	Plastics – Determination of temperature of deflection under load – Plastics and ebonite
ISO 75-3:2004	Plastics – Determination of temperature of deflection under load – High-strength thermosetting laminates and long-fibre-reinforced plastics
ISO 179-1:2000	Plastics – Determination of Charpy impact properties – Non-instrumented impact test
ISO 179-2:1997	Plastics – Determination of Charpy impact properties – Instrumented impact test
ISO 527-1:1993	Plastics – Determination of tensile properties – General principles
ISO 527-2:1993	Plastics – Determination of tensile properties – Test conditions for moulding and extrusion plastics
ISO 527-4:1997	Plastics – Determination of tensile properties – Test conditions for isotropic and orthotropic fibre-reinforced plastic composites
ISO 1172:1996	Textile-glass-reinforced plastics – Prepregs, moulding compounds and laminates – Determination of the textile-glass and mineral-filler content – Calcination methods
ISO 1268-4:2005	Fibre-reinforced plastics – Methods of producing test plates – Moulding of prepregs
ISO 14125:1998	Fibre-reinforced plastic composites – Determination of flexural properties

AMERICAN

ASTM A240/ A240M:2007	Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications
ASTM C1609/ C1609M:2006	Standard test method for flexural performance of fiber-reinforced concrete (using beam with third-point loading)
ASTM D3029:1995	Test methods for impact resistance of flat, rigid plastic specimens by means of a tup (falling weight)
ASTM A240/ A240M:2007	Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications
ASTM D4097:2001	Standard specification for contact-molded glass-fiber-reinforced thermoset resin corrosion-resistant tanks

BRITISH

BS 3396.3:1987	Woven glass fibre fabrics for plastics reinforcement. Specification for finished fabrics for use with polyester resin systems
BS 3749:1991	Specification for E glass fibre woven roving fabrics for the reinforcement of polyester and epoxy resin systems
BS EN 13923:2005	Filament-wound FRP pressure vessels. Materials, design, manufacturing and testing
BS EN 14020-3:2002	Reinforcements. Specification for textile glass rovings. Specific requirements
BS EN 14118-3:2003	Reinforcement. Specifications for textile glass mats (chopped strand and continuous filament mats). Specific requirements

NEW ZEALAND LEGISLATION

Building Act 2004
 Building Regulations 1992
 Resource Management Act 1991

LATEST REVISIONS

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Amendments for Australian, New Zealand, and Joint Australian/New Zealand Standards can be found on www.standards.org.au or www.standards.co.nz.

1.7 Definitions

For the purpose of this Standard, the definitions below apply:

Access opening	An opening in the top surface of the tank fitted with a cover which is removable to allow access for desludging and for visual inspection of the interior of the tank and contents, but not intended to allow people to enter a tank
Anchorage	A device or technique for holding the tank in the ground against hydrostatic uplift pressures
Blackwater	Wastewater carrying products of human excretion
Capacity	The volume of the tank below the invert of the outlet
Collection well	(See Holding tank)
Cure	The chemical reaction resulting in the final product
Desludging	Removal of accumulated sludge, liquid, and scum from a septic tank
Domestic wastewater	Wastewater originating from household or personal activities including water closets, urinals, kitchens, bathrooms (including shower, washbasins, bath, spa bath but not a spa), and laundries. Includes wastewater from facilities serving staff/employees/residents in institutional, commercial, and industrial establishments, but excluding commercial and industrial wastes, large-scale laundry activities, and any stormwater flows
Effluence	The liquid discharged from a wastewater treatment process
Extension	A structure used to bring the access or inspection cover to finished ground level
Food waste disposal unit	An appliance being an electrically-operated mechanical device for reducing kitchen food waste into fragments small enough to be flushed into the drainage system (also known as garbage grinder)
Foul water	(See Wastewater)
Garbage grinder	(See Food waste disposal unit)
Gas baffle	A device, usually a simple deflecting plate, installed internally on the outlet of a septic tank, or the outlet of a second chamber, to prevent gas borne solids passing from the tank into the effluent land application system
Gel-coat	For glass fibre manufacture, the thin layer of unreinforced resin on the surface of a glass fibre laminate, which covers the fibre of the reinforcement, protects the bond between resin and reinforcement, and provides special surface properties. It may be pigmented

Grease trap	A pre-treatment chamber to remove fat, oil, and grease from kitchen wastewater prior to it discharging into the septic tank
Greywater	The domestic wastes from a bath, shower, basin, laundry, and kitchen, but excluding toilet and urinal wastes. It may contain pathogens
Holding tank	A tank used for holding effluent or domestic wastewater prior to removal (sometimes called Collection well)
Hydrostatic flange	A horizontal projection on the wall of the septic tank designed to prevent the tank being forced out of the ground by hydrostatic pressure in areas having a high water table. Sometimes called an anchor collar, or ground retention lip (see Anchorage)
Inlet fitting	A device that allows a connection to be made between the drainage system carrying the wastewater and the septic tank
Invert	Opening in the top surface of the tank which allows for inspection of the inlet or outlet fitting
Laminate	For glass fibre manufacture, the set layer or layers of reinforcement impregnated with polyester or other resin forming a thick structural membrane, excluding the gel-coat
Land application	The application of effluent to areas of land for further treatment
Lateral load	The load applied sideways onto a buried tank due to the combined effects of soil, water, and traffic
Manufacturer	Any person, company or firm and any nominated representative of the company or firm that manufactures the septic tank
Outlet fitting	A device that allows a connection to be made between the outlet of the tank and the drainage system that conducts the effluent away for further treatment
Outlet filter	A device that fits into/or is part of the outlet fitting of a septic tank for the purpose of reducing the amount of solid matter in the outflow
Partition	An internal wall within a septic tank
Performance requirements	The functions that a system has to perform in order to operate as defined
Performance criteria	The qualitative or quantitative description of the performance requirements
Pre treatment systems	A system in which wastewater is partially treated before discharge into the septic tank

Pump well	A tank (or a compartment within a larger tank) designed for holding either effluent or domestic wastewater prior to discharge directly to either a land application system or the sewer
Regulatory authority	The authority which is empowered by statute to be responsible for managing/controlling domestic on-site wastewater
Scum	The floating mass of wastewater solids buoyed up by entrained gas, grease or other substances which form an accumulating layer on the liquid surface inside the septic tank
Septic tank	A single or multiple chambered tank through which wastewater is allowed to flow slowly to permit suspended matter to settle and be retained, so that organic matter contained therein can be decomposed (digested) by anaerobic bacterial action in the liquid
Serviceable life	The period of time in which with only normal and routine maintenance, the septic tank and associated fittings perform satisfactorily without failure
Sludge	The semi-liquid solids settled from wastewater
Vent	A device, usually a pipe, which allows odours to be removed from the tank
Wastewater	The used water arising from activities in dwellings, institutions, or commercial facilities consisting of all-waste, greywater, or blackwater. Wastewater is defined as Foul water in the New Zealand Building Code

1.8 Abbreviations

The following abbreviations are used in this Standard:

GRP	Glass fibre-reinforced plastic
s	Seconds
TSS	Total suspended solids
UV	Ultraviolet
w/w	The portion by weight, formed by the concentration of a substance in a mixture or solution.

2 PERFORMANCE REQUIREMENTS AND PERFORMANCE CRITERIA

2.1 Scope

This section specifies the performance requirements and performance criteria for septic tanks and associated fittings.

2.2 General

The function of a septic tank is to provide a relatively still zone of adequate size for the treatment of all domestic wastewater at all flow rates from a household, institution, or commercial facility. Scum, and solids capable of settling, are separated from the wastewater flow. The solids are retained, digested and consolidated between maintenance operations. The tank design allows for the liquid above the settled solids (sludge) and below the scum layer to be discharged either for further treatment, or directly to a land application system, and for essential regular desludging to be carried out so that the volume for storage and treatment of wastewater is maintained.

Septic tanks are either installed in the ground or freestanding in the open air. In these situations, they are exposed to the effects of the weather, internal loads/pressures, external loads/pressures, and any ground movement. In addition corrosion of the tank material is possible internally from the wastewater, and externally from the surrounding environment.

When installed in the ground the top surface of the tank or tanks is placed at or just above the ground surface, so that inspection and access covers are readily accessed and ingress of surface water is prevented. When the tank is installed below ground level, then a watertight vertical extension shall be installed. The vertical extension shall support the access and inspection covers at or just above finished ground level.

In systems serving premises where the wastewater may have a high fat, oil, and grease level in comparison to that of typical domestic wastewater from individual dwellings/homes, a grease trap may be necessary to pre-treat kitchen wastewater, before it enters the septic tank.

2.3 Performance requirements

2.3.1 General

The tank and associated fittings shall be constructed of durable materials. The tank shall be watertight, have smooth internal surfaces, be capable of withstanding loads imposed on its roof and walls during and after installation, and shall be constructed and installed so that flotation will not occur in areas of high water table level or when the tank is emptied.

Septic tanks shall perform not only under normal conditions but also under those resulting from peak hydraulic and/or organic flow events.

All septic tanks shall incorporate features to control the discharge of total suspended solids (TSS) which may result from peak hydraulic and/or organic flow events. These features may include optional devices detailed in 3.4.

2.3.2 Septic tank

Septic tanks shall be constructed:

- (a) With capacity for the settlement of solids from the design wastewater flow;
- (b) To allow for scum and sludge retention between desludging operations;
- (c) To allow entry of wastewater with the minimum of disturbance to surface layers under normal operating conditions;

- (d) To prevent the direct flow of wastewater between inlet and outlet;
- (e) To avoid the likelihood of blockage;
- (f) To reduce the discharge of suspended solids in the effluent;
- (g) To avoid the likelihood of foul air and gases creating an odour nuisance and entering buildings;
- (h) To avoid contamination of soils, groundwater and waterways;
- (i) So that the entire structure of the tank and its associated inspection and access covers and/or extensions are integrally sound;
- (j) So that penetration by roots, entry of groundwater and stormwater, and entry of insects are avoided;
- (k) From materials which are resistant or impervious both to the waste contained in the tank and to groundwater for the serviceable life of the tank;
- (l) To retain structural integrity for their serviceable life;
- (m) To prevent the likelihood of damage from superimposed loads or normal ground movement;
- (n) To be able to resist hydrostatic uplift pressures;
- (o) To be able to perform adequately with only normal maintenance over their serviceable life.
- (p) With access for removal of tank contents; and
- (q) To reduce the likelihood of unauthorised access by people.

2.3.3 *Holding tanks and pump wells*

Holding tanks and pump wells shall be designed and constructed:

- (a) To avoid the likelihood of foul air and gases creating an odour nuisance and entering buildings;
- (b) To avoid contamination of soils, groundwater, and waterways;
- (c) So that the entire structure of the tank and its associated inspection and access covers and/or extensions are integrally sound;
- (d) So that penetration by roots, entry of groundwater and stormwater, and entry of insects are avoided;
- (e) From materials which are resistant or impervious both to the waste contained in the tank and to groundwater for the serviceable life of the tank;
- (f) To retain structural integrity for their serviceable life;
- (g) To prevent the likelihood of damage from superimposed loads or normal ground movement;
- (h) To be able to resist hydrostatic uplift pressures;
- (i) To be able to perform adequately with only normal maintenance over their serviceable life.
- (j) With access for installation and maintenance of the pump; and
- (k) To reduce the likelihood of unauthorised access by people.

2.3.4 *Serviceable life*

The serviceable life of a septic tank and associated fittings shall be a minimum of 15 years provided the tank is used and installed in accordance with the manufacturer's recommendations. See Appendix B for recommended installation requirements.

C2.3.4

The ultimate durability of some materials is unknown. Accelerated test results are difficult to relate to actual in-service conditions. The use of new materials or formulations is usually justified on the basis of long term testing, experience, and assessment against existing similar materials. This type of evidence for durability should be available to and retained by the manufacturer.

The New Zealand Building Code requires a durability of not less than 15 years for easy to access units (for example, in ground but accessible).

2.4 Performance criteria

Alternative designs or developments shall meet the performance requirements of 2.3 and the associated performance criteria in this section.

2.4.1 Capacities

Septic tanks shall be designed to cater for the number of people for which the dwelling is designed.

Recommended minimum capacities for septic tanks are given in Appendix C.

C2.4.1

The allowance for scum and sludge accumulation in the septic tank does not allow for extra solids from a food waste disposal unit. The disposal of food waste into septic tanks is not recommended. Where a food waste disposal unit is used allowance should be made for the increased solids loading.

2.4.2 Flow path

The minimum unobstructed distance between the inlet and outlet over which settling can take place shall be 1200 mm (see Figure 3.4).

2.4.3 Inlet and outlet fittings

Inlet fittings shall have a cross-sectional area sufficiently large to allow the passage of solids of a size expected in the system.

2.4.4 Outlet filters

Outlet filters, where fitted, shall be accessible for maintenance through an access or inspection opening sized in accordance with the design requirements for the filter (see Appendix D).

2.4.5 Joints

The joints between a fitting and the wall of a septic tank and between tank components, such as the wall and lid, shall have a durable seal, be watertight, and have sufficient integral strength and/or flexibility to maintain a sound structure. The verification test for joints around fittings is given in Appendix E.

2.4.6 Partitions

When a septic tank is divided into chambers:

- (a) The partition(s) shall be structurally sound and fixed without diminishing the integrity of the tank; and
- (b) The tank shall be able to be pumped out without the partition collapsing, or permanently deforming. A verification test is given in Appendix F.

2.4.7 Access and inspection openings and covers

Access openings shall be located to allow access for desludging of the chamber(s), for maintenance or replacement of any outlet filter where fitted and shall be of sufficient size to allow the desludging mechanism to reach all parts of the chambers and the removal of the outlet filter where fitted.

Inspection openings shall be located to give access to the inlet and outlet fittings, for maintenance of any outlet filter where fitted, and shall have a cross-sectional area of not less than 7,500 mm² (equivalent to 100 mm diameter).

Access openings and inspection openings shall either be at or above ground level, or be able to be extended to the finished ground level if the septic tank is installed underground.

Covers for access openings and inspection openings shall:

- (a) Provide an effective, durable and watertight seal and be able to be resealed each time the cover is removed;
- (b) Be durable and able to withstand superimposed loads; and
- (c) Be secure and shall be designed to prevent removal by children.

C2.4.7

Access openings are not intended to allow people to enter the tank. Where it is envisaged that a person must be able to enter the tank, such as for the purposes of repairs and maintenance, the access opening size shall comply with the appropriate regulations.

2.4.8 Extensions

Where required, extensions to access and inspection openings shall be fitted so that a watertight seal is achieved, and so that the extension and the joint are able to withstand external loads and pressures.

C2.4.8

The burial of septic tanks so that the access and inspection covers become situated below ground level is forbidden by some Regulatory Authorities. Other authorities allow burial but usually with the expectation that this would be 300 – 500 mm below ground level at the most with extensions used to bring the access and inspection covers up to finished surface level. In the latter case, the extensions are typically short and in one piece.

2.4.9 Watertightness

When assembled ready for use the septic tank fittings and covers shall be watertight. When tested in accordance with Appendix G, tanks shall meet the criteria in that Appendix.

2.4.10 Integrity

The integrity of the tank shall be such that no full penetration crack shall develop a width greater than 0.1 mm (approximately) during any stage of production. Further widening or lengthening of any crack shall not occur during subsequent handling, installation, or use.

Structural cracking in nonreinforced concrete tank elements is not permissible.

C2.4.10

It is known from experience that cracks of less than 0.1 mm will self-seal with time due to solids build-up from the inside of the tank.

2.4.11 Loading of tanks**2.4.11.1 General**

Tank designers shall apply the recognised design methodologies and appropriate ultimate and serviceability load factors to all specified and anticipated loads. A minimum ultimate limit state load factor for 1.5 shall be used unless noted elsewhere in this Standard.

Tanks shall be designed and constructed to resist loads incurred during transport and installation.

Tanks buried in the ground, shall resist lateral and top loads, uplift loads from groundwater, and where applicable superimposed loads from vehicular traffic. Manufacturers shall nominate in their specifications and installation instructions the maximum depth of cover for which their tanks are designed.

Freestanding tanks shall also resist snow loads and shall be anchored against ground movement or seismic loads if such requirement is applicable. It is not necessary to perform the lateral load test or top load test.

2.4.11.2 Integrity during handling or installation

There shall be no structural failure when the tank is lifted, or is moved during installation. Any cracking shall be limited to that permitted by 2.4.10.

When a tank that matches the manufacturer's nominated delivery age is lifted using the manufacturer's nominated lifting method, there shall be no structural failure or visible cracking after being so lifted for one hour.

2.4.11.3 Hydrostatic uplift

An installed septic tank shall not move when subjected to uplift forces generated by surrounding groundwater or be stressed to such an extent that cracks in excess of those permitted in 2.4.10 develop.

2.4.11.4 Lateral loads

Septic tanks shall be designed so that there shall be no structural failure, undue distortion or in surface cracking in excess of that permitted by 2.4.10 due to external hydrostatic groundwater and soil loading of 11 kPa/m depth acting on an empty tank.

Account shall be taken of any loads imposed on the tank structure as a result of the technique used to anchor the tank in the ground.

Verification test methods are given in Appendix H and in Appendix J. All tanks may be tested under Appendix H and only concrete tanks may be tested under Appendix J.

C2.4.11.4

Because holding tanks and pump wells that are external to the main tank are partially empty for longer periods than septic tanks, they should be designed for soil loading of 11 kPa/m depth acting on an empty tank with a minimum ultimate (strength) load factor of 2.0. Anchorage should be designed and provided on tanks where the deadweight of the empty tank and applicable soil loads is less than 1.5 times the force due to hydrostatic uplift. The test methods are not readily adaptable for this loading.

2.4.11.5 Top loads

Septic tanks shall be designed to withstand a top load related to the maximum allowable depth of cover specified by the manufacturer. When tested in accordance with Appendix K, there shall be:

- (a) No cracking in excess of that permitted by 2.4.10; and
- (b) No other failure.

C2.4.11.5

The loads in Appendix K, in addition to the load from the soil cover, allow for pedestrian traffic only and not those arising from vehicular traffic.

MEANS OF COMPLIANCE

SECTIONS 3 TO 9 OF THIS STANDARD PROVIDE GENERAL REQUIREMENTS AND ALTERNATIVE MEANS OF COMPLIANCE WITH THE PERFORMANCE REQUIREMENTS OF SECTION 2.

Sections 3 to 9 cover the manufacture of conventional septic tanks in various materials.

Sections 3 and 4 cover general requirements common to all tanks.

Sections 5 to 9 cover material-specific manufacture of tanks.

NOTE: These means of compliance sections are one way of achieving the objectives of the Standard, there may be others. Non-standard materials, installations, and designs shall meet the performance requirements and performance criteria of section 2.

3 GENERAL REQUIREMENTS OF SEPTIC TANKS

3.1 Scope

This section specifies general requirements for the design of septic tanks, fittings, access/inspection provisions, and optional features that are a means of compliance with the performance requirements of Section 2 of this Standard.

3.2 Design

3.2.1 Tank

Septic tanks shall be designed to provide the capacity required by 2.4.1 in a single or multi-chamber configuration. Figure 3.1 shows two typical arrangements of the parts of a septic tank.

C3.2.1

For twin chamber septic tanks, the recommended ratio of the volume of upstream chamber to the downstream chamber is 2:1.

3.2.2 Anchorage

In situations when flotation due to hydrostatic uplift from a high water table is possible, the septic tank shall be provided with a means of being anchored by use of attachments to the tank or other proven means of holding the tank down in place. Anchorage shall be designed and provided on tanks where the deadweight of the empty tank and applicable soil loads are less than 1.5 times the force due to hydrostatic uplift.

Details shall be provided by the tank manufacturer with the installation instructions which shall show the recommended relationship between levels in the tank, groundwater levels surrounding the tank, and anchorage requirements.

C3.2.2

Typical methods of anchorage are:

- (a) Hydrostatic flange or an integrally moulded flange of similar size to the anchor collar in (b).*
- (b) Anchor collar to be affixed at the time of installation: an L-shaped anchor collar section constructed not less than 65 mm wide and not less than 6 mm thick to be fixed to the outside circumference of the tank with durable material protected from the corrosive environment. The collar may be continuous around the circumference or may be in at least two sections each not less than 600 mm long and fixed to opposite sides of the tank. For a vertical cylindrical tank the flange is fixed not more than 300 mm from the base and for a horizontal cylindrical tank the flange is situated along the line of the greatest horizontal perimeter.*
- (c) Loops to be affixed at the time of installation. Each 'side' of the tank is held into the ground by a piece of pipe, typically 100 mm PVC sewer grade pipe, attached to the tank by durable ties. These ties are anchored to the tank via the anchor points provided and have a loop in the other end at excavation ground level. The pipes have a length of not less than the diameter of the tank and each is passed through two loops. Backfilling then covers the pipes.*

The ties and anchor points used should have a combined breaking strain of not less than 1.5 times the displaced volume of the tank below ground level (minus deadweight of the complete tank). The ties should be tested via tensile testing of the tie itself or documentation provided by the supplier of the tie material.

The anchor points provided on the tank should also be type tested via a tensile test on the actual anchor point. This could be achieved through testing a tank using the methods provided for in Appendix J and using the actual anchor points to restrain the test tank in the hydraulic chamber. Alternatively sections of the tank including the anchor point could be laboratory tested to ensure the anchor points (combined) are of greater strength than that which would be applied in the hydraulic test of Appendix H. The section of the tank should be of sufficient size so the effects of the load on the point can be evaluated.

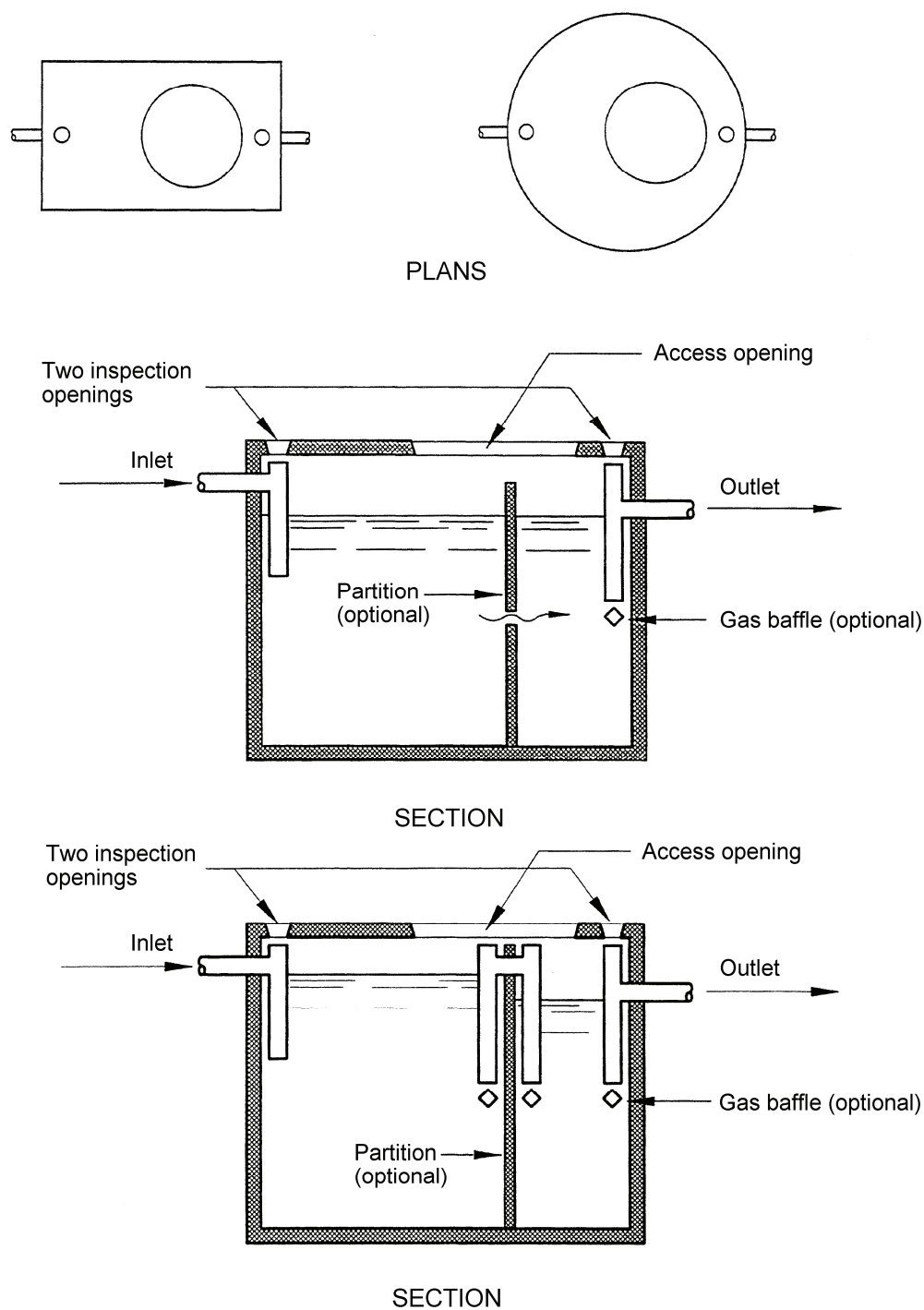


FIGURE 3.1 TYPICAL ARRANGEMENT OF A SEPTIC TANK

3.2.3 Vehicular loads

Tanks that will be subjected to top loading from vehicular traffic (such as tanks installed under roadways, parking areas, or other trafficable locations) shall be designed to carry the expected loads. The tank shall be subject to engineering design and a certificate verifying the load-carrying capacity shall be provided with the tank.

3.3 Inlet fittings and outlet fittings

3.3.1 Design

The inlet and outlet fittings shall be designed to:

- (a) Reduce short-circuiting of liquid between inlet and outlet;
- (b) Allow clearance of any internal blockage; and
- (c) Ensure that solids that form the scum layer do not flow through the outlet.

3.3.2 Size

Minimum dimensions for fittings shall be as shown in Figure 3.2 and Figure 3.3 which are based on a fitting formed using a 'T' shaped pipe junction, and a manufactured baffle that is sealed on to the tank wall.

For effective performance the following dimensions are identified:

- (a) The inlet fittings of septic tanks shall be capable of passing a 90 mm diameter sphere and are typically, 100 mm diameter;
- (b) The outlet pipe nominal size is also, typically, 100 mm diameter;
- (c) Any reduction in size of the outlet pipe shall be achieved in the pipework external to the tank;
- (d) The inlet and outlet fittings shall extend not less than 170 mm above the invert of the outlet (the tank liquid level) to prevent scum spilling into the inlet or outlet. See C3.3.2;
- (e) The fittings shall extend downwards to be not less than 75 mm below the expected depth of scum after 3 years' use; and
- (f) The outlet fitting shall extend downwards for a sufficient depth to minimise the flow of any grease, fat, or scum through the outlet pipe.

C3.3.2

The conventional length of fitting is a depth of 205 mm below the invert of the inlet, and 330 mm below the invert of the outlet.

3.3.3 Position of inlet and outlet fittings in tank

3.3.3.1 Inlet pipe

The position of the inlet pipe below the tank rim or tank top shall be governed by the depth of cover that is intended to be used when installing the tank. This depth of cover is specified in AS/NZS 3500.2, and takes into account the location of the pipe in terms of vehicular traffic above it.