

DRAFT

New Zealand Standard

Draft Number: DR 06928

Public Comment Draft

**On-site domestic-
wastewater treatment units
Part 2: Waterless
composting toilets**

Draft	SPEX #	Date
V1	WS-013	26/04/06

Committee: 1546. Part 2

DO NOT USE THIS DRAFT AS A STANDARD –
IT MAY BE ALTERED BEFORE FINAL PUBLICATION

Standards New Zealand

Private Bag, Wellington. Fax: 04 498 5994

EXPLANATORY NOTES FOR REVIEWERS

Credentials

This document is a proposed joint Australian and New Zealand Standard in terms of the Standards Act 1988. Issue as a draft in this form provides the required statutory opportunity for consideration and comment by the bodies and persons having an interest in the Standard.

Commenting

- (a) Comments are invited, preferably in electronic format, on the technical content, wording and general arrangement of this draft. Please use the comments pages, provided behind this notice, for your comments.
- (b) Editorial matters (i.e. spelling, punctuation, grammar, numbering, references etc) will be corrected before final publication.
- (c) Electronic comments should be sent by e-mail to danielle.frude@standards.co.nz or on a disc. Other formats - Comments should preferably be typewritten. Please do not return marked-up drafts as comments.
- (d) When completing the comments page ensure that the number of this draft, your name and organization (if applicable) is recorded. Please place relevant clause numbers beside each comment.
- (e) Please provide supporting reasons and suggested wording, for each comment. Where you consider that specific content is too simplistic, too complex or too detailed, provide an alternative.
- (f) If the draft is acceptable without change, an acknowledgement to this effect would be appreciated.
- (g) Normally no acknowledgement of comment is sent. All comments received by the due date will be put before the relevant drafting committee. Where appropriate, changes will be incorporated before the Standard is formally approved.

Postal address:
Standards New Zealand
Private Bag 2439
WELLINGTON

Physical address:
Level 10
Radio New Zealand House
155 The Terrace
WELLINGTON

Telephone: +64 4 498 5940

Fax: +64 4 498 5994

Enquiries: Danielle Frude

Email danielle.frude@standards.co.nz

Web site: www.standards.co.nz

RECOMMENDED CHANGES TO DRAFT STANDARD

To: Danielle Frude Standards New Zealand Private Bag 2439 WELLINGTON Fax: +64 4 498 5994 Email: danielle.frude@standards.co.nz	From: (Your Name and Address)	
	Closing date for comment	Date of your comments
DR 06928 Committee: WS-013 Title: Onsite Wastewater Treatment Units Waterless Composting Toilets		

Comment is preferred in electronic format using Microsoft Word 97 or above, following the layout below. Electronic drafts are available from Standards New Zealand web site at <http://www.standards.co.nz>.

The following form is for comments to be submitted electronically. Please email your comments to danielle.frude@standards.co.nz

GENERAL COMMENT

Type your general comments in the box. The comment box will automatically expand to accommodate comments of any length.

SPECIFIC COMMENT

Insert the number of the clause, paragraph or figure. Do not preface the number with words (i.e. 1 not clause 1). If there is no clause number, use the section heading (e.g. Preface). Insert the page, paragraph and line number as appropriate. Use a new row for each comment.

The rows will automatically expand to accommodate comments of any length. Remove unused rows, or insert additional rows as required. To insert extra rows at the end of the table, go to the last cell and press the TAB key.

Clause/ Para/ Figure/ Table No	Page No	Recommended Changes and Reason <i>Exact wording of recommended changes should be given</i>

DR06928

Australian/New Zealand
Standard[®]

**Onsite Wastewater Treatment
Units**

**Part 2: Waterless Composting
Toilets**

Committee Representation

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee WS/13 On-site Domestic Wastewater Management. It was approved on behalf of the Council of Standards Australia on xxxxxxxx and on behalf of the Council of Standards New Zealand on xxxxxx. It was published on xxxxxxxx.

The following interests are represented on the committee responsible for this draft Australian/ New Zealand Standard:

Association of Accredited Certification Bodies (Australia)
Australian Water Association (NOSSIG)
New South Wales Health
Department of Human Services Victoria
Environment Management Industry Association of Australia
Department of Health Western Australia
Master Plumbers Australia
National Precast Concrete Association of Australia
Plastics and Chemical Industries Association Inc
Queensland Department of Local Government and Planning
Association of Rotational Moulders (Australasia)
Institution of Professional Engineers New Zealand
Local Government New Zealand
Ministry of Health New Zealand
Master Plumbers, Gasfitters and Drainlayers NZ Inc
New Zealand Water and Wastes Association (SWANSIG)
The University of Auckland
Master Plumbers NSW
Institute of Environmental and Scientific Research (ESR)
Department of Health South Australia
Department of National Resources Queensland
Department of Health and Community Services Northern Territories
Auckland Regional Council
Business New Zealand
Tasmania Department of Infrastructure, Energy and Resources
Queensland Health
Engineers Australia

Review of Standards.

To keep abreast of progress in industry, Joint Australian/New Zealand Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Joint Standards and related publications will be found in the Standards Australia and Standards New Zealand Catalogue of Publications; this information is supplemented by the magazines 'The Australian Standard' and 'Standards New Zealand', which subscribing members receive, and which give details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Joint Standards, addressed to the head office of either Standards Australia or Standards New Zealand, are welcomed. Notification of any inaccuracy or ambiguity found in a Joint Australian/New Zealand Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

This Standard was issued in draft form for comment as DR 06928

AS/NZS 1546.2:2006

Australian/New Zealand Standard[®]

**On-site domestic wastewater
treatment units**

Part 2: Waterless Composting Toilets

Originated in Australia and New Zealand as AS/NZS 1546.2:2001

PUBLISHED JOINTLY BY:

STANDARDS AUSTRALIA
1 The Crescent,
Homebush NSW 2140 Australia

STANDARDS NEW ZEALAND
155 The Terrace, Wellington 6001 New Zealand

PREFACE

This Standard is one of a series being revised by the Joint Standards Australia/Standards New Zealand Committee WS/13 on On-site Domestic Wastewater Management. It will supersede AS/NZS 1546.2:2001 *On-site domestic wastewater treatment units Part 2: Waterless composting toilets*. The other Standards being revised by the committee are:

AS/NZS 1547:2000	On-site domestic-wastewater management;
AS/NZS 1546.1:2001	On-site domestic-wastewater treatment units Part 1: Septic Tanks; and
AS/NZS 1546.3:2001	On-site domestic wastewater treatment units Part 3: Aerated wastewater treatment systems.

There are three objectives in this Standard. The first is to provide a set of performance statements that provide a base against which any waterless composting toilet, conventional or innovative may be assessed. The second is to provide manufacturers of waterless composting toilets with a performance evaluation test that will confirm the conditions under which it will function best. This will enable certification bodies to check that a product conforms to the Standard. The third objective is to ensure that the operation and maintenance of a waterless composting toilet, is done in a safe manner that meets basic health requirements involving the removal of composted or partially composted material.

© Copyright - STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

The copyright of this document is the property of the Standards Council. No part of it may be reproduced by photocopying or by any other means without the prior written approval of the Chief Executive of Standards New Zealand unless the circumstances are covered by Part III of the Copyright Act 1994.

Standards New Zealand will vigorously defend the copyright in this Standard. Every person who breaches Standards New Zealand's copyright may be liable to a fine not exceeding \$50,000 or to imprisonment for a term of not to exceed three months. If there has been a flagrant breach of copyright, Standards New Zealand may also seek additional damages from the infringing party, in addition to obtaining injunctive relief and an account of profits.

Jointly published by Standards New Zealand, the trading arm of the Standards Council, Private Bag 2439, Wellington 6020. Telephone (04) 498 5990, Fax (04) 498 5994. Website www.standards.co.nz and Standards Australia, GPO Box 476, Sydney, NSW2001

CONTENTS

1	GENERAL	10
1.1	Objective.....	10
1.2	Scope and interpretation	10
1.3	Application.....	10
1.4	Legislation	10
1.5	Referenced documents	11
1.6	DEFINITIONS.....	12
2	PERFORMANCE	14
2.1	Scope	14
2.2	Performance Objectives	14
2.3	Function and context of use.....	14
2.4	Performance requirements.....	14
2.5	Performance criteria - Public health and environment	16
2.6	Performance criteria - Construction	17
3	DESIGN FACTORS	19
3.1	Scope	19
3.2	General.....	19
3.3	Design considerations - Public health and environment	19
3.4	Design considerations - Construction	20
3.5	Composting requirements	21
4	MANUFACTURER'S INFORMATION.....	22
4.1	Scope	22
4.2	Manufacturer's manual.....	22
5	IDENTIFICATION.....	24
5.1	Marking.....	24
5.2	Permanence and visibility.....	24

APPENDICIES

Appendix A	Demonstrating Compliance with this Standard.....	26
Appendix B	Composted end product quality	29
Appendix C	Sampling of composted end product	30
Appendix D	Performance Evaluation Process	32
Appendix E	Determination of Watertightness.....	35
Appendix F	Procedure for Monitoring.....	36
Appendix G	Design Factors and Information	37
Appendix H	Installation Certification.....	39
Appendix J	Operation and Maintenance	40
Appendix K	Risk Management Plan.....	42
Appendix L	Safe Handling of Solid and Liquid End Products	43

TABLES

Table A1	Type Tests	28
Table A2	Batch Release Tests	28
Table B1	Requirements for composted end product quality	29
Table C1	Sampling.....	31
Table G1	Non-residential/Public facilities.....	37

FIGURES

Figure G1	Time v Temperature Graph	38
-----------	--------------------------------	----

1 GENERAL

1.1 Objective

The objectives of this Standard are to provide:

- (a) A set of performance statements which define the requirements for waterless composting toilets as defined by this Standard;
- (b) A performance evaluation test against which any waterless composting toilet, conventional or innovative may be assessed;
- (c) Manufacturers or suppliers of waterless composting toilets with basic test requirements that will enable quality assessors to check that a product conforms to the Standard; and
- (d) Guidelines for the operation and maintenance of waterless composting toilets so that public health and environmental requirements will be met.

1.2 Scope and interpretation

1.2.1 Scope

This Standard covers the requirements of waterless composting toilets.

1.2.2 Interpretation

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

1.3 Application

This Standard is intended for use by consultants, designers, manufacturers and supplies, certifying bodies, installers and regulators in conjunction with AS/NZS 1547 *On-site domestic wastewater management* to which reference should be made.

Appendix A details requirements to be used for third party audit/certification purposes to demonstrate compliance with the construction performance requirements of this Standard and Appendix B with the quality of the end product.

1.3.1 Conventional designs and materials

This Standard includes traditionally used materials, designs and techniques.

C1.3.1

Waterless composting toilets are broadly categorised into continuous or batch systems. Both are produced with a range of capacities.

1.3.2 Non-standard materials, installations or designs

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

C1.3.2

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

1.3.3 Operation and maintenance

Operation and maintenance requirements are included in this Standard as waterless composting toilet systems require regular removal of material and maintenance.

1.4 Legislation

This Standard shall be read in conjunction with the by-laws and regulations of the regulatory authorities in Australia and with the New Zealand Building Act 2004.

1.4.1 Australia

1.4.1.1 Approval

Approval of a manufactured waterless composting toilet is the responsibility of the State or Territory regulatory authority. The approval of the installation of a waterless composting toilet is the responsibility of the local regulatory authority.

1.4.1.2 Building Code of Australia

The Building Code of Australia (BCA) and State/Territory appendices to the BCA may impact on installation and other requirements in relation to WCT's.

1.4.2 New Zealand

Waterless composting toilets 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 waste water (foul water) are given in New Zealand Building Code contained in the First Schedule of the Building Regulations 1992, which is currently being revised.

Through the Resource Management Act, Regional Councils will have established a regional plan which will control the nature of effluent released to the environment. Territorial authorities will advise if special discharge consent is required and once any necessary discharge consent obtained, will give a building consent to install a system, .

The Health Act 1956 gives territorial authorities a duty to "improve, promote and protect" public health (Section 23), primarily through the detection and abatement of "nuisances", i.e. conditions likely to be injurious to health or offensive.

C1.4.2

Section 54 relates to sludge collection and disposal and specifies that this is an 'offensive trade', which requires authorisation by the local authority and Medical Officer of Health.

Each territorial authority has Environmental Health Officers who administer most of the provisions in the Health Act related to nuisances and sanitation, and similarly in the Building Act. Public Health Services, which are part of District Health Boards, provide advice to councils, members of the public and government departments on strategic and operational sanitation issues, and nuisances.

1.5 Referenced documents

The following documents are referred to in this Standard:

AUSTRALIAN

AS 1359	Rotating electrical machines - General requirements
AS 1360	Rotating electrical machines of particular types or particular applications
AS 1668.2	Mechanical ventilation for acceptable indoor-air quality
AS 2031	Selection of containers and preservation of water samples for chemical and microbiological analysis
AS 2031.2	Part 2: Microbiological

JOINT AUSTRALIA/NEW ZEALAND

AS/NZS 1260	PVC pipes and fittings for drain, waste and vent applications
AS/NZS 1546.1	On-site domestic wastewater treatment units Part 1: Septic tanks
AS/NZS 1547	On-site domestic-wastewater management
AS/NZS 3000	Wiring rules
AS/NZS 3500	National plumbing and drainage code
AS/NZS 3500.0	Part 0: Glossary of terms
AS/NZS 3500.2	Sanitary plumbing and drainage
AS/NZS 4360	Risk management
AS/NZS 5667	Water quality – Sampling
AS/NZS 5677.1	Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

NEW ZEALAND

NZS 4241:1999 Public toilets

NZS 4303:1990 Ventilation for acceptable indoor air quality

The New Zealand Building Code Handbook and Approved Documents, BIA 1992

AMERICAN

ASTM D4959-00 Standard test method for determination of water (moisture) content of soil by direct heating

OTHER DOCUMENTS

Standards Methods for Examination of Water and Wastewater, 17th edition (1989)

Standard Method Test 9260 Detection of Pathogenic Bacteria

Standards Methods for Examination of Water and Wastewater, 19th edition (1995)

Standard Method Test 9221E Faecal Coliform Procedure

Standard Method Test 9222D Faecal Membrane Filter Procedure

1.6 DEFINITIONS

For the purpose of this Standard the definitions given in AS/NZS 3500.0 and those below apply:

ACCESS OPENING means an opening in the top or side of the chamber fitted with a cover which is removable to allow access for inspection of the interior and contents, and for operations and maintenance, but not intended to allow people to enter a tank.

BATCH SYSTEM means a waterless composting toilet using two or more chambers or bins which when full are moved aside to complete the composting process.

BIN (see CHAMBER)

BULKING AGENT means material added and mixed into the composting material to improve air flow for promoting aerobic bacteria and to assist with achieving the optimum carbon/nitrogen ratio for promoting microbial growth in composting process.

CONTRACTOR (see OPERATOR) means the person contracted by the system owner to regularly maintain the waterless composting toilet, (may be the system supplier).

CHAMBER means a container usually situated beneath the pedestal to receive human excreta, domestic organic matter and bulking agents in which the composting process takes place, (with some batch processes the container is called a BIN).

COMPOSTED END PRODUCT means material which has undergone decomposition within a waterless composting toilet and which is not a public health or environmental risk.

COMPOSTING PERIOD means a minimum period that allows the human and domestic organic matter to decompose to the degree necessary for public health and environmental protection.

CONTINUOUS SYSTEM means a waterless composting toilet in which only one chamber is available to receive new material at all times and in which the composting process is completed.

CONTROL AGENCY means an agency designated by the relevant authority to license and monitor the operation of waterless composting toilets in the area.

DESIGN CAPACITY means the maximum number of people for a specified use.

DISPOSAL means the removal of *composted end product* from the waterless composting toilet for its burial or for further processing.

EXCESS LIQUID means waste liquid composed of urine and condensation with possibly a small quantity of water from cleaning operations.

FAECAL COLIFORMS means a subset of coliforms found in the intestinal tract of humans and other warm blooded animals, which can ferment lactose at 44 °C to 44.5 °C to produce acid and gas. They are used as indicators of faecal pollution.

MANUFACTURER means the person, company or firm manufacturing prefabricated or kit-set units, or producing a home-built unit.

OPERATOR means the person or agency regularly operating and maintaining the waterless composting toilet.

PERFORMANCE CRITERIA means the qualitative or quantitative description of the performance requirements.

REGULATORY AUTHORITY means the authority which is empowered by statute to be responsible for controlling the management of domestic on-site wastewater.

SERVICEABLE LIFE means the period of time in which with only normal and routine maintenance, the septic tank and associated fittings perform satisfactorily without failure.

TESTING AGENCY means an organisation that is accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ) or a competent person/s authorised by the regulatory authority to examine all or identified aspects of the performance of the waterless composting toilet.

TYPE TEST means a test that it is used to prove or assess a product or system and any subsequent redesign or modification to that product or system.

WATERLESS COMPOSTING TOILET means a device that receives and treats human excreta, domestic organic matter and bulking agents using natural, aerobic stabilisation and disinfection processes to produce a product that is not a public health or environmental risk.

2 PERFORMANCE REQUIREMENTS AND PERFORMANCE CRITERIA

2.1 Scope

This section of the Standard specifies the performance requirements and performance criteria for waterless composting toilets.

2.2 Performance Objectives

A waterless composting toilet should collect and treat human excreta and any other organic material and bulking agents from a household or non-residential facility in a manner that is:

- (a) No risk to public health; and
- (b) No risk to the environment.

2.3 Function and context of use

A composting toilet is a well ventilated vessel that provides an optimum environment for biological and physical decomposition of unsaturated, but moist human excrement, under sanitary controlled aerobic conditions. The primary objective of composting toilet systems is to contain, immobilise and/or reduce destroy pathogens and to accomplish this in a manner that is consistent with good sanitation (minimum human contact or contact with disease vectors such as flies). The process should produce an inoffensive and reasonably dry end product with low concentrations of indicator bacteria.

2.3.1 Function

The function of a waterless composting toilet is to collect and treat human excreta and any other added organic material and bulking agents from a household or non-residential facility. The composting process used to treat the human excreta usually requires little or no added water. For this reason, urine and condensation may be separated from the solid waste. The toilet provides the conditions necessary for natural processes to convert the material to safer, more stable, less offensive products. Some waterless composting toilets encourage a dehydrating process and may use auxiliary heating and/or a forced air process at a point separate to the collection of solid waste. Excess liquid is treated separately.

At the completion of the composting processes, the solid end product shall be buried in the soil or be removed for disposal in a manner approved by the regulatory authority. Refer to Appendix b.

2.3.2 Context of use

Dependent on size and design, waterless composting toilets are either installed with a toilet pan pedestal above floor level and a collection chamber below, or complete and free-standing on a floor if they are small enough. Waterless composting toilets shall be protected from the direct effects of the weather.

The chambers of waterless composting toilets shall hold all material hygienically and safely.

NOTE - The chambers may be installed freestanding, partially in-ground or buried. In these situations they will be subject to internal and external loads or pressures and to any ground movement. The chamber and other components may be corroded internally by the waste materials and externally by the environment.

Adequate information on the capacity, design, operation and maintenance of waterless composting toilets that is necessary shall be provided for the user and to the satisfaction other agencies. Further, proper operation and maintenance of waterless composting toilets is essential to ensure that the performance objectives of waterless composting toilets are achieved in accordance with public health and environmental requirements, and with the requirements of AS/NZS 1547.

2.4 Performance requirements

2.4.1 General

Waste material shall not be allowed to putrefy. The waterless composting process shall produce composted end products that reduce health risk to people and which will not pollute the environment.

The waterless composting toilet and associated fittings shall hold waste matter securely and safely. They shall be constructed of durable materials, be watertight, be capable of withstanding imposed internal or external loads and if installed in the ground, the chamber shall be constructed and installed so that they will not float.

2.4.2 *Public health and environment*

The design, operation and installation of waterless composting toilets shall ensure that:

- (a) Those designs that use a composting process promote aerobic biological decomposition;
- (b) There shall be no contact between a person and the untreated waste material when in use;
- (c) They are free of hazards which could cause injury to any persons installing, adjusting, servicing or using the toilet;
- (d) A child could not fall through the pedestal opening;
- (e) They do not allow material that has not been fully composted, or any liquid to contact any person, or spill from the chamber, during operation, maintenance, removal or cleaning;
- (f) They avoid the likelihood of foul air and gases creating a nuisance and entering buildings;
- (g) The entire structure of the chamber and any associated inspection and access covers and/or extensions are integrally sound, and excludes penetration by roots; or entry of groundwater, insects and vermin; and
- (h) They do not contaminate soils, groundwater and waterways or provide risk to public health; and
- (i) The product shall meet the quality requirements of appendix B with faecal coliform concentrations <100MPN/g dry weight and Salmonella <1/25g dry weight.

2.4.3 *Summary of Key Construction Criteria*

Waterless composting toilets shall be constructed:

- (a) To provide adequate capacity for the treatment of solids;
- (b) To allow for the retention of solids for the composting / treatment time period;
- (c) To provide for storage or transferring excess liquid for further treatment;
- (d) To avoid the likelihood of blockage;
- (e) To provide access for removal of the contents of the chamber or for maintenance;
- (f) To reduce the likelihood of unauthorised access by people;
- (g) From materials which are resistant or impervious both to the waste contained in the chamber, to soil and to groundwater, for the serviceable life of the toilet;
- (h) To prevent the likelihood of damage from any superimposed loads or normal ground movement;
- (i) To resist hydrostatic uplift pressures;
- (j) To remain integral for their serviceable life; and
- (k) To perform adequately with only normal maintenance over their serviceable life.

2.4.4 *Mechanical and electrical equipment*

Mechanical and electrical equipment shall be safe and accessible for maintenance or replacement.

2.4.5 *Serviceable Life*

- (a) For waterless composting toilets to which access is difficult and for components and attachments which are hidden, the serviceable life of the units shall be a minimum period of 50 years with only normal maintenance (please refer to NZBC Clause B2 Durability);

- (b) For waterless composting toilets to which access is moderately easy and for fixings of the external envelope and attachments that are not difficult to replace, the serviceable life of the units shall be a minimum period of 15 years with only normal maintenance (please refer to NZBC Clause B2 Durability); and
- (c) Electrical and mechanical components are excluded from (a) or (b).

C2.3.5

The New Zealand Building Code requires a durability of 15 years for the envelopes, non-hidden fittings and other elements of a waterless composting toilet having moderate ease of access but which are difficult to replace.

2.5 Performance criteria - Public health and environment

All designs or developments must meet the performance requirements of Clause 2.4, the associated performance criteria in this section, have a faecal coliform concentration <100MPN/g dry weight and Salmonella <1/25g dry weight and the performance requirements of AS/NZS 1547.

2.5.1 Non-contact with waste

All designs shall guard against the possibility of contact between a person and human waste that is not yet a composted end product.

2.5.1.1 Large pedestal opening

If an air space is used in the design and there is a large pedestal opening (see Clause 2.5.2), the distance between the user and the expected top of the waste pile shall not be less than 400 mm.

C2.4.1.1

In practice, a distance of 500 mm between the top of the pedestal and top of the waste below is most commonly used. The height of the compost pile is often controlled by use of a compost-leveling device.

2.5.1.2 Small pedestal opening

If an air space is used in the design and there is a small pedestal opening, typically 60-70 mm, the distance between the user and the expected top of the waste pile shall not be less than 200 mm.

2.5.1.3 Barrier

If a barrier is used across the pedestal opening it shall be easily cleaned.

2.5.2 Pedestal Opening

The largest unobstructed dimension of the toilet pedestal opening shall not exceed 190 mm.

2.5.3 Ventilation

2.5.3.1

There shall be continuous extraction from the toilet pedestals so that no odour from the composting toilet is detected by the user.

2.5.3.2

Any venting system shall be constructed according to the manufacturer's instructions and for mechanical venting systems in Australia AS 1668.2, and in New Zealand NZS 4303.

2.5.4 Insect and vermin control

The chamber(s) of a waterless composting toilet shall be designed and fabricated to minimise entry of insects or vermin into any part in which there will be biological activity.

2.5.5 Watertightness

Chambers and component parts of waterless composting toilets shall be designed and fabricated to prevent infiltration of water or escape of liquid. When tested according to Appendix E there shall be no leakage or damp patches.

2.5.6 *End product quality*

2.5.6.1 *Solid end product*

Composted end product produced by any waterless composting toilet shall meet the requirements as set out in Table B1 Appendix B.

2.5.6.2 *Liquid end product*

Excess liquid diverted or separated from solids in a waterless composting toilet shall be collected and either treated as blackwater or treated in combination with greywater in accordance with AS/NZS 1547, or in a solid absorbent material designed to be converted to fertiliser.

2.6 **Performance criteria - Construction**

2.6.1 *Access openings and covers to chambers*

2.6.1.1 *General*

Access openings are not intended to allow people to enter the chamber. Where it is envisaged that a person must be able to enter (e.g. for the purposes of repairs and maintenance) the access opening size shall comply with the requirements of the regulatory authority.

2.6.1.2 *Access covers*

Access covers shall be secure and shall be designed to prevent removal by children.

2.6.2 *Materials*

2.6.2.1 *Degradation*

All materials coming into contact with excreta, blackwater or composted end product shall not undergo any change or degradation that would impair the performance or life of the toilet.

2.6.2.2 *Exposure to the environment*

External materials exposed to the environment, shall be resistant to degradation for the serviceable life of the toilet.

2.6.2.3 *Cleaning*

The internal surfaces of the chute and/or any other surfaces accessible to the user shall be fitted such that they can be cleaned easily.

2.6.3 *Loads*

2.6.3.1 *General*

Waterless composting toilets shall be designed and constructed to resist loads incurred during transport, installation and normal use. Free-standing chambers shall be anchored against ground movement or seismic loads, if such requirement is applicable. If installed in the ground, chambers shall resist lateral and uplift loads.

2.6.3.2 *Integrity during handling or installation*

2.6.3.2.1 *General*

There shall be no structural failure when the composting chamber is lifted, transported or moved during installation.

2.6.3.2.2 *Verification test*

Only curing chambers (chambers that conform to the manufacturer's normal delivery package) shall be selected. The chamber shall be lifted using the manufacturer's nominated lifting method and shall show no structural failure or cracking after being lifted for 5 minutes.

2.6.3.3 *Lateral loads*

If installed in the ground, the chambers shall be designed so that there shall be no structural failure or undue distortion due to external hydrostatic ground water and soil loading of 6.6 kPa/m depth. Account shall be taken of any loads imposed on the chamber structure as a result of any technique used to anchor the chamber in the ground.

Verification test methods are to be found in Appendix F and in Appendix G of AS/NZS 1546.1. Either test may be used.

2.6.3.4 *Hydrostatic uplift*

If installed in the ground, the chamber shall not move when subjected to uplift forces generated by surrounding groundwater.

2.6.4 *Inspection and maintenance*

Component parts shall be accessible for inspection, cleaning, repair, or replacement.

2.6.5 *Mechanical equipment*

Mechanical equipment shall be:

- (a) Durable;
- (b) Require minimal maintenance;
- (c) Adequately protected from any aggressive environment; and
- (d) Capable of being easily serviced.

2.6.6 *Electrical equipment*

Electrical equipment shall:

- (a) Have electric motors that comply with AS 1359 and AS 1360 and be fitted with thermal overload devices;
- (b) Be intrinsically safe where there is any possibility of an explosive gas mixture developing near a motor; and
- (c) Comply with AS/NZS 3000.

2.6.7 *Alarm System*

Any alarm system on mechanical or electrical components shall:

- (a) Comprise audible and visible alarms with muting facility for the audible alarm; and
- (b) Be located in a readily visible position.

2.6.8 *Noise*

The maximum permissible noise level with all equipment (except the alarm) operating shall be 40 dB(A) measured on fast response at a distance of 1 m from the nearest item of noise-emitting equipment.

3 DESIGN FACTORS

3.1 Scope

This section identifies design considerations that stem from the performance requirements of Section 2, for the manufacture, use and installation of waterless composting toilets in dwellings and other facilities.

3.2 General

Waterless composting toilets shall be designed and manufactured so that they:

- (a) Meet the performance requirements of this Standard, and AS/NZS 1547; and
- (b) Perform the intended function when installed and operated according to the manufacturer's instructions.

3.3 Design considerations - Public health and environment

3.3.1 End products

3.3.1.1 Composted end product

The design shall provide for the composted end product to be safely removed from the chamber for subsequent treatment or disposal.

C3.3.1.1

The operational procedures should not be designed on the assumption that the composted end product is safe to handle at the end of the nominated composting period. Composting is a natural process and is significantly affected by the temperature and moisture content of the composting mass. The degree of composting and the residual pathogen content will vary. This variability means that there is always a health risk with the composted end product.

The supplier should provide clear maintenance guidelines with instructions for turning and maintaining the compost unit and the conditions in which compost end product must be removed with corresponding disposal requirements specified and consistent with requirements of regulatory authorities.

3.3.1.2 Excess liquid

The design shall provide for the excess liquid from the chamber to be collected and treated according to the provisions of AS/NZS 1547, or dealt with in some other way acceptable to the regulatory authority.

C3.3.1.2

The excess liquid is primarily composed of urine and condensation. Usually it is either held in temporary storage with periodic pump-out and removal to an approved off-site facility or it is discharged in a land application system, (see AS/NZS 1547), approved by the regulatory authority. Other methods of handling the liquid are possible, e.g. evaporation of water from the liquid.

3.3.2 Odour control

The ventilation system for control of odour in any room or building that houses the waterless composting toilet shall meet the requirements of Clause 2.5.3 and shall be independent of any other household venting systems.

C3.3.2

A flow of air through the toilet room and through the pedestal is often used to prevent an odour nuisance forming in a room, (see also Clause 3.5.1). NZS 4241 recommends a flow of 15 air changes per hour to control odours.

3.3.3 Insect and vermin control

Clause 2.5.4 requires that there shall be minimal entry of insects and vermin.

C3.3.3

This may be achieved by:

- (a) *Ensuring that no lighting shines directly down the chute;*

- (b) *Providing a closing lid on the pedestal;*
- (c) *Making any room or building that houses the waterless composting toilet insect and vermin proof;*
- (d) *Ensuring the ventilation system does not allow entry of insects and vermin; and*
- (e) *Ensuring the chamber and any connection to the pedestal chute do not allow entry of insects and vermin.*

3.4 Design considerations - Construction

3.4.1 *Design capacity*

The waterless composting toilet chamber shall have sufficient capacity to cater for any number of people using the dwelling or the facility.

The capacity of the chamber shall be expressed in terms of the number of people it is designed for when used on a regular basis. This rating will take into consideration the usage pattern and the ambient temperature and humidity conditions for which the waterless composting toilet is designed. See also Appendix G.

3.4.2 *Composting chamber*

The design of the composting chamber shall take account of the following:

- (a) Internal and structural pressures and external pressures, if applicable, including hydrostatic and geotechnical pressures;
- (b) Mass of the chamber and its contents;
- (c) Localised loads acting on the supports, lugs and other attachments and on internal baffles and ducting;
- (d) Normal loads applied during transport and installation;
- (e) Ground anchorage;
- (f) Fatigue;
- (g) Soil conditions; and
- (h) Corrosive environment.

3.4.3 *Access*

There shall be ready access to the chamber without major dismantling of component parts to enable:

- (a) Adding bulking material or water as may be required by the design;
- (b) Periodically inspecting, raking, turning or removal of composting material or composted end product material as required by the design;
- (c) Retrieving foreign objects or matter;
- (d) Cleaning any liquid separation grates or filters;
- (e) Repairs to the inside of the chamber; and
- (f) Emergency access to the pile.

3.4.4 Materials

3.4.4.1 Selection and use

The materials and products used shall be selected to ensure the required serviceable life of the installation. Factors to be taken into account include:

- (a) The likely type of usage and the nature of the compost and liquid to be stored or conveyed;
- (b) The nature of the ground and the possibility of chemical attack;
- (c) The physical and chemical characteristics of the materials and products;
- (d) The possibility of abrasion by solids; and
- (e) Exposure to the weather.

3.4.4.2 Pipes, fittings and fixings

Pipes, pipe fittings, other fittings and fixtures shall be made from corrosion resistant material which will last for the life of the unit.

3.5 Composting requirements

3.5.1 Compost aeration

The design and operating instructions shall ensure that airflow to the composting material is sufficient, refer to Appendix G.

C3.5.1

The design of the odour-control ventilation system is a large factor in controlling the evaporative process and level of humidity of a compost pile inside a chamber.

It should be noted that continual exposure of the composting chamber to humid air, e.g. from high humidity climates, domestic showers etc, may adversely affect the performance of the composting process, see Appendix G6(b).

3.5.2 Temperatures and humidities - manufacturers specification

The design shall ensure that the composting processes are carried out under the range of conditions of temperature and humidity specified by the manufacturer.

C3.5.2

Usually the conditions will be the average monthly minimum temperature and monthly maximum humidity range for which the waterless composting toilet has been tested.

3.5.3 Temperatures and humidities – short-term variance

The design shall take account of the manufacturer's specified operating range and minimise any adverse effect on the composting process from short-term changes in ambient temperature and humidities.

3.5.4 Temperatures and humidities - Long-term variance

The manufacturer may specify modifications to the design or the operation of the waterless composting toilet for the toilet to operate effectively in an area that has average monthly minimum temperatures and maximum humidities that are outside the design range for the toilet.

C3.5.4

Usually low temperatures and/or high humidity conditions affect the efficiency of the composting process, (see Appendix G which discusses optimum conditions for composting).

If the unit is to be operated at a temperature lower than the design temperature range then modification to the design may be necessary to raise the temperature of the composting material. For example, this may be by the use of supplementary heating of the air-inlet temperature or direct heating of the compost pile.

4 MANUFACTURER'S INFORMATION

4.1 Scope

This section outlines the information a manufacturer is required to provide for the safe, reliable and effective operation of a waterless composting toilet.

4.2 Manufacturer's manual

A manual shall be supplied by the manufacturer and shall incorporate the following information.

4.2.1 Operation

4.2.1.1 Operating conditions

The range of average monthly minimum air-inlet temperatures, the humidity range and ventilation requirements for which the waterless composting toilet has been designed, (and where applicable, tested and approved), shall be specified as the operating conditions.

4.2.1.2 Operating conditions outside approval test range

When a toilet is to be used in an area where the average monthly minimum temperatures and humidities are outside the approved range for the waterless composting toilet, the manufacturer shall advise the Operator and all the relevant Regulatory Authorities of operational changes, modifications and monitoring that are necessary for the toilet to operate as tested. Refer Clause 3.5.

4.2.2 Installation procedures

Information on installation shall cover:

- (a) Instructions detailing assembly, location and installation of the waterless composting toilet to optimise its operation;

C4.2.2(a)

Advice should be given to ensure that the waterless composting toilet is located and stored in a sunny, well-ventilated area with easy access for management and maintenance.

- (b) Assembly instructions for the ventilation system including pipework, ducting and other components;

C4.2.2(b)

Sketches or photographs of the installations should be used whenever possible.

- (c) A full description of major mechanical and electrical component parts; and
- (d) Assembly instructions for electrical components including wiring diagrams.

4.2.3 Operation and maintenance

Information for users of waterless composting toilets shall cover:

- (a) Principle and function of operation of the toilet;
- (b) Start up procedure;
- (c) Basic operating instructions;
- (d) The influence of temperature, humidity and ventilation on the composting process, see Appendix G;
- (e) Routine maintenance procedures, see Appendix J;
- (f) Minimum retention time before end product is removed;
- (g) A parts list with each part numbered and identified with the same designation on an illustration, photograph or print; and
- (h) User responsibilities regarding operation, maintenance and proper, safe handling of waste, see Appendix J.

C4.2.3

The basic operating instructions and routine maintenance procedures should be attached to the waterless composting toilets in such a manner that they are readily visible to the user.

4.2.4 Risk-management

Every manufacturer shall provide a risk management plan (including a trouble shooting guide) to inform the operator and user how to cope with unusual or emergency situations, see Appendix K.

4.2.4.1 Remedial action

Directions for remedial actions in the case of a malfunction shall include the manufacturer's or designated agent's name, address and telephone number, refer Clause 5.1.

4.2.4.2 Disposal of end products

Information on the handling of excess liquid and composted end product shall cover a:

- (a) Description of the method of treatment or handling of the excess liquid;
- (b) Safe and reliable method for handling and removal of the composted end product; and
- (c) Safe and reliable method for burial or other method of disposal of composted end product in accordance with regulatory requirements.

The minimum cover of soil over the composted-end product material shall be at least 300mm.

In most areas where composted end product is allowed to be recycled by burial, this should be done within the confines of the premises. The end product should be buried in soil that is not intended to be used for the cultivation of root vegetables. (Appendix L provides further details of recommended safe handling and disposal precautions).

5 IDENTIFICATION

5.1 Marking

The following minimum information shall be marked on each chamber:

- (a) The manufacturer's name or trademark;
- (b) The date of manufacture;
- (c) Design capacity;
- (d) Model identification;
- (e) Serial number; and
- (f) Contact details for service.

5.2 Permanence and visibility

All marking shall be permanent, legible, and clearly visible.

C5.2

Marking situated adjacent to the access opening or sampling point is recommended.

Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging or promotional material related to that product, are advised to ensure that such compliance is capable of being verified and that such verification is available for inspection.

APPENDIX A DEMONSTRATING MANUFACTURING COMPLIANCE WITH THIS STANDARD

(Normative)

A1 Scope

This Appendix sets out the means by which compliance with this Standard can be demonstrated by a manufacturer.

A2 Relevance

The long-term performance of plumbing systems is critical to the durability of building infrastructure, protection of public health and safety, and protection of the environment.

A3 Product Certification

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with this Standard.

The certification scheme shall meet the criteria described in SA HB 18.28/ (ISO/IEC Guide 28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of this Specification. The frequency of the sampling and testing plan, as detailed in Paragraph A5, shall be used by the certifying body.

A4 Definitions

A4.1 *Batch release test*

A test performed by the manufacturer on a batch of units or components of the units, which has to be satisfactorily completed before the batch can be released.

A4.2 *Production batch*

A clearly identifiable collection of units, manufactured consecutively or continuously under the same conditions, using material to the same specification.

A4.3 *Sample*

One or more units of product drawn from a batch, selected at random without regard to quality, the number of units of product in the sample being the sample size

A4.4 *Sampling plan*

A specific plan, which indicates the number of units of components or assemblies to be tested.

A4.5 *Type test batch*

A schedule of units of the same type and nominal size, the batch being defined by the manufacturer.

A4.6 *Type testing*

Testing, normally conducted by a laboratory accredited to AS/ISO/IEC 17025, performed to demonstrate that the material, component, joint or assembly is capable of conforming to the requirements given in the Standard.

A5 Testing

A5.1 *Type testing*

Table A1 sets out the requirements for type testing and frequency of reverification.

A5.2 *Batch release testing*

AS/NZS 1546.1 Table A2 sets out the minimum sampling and testing frequency plan for a manufacturer to demonstrate compliance of the manufacture of products to this Standard on an ongoing basis. However, where the manufacturer can demonstrate adequate process control to the certifying body, the frequency of the sampling and testing nominated by the manufacturer's quality plan and/or documented procedures shall take precedence for the purposes certification to this Standard.

The test methods quoted in the tables are for reference purposes and alternative methods may be used so long as they reflect the general intent of the reference method and equivalence can be demonstrated.

A5.3 *Retesting*

In the event of a test failure, the products within the batch shall be 100% tested and only those units found to comply may be claimed and/or marked as complying with this Specification. If the two additional tanks meet the requirements the batch shall be deemed to meet the test requirements. If one of the additional tanks fails the batch shall be rejected or every tank subjected to the relevant test.

**TABLE A1
TYPE TESTS**

Characteristic	Clause	Requirement	Test method	Frequency
Design and construction				
Public health and environment	2.4.1	Non-contact with waste	Design review	During commissioning and at any change in design that affects the particular performance or requirement
	2.4.2	Pedestal opening	Design review	
	2.4.3	Ventilation	Design review	
	2.4.4	Vermin control	Design review	
	2.4.5	Watertightness	Appendix E	
	2.5.1	Access and inspection openings and covers	Design review	
Structural integrity	2.5.3	To the relevant requirements of AS/NZS 1546.1 Table A1		
Marking	5.1	Marking	Design review	
	2.4.6	Compost quality	Appendix B, C and D	For microbial testing, verification is required to ensure that the process is adequate. This requires 15 grab samples to be taken over a month (individual samples must be sent to the laboratory immediately). There must be 15 consecutive results that meet the value given in Table B1. If there are any changes to the process or any failures to meet the stipulated value, the verification process must be repeated.
Materials	To the relevant requirements of AS/NZS 1546.1 Table A1			At any change in materials
Manufacture	To the relevant requirements of AS/NZS 1546.1 Table A1			At any change in process or materials

**TABLE A2
BATCH RELEASE TESTS**

Refer to AS/NZS 1546.1

APPENDIX B COMPOSTED END PRODUCT QUALITY

(Normative)

B1 Scope

This Appendix sets out the requirements for the quality of composted end product that is regarded as safe and ready for disposal.

B2 Quality requirements

Table B1 sets out the tests and test requirements.

Table B1: Requirements for composted end product quality

CHARACTERISTIC	TEST	PERFORMANCE REQUIREMENT
Consistency	Visual	Sample shall contain no recognisable faecal material.
Odour	Olfactory	There shall be no offensive odours from the composted end product immediately following removal from the chamber
Moisture	ASTM D4959-00 (Note 1)	Not to exceed 75% by weight
Pathogen Test		
(a) Thermotolerant coliforms	Total faecal coliforms as indicator organism, Standard Methods test 9221E and 9222D (Note 2)	Less than 100 per gram dry weight
(b) Salmonella spp.	Standard Methods test 9260 (Note 3)	Not detected

Note:

- 1 ASTM is the American Society for Testing and Materials – see Referenced documents.
- 2 Standard Methods for Examination of Water and Wastewater, 19th edition (1995) or more recent editions or supplements as they become available – see Referenced documents.
- 3 Standard Methods for Examination of Water and Wastewater, 17th edition (1989) or more recent editions or supplements as they become available – see Referenced documents.

CB2

In general terms, well composted end product will be reduced in volume, friable and odourless.

B3 Colour

The colour of the composted end product shall be noted at time of sampling.

CB3

In general terms, good compost may be judged by its appearance. Colour will vary between continuous and batch processes. However, a change in colour for a particular waterless composting toilet could indicate a change in the composting and dehydration process. For composted material, yellow is 'poor', black is 'good'.

Note: Appearance is not adequate for judging the health risk of the product.

APPENDIX C

SAMPLING OF COMPOSTED END PRODUCT

(Normative)

C1 Scope

This Appendix sets out the method for the sampling of composted end product. These samples are then tested according to the requirements of Appendix B.

CC1

Detailed guidance on sampling is found in AS/NZS 5667.1 and AS 2031.2.

C2 Principles

The sampling technique varies depending on whether a continuous or a batch process is being operated. In specifying the sampling technique, account has been taken of the following:

- (a) The need for the sample to be taken from a location that is representative of the composted material available for disposal;
- (b) A concern that added material e.g. bulking agent should not compromise the sample;

CC2(b)

Bulking agents are sometimes added to continuous and batch systems. Through raking, it may be thoroughly mixed by the time a composted end product sample is required. Otherwise, care will be needed to ensure that the sample is from the composting material, and not from the bulking agent.

- (c) A need to take a fresh sample for each test, taking account of the fact that even though the previous sample will have disturbed the material, admitted air and allowed a certain amount of unrepresentative composting to occur at the sampling point.

A registered or approved laboratory (refer Table C1) then tests the sample of composted end product against the performance criteria given in Appendix B.

C3 Apparatus

The following apparatus is required:

- (a) Protective gloves and mask,
- (b) Sterile containers, and
- (c) Core sampling device containing an operable flap and a depth indicator.

C4 Procedure for sampling

The operator shall be protected with a mask and gloves while taking and transferring sample material to containers or when handling equipment contaminated with sample material.

C4.1 Samples

Samples shall be:

- (a) Taken directly from the chamber using a sterile core-sampling device (washed with 70% ethanol);
- (b) Kept separate without touching any other material; and
- (c) Placed into a sterile container provided by the laboratory and sealed.

C4.2 Size, location and number of samples

C4.2.1

Table C1 sets out size, locations and number of samples of composted end product to be taken.

Table C1 - Sampling

Representative minimum sample size	100 grams
Representative minimum number of samples	Minimum of 15 samples. Samples shall be taken at a minimum of weekly intervals until a minimum of 15 consecutive samples meet the requirements and criteria in Appendix B. Laboratory test must accredited to ISO/IEC 17025. All analyses shall be recorded.
Representative minimum number of samples for regrowth	4 samples taken weekly with 4 consecutive samples meeting the requirements and criteria in Appendix B.
Sampling location: (a) Continuous System (single chamber)	Three samples to be taken along and as close as possible to the base of the pile in the removal zone.
(b) Batch system (alternating or circulating chambers)	Three samples to be taken from the base, centre and top of the composted end product. Samples are to be taken as close as possible to the centre of the chamber.

C Table C1

The 15 samples are to ensure that the tests are representative. The suggested locations are those considered least likely to reach a satisfactory quality if the toilet is not operating properly. Temperature should be recorded to interpret results.

C4.2.2

The sample shall not be taken from a location within the chamber where a sample has been taken previously.

CC4.2.2

This is to try to ensure that the sample has not been aerated by the process of previous sampling.

C4.3 *Sample consistency, odour and colour*

At the time of sampling, notes shall be recorded of the consistency, odour and colour of the sample, see Appendix B.

C4.4 *Sample labelling*

The sample shall be labelled as follows:

- (a) Identification of test site and type of waterless composting toilet;
- (b) Date and time of sampling; and
- (c) Its consistency, odour and colour.

C4.5 *Sample storage and delivery*

The sample shall be stored at a temperature less than 4°C and shall be delivered to the testing laboratory within 24 hrs of sampling, refer AS/NZS 5667.1.

APPENDIX D

PERFORMANCE EVALUATION PROCESS

(Normative)

D1 Scope

This Appendix sets out the process for the evaluation of the performance of any waterless composting toilet, independent of its design or process of treatment of solid waste.

D2 Principle

The evaluation process sets out to replicate, as closely as possible, normal usage of a waterless composting toilet under controlled and monitored conditions. A series of samples are taken at different periods of time in order to track the composting process. In this way, a composting profile is established for the toilet operating under recorded conditions of ambient temperature and humidity. This process helps determine when the end product can be safely removed from the toilet.

D3 Model series

Evaluation of a series of waterless composting toilet models that vary only in size, number of unit components, hardware or rated capacities, shall be conducted on up to three chambers determined by the testing agency as being representative of the series, (e.g. small, medium and large). Results shall be analysed and accepted generally as indicative of the capabilities of all chambers in a series.

D4 Test site

The test site may be at a specified test facility, or at a location pre-selected by the testing agency, or at a field installation acceptable to the testing agency.

D5 Installation, operation and maintenance

Installation of the waterless composting toilet shall be in accordance with the manufacturer's instructions.

During evaluation, the waterless composting toilet shall be operated and maintained in accordance with the manufacturer's instructions.

Failure or breakdown of equipment during the evaluation shall be reported to the manufacturer. The test authority shall record the nature and extent of any maintenance that is carried out during the evaluation period.

D6 Testing

Sampling and analysis of the samples shall be performed by the testing agency or by a laboratory approved by the testing agency that is qualified for the task.

Testing shall commence within 24 hours of receipt of the sample.

D7 Test methodology

D7.1 Test loading

The waterless composting toilets shall be used and loaded at the design capacity for the duration of the evaluation period.

D7.2 Period of evaluation

The evaluation period shall commence on the date the waterless composting toilet is commissioned for testing and is under the guidance of the testing agency. It shall extend until the composting profile and the composting time period has been determined.

D7.3 Sampling

Sampling shall commence at a time nominated by the manufacturer and shall be carried out in accordance with Appendix C. The minimum frequency of sampling shall be as given in Table C1.

Each set of test samples shall be taken in a manner that ensures that the sampling process does not aerate the compost where it will be sampled next time.

D7.3.1 *Continuous process*

To confirm the manufacturers nominated composting period, the end product shall be sampled and tested after the nominated period in accordance with Appendix C4. After one month and prior to removing the composted end product from the system, the end product shall be sampled and tested again in accordance with Appendix C4, in order to confirm the results of the previous tests and to check that there has not been any regrowth of bacteria.

D7.3.2 *Batch process*

To confirm the manufacturers nominated composting period, the end product in the first batch chamber shall be sampled and tested after the nominated period in accordance with Appendix C4. After one month, the end product from the first batch chamber shall be sampled and tested again in accordance with Appendix C4, in order to confirm the results of the previous tests and to verify that there has not been any regrowth of bacteria.

D7.4 *Testing*

Sampling and testing shall continue until the requirements and criteria of Appendix B have been met for at least 15 consecutive samples taken at a minimum of weekly intervals (in accordance with Table B1) .

CD7.4

If the requirements in Appendix B are not satisfied by these tests, the required standard might be achieved by lengthening the period of composting as agreed between the manufacturer and the testing agency. There should normally be no need to clean the toilet out and start again.

D8 **Usage during test period**

Toilet use is to be recorded for a minimum period of three months. This shall be considered representative of use for the whole test period. Deposition of both faeces and urine are to be noted.

D9 **Meteorological data**

A record shall be obtained that gives the official average monthly maximum and minimum temperatures for each month of the test period for the test site.

D10 **Reporting**

A report for each unit shall include or be prepared covering:

- (a) Manufacturer, model, type and volume of chamber;
- (b) Schematic or design drawings to indicate integral components of unit tested;
- (c) Manufacturer's nominated design capacity in terms of the number of people for which the unit is designed;
- (d) Manufacturer's nominated minimum composting period;
- (e) Manufacturer's maintenance requirements for the test period;
- (f) Description of the test site;
- (g) Meteorological data relevant to test site area for the period of test;
- (h) Log of daily use during testing period;
- (i) Observations of any significance (e.g. undue distortion of the tank or components, or evidence of leakage of liquid, when the toilet is in operation);
- (j) Chronological list of any scheduled or unscheduled maintenance performed during test;
- (k) Chronological list of pertinent equipment or component failures and actions required for correction;
- (l) Chronological list of unscheduled visits to test site;

- (m) Incidents relating to equipment or personnel of the testing agency that affected test conditions, or data acquired during testing;
- (n) Quantity and type of wastes discharged or removed from the unit or any of its components, during test;
- (o) Report of all test results covering consistency, odour and colour of samples, their moisture content and the pathogen test results, see Appendix B;
- (p) Assurance that evaluation has been carried out in accordance with this Standard

D11 Assessments

On the basis of the test results, the performance, the design capacity and serviceable life of the toilet and its components shall be assessed, stating the minimum composting period for the meteorological conditions, notably temperature and humidity, under which the test was conducted.

APPENDIX E

DETERMINATION OF WATERTIGHTNESS

(Normative)

E1 Scope

This Appendix sets out a method of testing the watertightness of waterless composting toilet chambers. The test is used as a type test or as a quality control test when required.

E2 Principle

The chamber is subjected to a hydrostatic pressure head and is then examined for signs of water leakage.

E3 Apparatus

Supports e.g. bearing blocks are required to hold a chamber off the floor for inspection of its underside.

E4 Testing

E4.1 Procedure

The procedure shall be as follows:

- (a) Chambers shall be stood and levelled on the supports;
- (b) The chamber shall be filled with water to the greatest depth that may be experienced under normal or abnormal operating conditions. The access cover may be in the wrong place for this criterion to work.
- (c) Allow to stand for a minimum of 4 hours; and
- (d) Observe for any leakage.

E4.2 Test criteria

The chamber shall show no leakage and no damp patches.

E4.3 Frequency

The frequency of testing will be governed by the needs of any internal quality assurance programme, or external quality assessment programme.

CE4.3

When used as a quality-control test, it is recommended that at least one chamber per week be tested. This should be representative of the capacity and design of chamber made in that week. When a number of different capacity or design chambers are made in a manufacturing period, then each capacity or design should be tested on a rotation basis at a minimum rate of one per week.

E5 Repair

Isolated minor leakages may be repaired. After repair, the chamber shall be retested.

E6 Test records

The report shall include the following information for each test specimen:

- (a) Person and organisation carrying out test;
- (b) Model and serial number of the chamber tested;
- (c) Date of test;
- (d) Reference to this test method, i.e. AS/NZS 1546.2, Appendix E; and
- (e) Test records shall be kept as required by the quality assurance programme.

APPENDIX F PROCEDURE FOR MONITORING

(Informative)

F1 Scope

This Appendix sets out a procedure to enable a third party to check the performance and the operation and maintenance of a waterless composting toilet. Part 3 of AS/NZS 1547 covers management procedures and techniques for monitoring all types of on-site domestic wastewater systems in detail.

F2 Control System

In the interests of public health, a long term controlled system of monitoring is needed to ensure waterless composting toilets are operating effectively.

The control system should ideally be centralised for any area. In some areas, the relevant regulatory authority may undertake this control directly or may designate an agency.

F2.1 Pre-qualification

Persons qualified for checking the performance of a waterless composting toilet may be manufacturer's accredited representatives, persons with qualifications in environmental health, plumbers or other persons deemed satisfactory to a control agency.

F2.2 Licensing

A licensing system administered by the control agency is suggested and would:

- (a) Licence a householder as being able to operate and manage a waterless composting toilet satisfactorily;
- (b) Keep track of subsequent sale of property or change of 'ownership' or tenants in order to renew an inspection regime;
- (c) Establish a regular monitoring procedure (see F3);
- (d) Have the authority to report any continuing malfunctioning toilet to the relevant public health authorities and to the regulatory authority which has jurisdiction over the approval of waterless composting toilets; and
- (e) Have the authority to approve kit-sets, owner-built units and the installation of second-hand waterless composting toilets.

F3 Monitoring systems

The following monitoring system for a waterless composting toilet is suggested.

- (a) The waterless composting toilet should be checked by a suitably qualified person one year after installation or upon change of ownership;
 - (i) This person would certify that the system is operating satisfactorily, and a certificate to this effect would be lodged with the control agency;
 - (ii) Sample shall be taken and microbiological quality checked against the criteria in Table B1.
- (b) If the waterless composting toilet is operating satisfactorily at a second annual inspection, re-inspections should then be every three years;
- (c) If the waterless composting toilet is operating unsatisfactorily, the deficiency should be drawn to the householders' attention and rectified. The toilet would then be re-inspected after three months, six months, then after a year, before a more normal frequency of three years is allowed; and
- (d) Records shall be kept of each monitoring inspection, with records to include but not be limited to:
 - (i) Date of Inspection;
 - (ii) Estimate of approximate volume of compost in chamber (e.g. percent of full tank capacity);

- (iii) Compost consistency, colour and odour;
- (iv) Moisture content, temperature and pH;
- (v) Record of when chamber was last emptied with recommendation of when next service (for compost removal) should be undertaken;
- (vi) Recommendation of any changes to ongoing maintenance and monitoring frequency;
- (vii) Record of any mixing undertaken or recommendation of when and frequency at which mixing may be necessary; and
- (viii) Any other servicing requirements (e.g. recommendations for addition of carbon source or bulking material: including approximate amount and frequency).

APPENDIX G

DESIGN FACTORS AND INFORMATION

(Informative)

G1 Scope

This Appendix provides information of potential value to designers.

G2 Residential use

For residential use it is assumed that the average person uses a toilet four times per day to urinate and once a day to defecate, producing approximately 1.3 litre of urine and 200 g of faeces per person per day.

G3 Non-residential/Public facilities

G3.1 *Design capacity*

Waterless composting toilets for non-residential use and for use in public toilet facilities usually require larger chambers. Examples are in national parks or camping/caravan sites. Guidance on the design capacity to be allowed for is given in Table G1.

Table G1 – Non-residential/Public facilities

User	Design capacity basis
Overnight visitors/campers	Allow 4 uses/person/day
Day visitors	Allow 2 uses/person/day

An estimation of the average number of users will allow the total design capacity to be determined. Allowance should be made for times of peak usage, e.g. at holiday periods, for the extra volume of waste and the shock-loading this puts onto the toilet facility and on the composting process (see Clause G4).

The pattern of usage of a facility will vary according to whether people stop to sight-see or stop for a period of time.

Non-residential units may need a urine separation device, see Clause G4.

G3.2 *Numbers of toilet pedestals*

Consideration needs to be given to the number of pedestals required to serve the expected peak population in a reasonable time and to minimise queuing. This is particularly important at scenic viewpoints and rest areas on travel routes used by coach tours.

The calculation of the number of pedestals required in public toilet facilities is based on the population in an area, the length of stay of that population, the arrival rate at the toilet facility, the gender ratio, and the occupancy time. These factors are discussed and example calculations are given in NZS 4241, Public Toilets. The number of pedestals will be determined by the regulatory authority.

G4 Separation of urine

Separating urine from the compost can be useful for enhancing the composting process. It reduces the volume of liquid needing to be disposed of by evaporation. It also reduces the need to evaporate ammonia, and thus keeps down the odours from the vent.

Devices that separate the urine from the compost need to be designed carefully, to ensure they are not likely to become clogged by faeces and/or toilet paper. A separate wastewater system needs to be installed (in accordance with AS/NZS 1547 and regulations of the relevant regulatory authorities to accommodate the urine wastewater).

G5 Removal of excess moisture

G5.1 *Ventilation*

Ventilation and airflow over the compost pile will usually assist in removal of excess moisture. The amount of moisture removed will depend on the initial moisture content of the pile (and whether urine was separated or not), on the airflow and the humidity of the air itself. Humid air can be detrimental to the moisture content of the pile. Refer Clause G6(b).

G5.2 *Bulking material*

When urine has been previously separated, the addition of bulking material and the physical mixing of these into the pile can be sufficient in itself for the control of excess moisture.

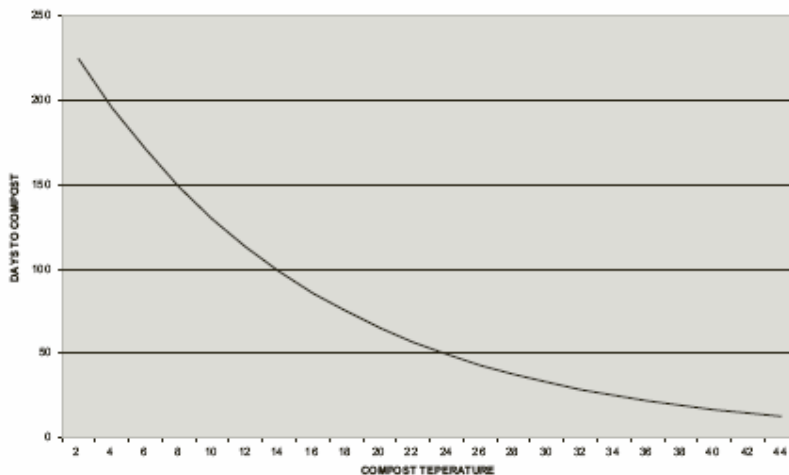
G6 **Conditions for composting**

The composting process is sensitive to the following factors:

- (a) Temperature is the most significant over-riding factor controlling the composting rate. At 40C the rate is such that 180-200 days are needed to successfully produce compost. Below 40C composting basically ceases, see Figure G1.

If the flow of air through the chamber is too high it will remove heat from the compost pile and for all practical purposes slow the composting process. It may also render the insulation of composting chambers ineffective;

Figure G 1 Time v Temperature Graph*



* This graph is unpublished and has been reproduced with the permission of Paul Chapman, Lincoln University, New Zealand, 1993.

- (b) The optimum moisture content for a compost pile is in the range of 35-65%, maximum 75%. If the compost is too wet, the composting process will become anaerobic and extend processing time; and
- (c) As a guide, 200 - 300 litres of air per person per day is needed to provide sufficient oxygen for the composting process of a 'full' pile. This is significantly less than the airflow required for odour removal from the pedestal room through the chamber. In some situations, e.g. if a complete barrier is installed across the throat of a pedestal, a separate aeration system for the compost pile may be needed. The design must ensure that at least 200 L/person/day flows past the compost, and does not pass directly from the pedestal chute to the vent pipe.

G7 **Composting Design Requirements**

The composting process is sensitive to the following factors which should be specified in design details when sizing a compost systems:

- (a) Maximum Occupancy/People User Numbers;
- (b) Number/Type Uses per Person per day;
- (c) Lowest average monthly temperature anticipated in chamber;
- (d) Minimum and maximum retention time requirements;
- (e) Space requirements for mixing mechanism and mixing frequency;
- (f) Void space requirements for air flow and locations of vent connections; and
- (g) Drainage facility for collection of excess moisture.

APPENDIX H INSTALLATION CERTIFICATION

(Informative)

The installation should be certified to conform to AS/NZS 1547. The certification shall be undertaken by the system installer or designer and shall certify that all the system components have been installed as per the approved design plan.

The certification documents shall be provided to the system owner and copies should be held by the regulatory authority. Where the designer and installer are the same person, this requirement is not diminished in any way.

APPENDIX J OPERATION AND MAINTENANCE

(Informative)

J1 **Scope**

This appendix covers the provision of information on the operation and maintenance of a waterless composting toilet that is seen as essential for effective daily use. Part 3 of AS/NZS 1547 covers in detail operation and management procedures and techniques for all types of on-site domestic wastewater systems.

J2 **Training/Education**

J2.1 *General*

The waterless composting toilet needs to be operated and maintained with an understanding of the processes involved, (composting, dehydration) and the optimum conditions for those processes.

J2.2 *Responsibility*

A first-time owner of a waterless composting toilet needs guidance on safe handling of the compost material in the chambers. The prime responsibility for the production of educational material on operation and maintenance rests with the manufacturer. The manufacturer may act directly with the homeowner, through a service provider or contractor, or in some areas through the co-operation of the local regulatory authority. When ownership changes the local regulatory authority shall undertake a monitoring visit and provide the same level of information as for a first time owner.

J2.3 *Education material*

J2.3.1

Ways of providing education material are:

- (a) Provision of a manual specifically aimed at the homeowner and made with durable material suitable for keeping close to or preferably on the waterless composting toilet, see Section 4;
- (b) Use of a short course of instruction either publicly for a number of new owners of waterless composting toilets or directly on site; and
- (c) Provision of an audio-visual explanation which could double as the instruction course to the homeowner.

J2.3.2

The education material should cover the best practice for the optimal operation of the specific waterless composting toilet covering such items as:

- (a) Basic operating principles of successful composting;
- (b) Basic operating principles of the waterless composting toilet;
- (c) The treatment of solid and liquid waste;
- (d) The use of additives, bulking agents;
- (e) The effect of chemicals, cleaning agents, water;
- (f) Optimum moisture and temperature levels;
- (g) Air sources and minimum levels of ventilation;
- (h) How to cope with short-term overuse;
- (i) How to recognise long-term overuse;
- (j) Trouble-shooting;
- (k) The handling of solid and liquid end products; and

- (l) How to get advice and assistance.

J2.4 *Replacement material*

It must be stressed that any education material is a part of a waterless composting toilet system and must remain with it. If this information is lost then a label on the chamber itself should inform the owner of a contact where the material can be obtained.

J3 Risk

J3.1

Of particular importance in the education material to homeowners and service operators or contractors is an appreciation of any health risks involved in the operation of the waterless composting toilet. The requirements of a risk management plan are outlined in Appendix K.

J3.2

Of no less importance is the understanding of risks for natural or man-made environments when semi-composted material is buried in the soil.

J4 Information for service operators/contractors

The manufacturer should consider provision of manuals, instruction courses, audio-visual material aimed at sales agents, service providers, service providers, service contractors covering:

- (a) Handling installation and start-up of the waterless composting toilet;
- (b) Operation and maintenance for the owner;
- (c) Routine service or maintenance by the service provider;
- (d) User responsibilities; and
- (e) User information.

APPENDIX K

RISK-MANAGEMENT PLAN

(Informative)

K1 Scope

This appendix discusses the need for a manufacturer or a designated service operator/contractor, to have a risk management plan to cope with unusual or emergency situations.

K2 General

In drawing up a riskmanagement plan, reference to the techniques given in AS/NZS 4360 is recommended.

The plan should primarily relate to health issues, environmental issues and to issues of concern to Work Safe (Australia) or Occupational Safety and Health (New Zealand) organisations.

K3 Contents

A risk-management plan should be product specific and ensure that it discusses and provides advice for the following situations, where relevant:

- (a) A new owner is not told what to do;
- (b) A new owner does not look after the toilet;
- (c) No bulking material is fed in;
- (d) No raking of the material;
- (e) No spraying of the material;
- (f) No turning of the carousel;
- (g) Chambers/bins or other receptacles are not alternated;
- (h) Too hot;
- (i) Too cold;
- (j) Too humid;
- (k) Compost removed too early; and
- (l) Poor drainage of excess liquid.

K4 Assessment of risk

A waterless composting toilet is deemed to have an acceptable risk if:

- (a) To ensure safety it does not require more than annual inspections by the relevant regulatory authority or designated agency;
- (b) No material, which has yet to be composted, is likely to come into contact with the operator;
- (c) If material, which has yet to be fully composted, is moved, it is done so in a manner specified by the manufacturer that keeps it sealed and the aeration and drainage systems maintained;
- (d) Any equipment that contains material not yet fully composted, cannot spill its contents during movement;
- (e) It meets the compost quality requirement in Table B1.

The locations where equipment containing material not yet composted are stored and moved are sufficiently flat for there to be a low likelihood of overturning.

APPENDIX L

SAFE HANDLING OF SOLID AND LIQUID END PRODUCTS

(Informative)

L 1 Scope

Risks from domestic composting systems are linked to exposure to pathogens from the use and/or maintenance of the compost systems and from exposure to the system end product. If compost is not properly composted, a person may come into contact with pathogens directly by ingestion of compost particles, by inhalation of dust/aerosols or by absorption into a lesion/abrasion. A person may also come into contact with pathogens indirectly by contact with soils, vegetation or food crops contaminated by improperly composted material.

Measures are necessary in the operation and maintenance of composting systems and in the disposal of compost end products to minimize the risks of exposure to improperly composted material.

L 2 PRINCIPLE

Assume all waste is hazardous and is treated with caution accordingly.

- i. Reduce Risk of Inhalation
 - Wear protective clothing whenever handling the compost unit or its materials. A face mask and ideally goggles should also be worn during all maintenance actions.
 - Disposal of waste to land should be undertaken in areas where direct access is restricted in accordance with local regulations. Where on-site disposal is not authorized, the compost end product should be collected from the compost system and either removed from the site by an authorized waste removal contractor, or as otherwise specified by the relevant regulatory authority.
- ii. Reduce Risk of Ingestion
 - Bury compost for 6 to 12 months to a minimum depth of 150mm and in an area where it will not be in contact with any consumable plants for surface waters, prior to its use for soil amendment.
 - Restrict access by children to any areas containing compost.
- iii. Reduce Risk of Abrasion
 - Wear protective clothing, including thick gloves and appropriate footwear at all times during maintenance and disposal.
 - Use and wash handling equipment and all protective clothing cautiously, and disinfect gloves after use.

Other more general maintenance requirements include:

- iv. Caution with the cleaning agents used near and/or discharged into the compost toilet unit, in accordance with the system supplier/manufacturer's instructions.
- v. Periodic mixing of the compost material, should be undertaken in accordance with the system supplier's /manufacturer's instructions,. This is more important for continuous single chamber systems, where new material may mix randomly with composted material.
- v. Regular addition of organic bulking agents should be provided where necessary in accordance with the system supplier's /manufacturer's instructions, for a carbon source and to enhance porous conditions for air transfer.
- vi. In cooler winter conditions, heating of the compost unit may be required to levels specified by the supplier/manufacturer.
- vii. Regular removal of composted end product should be undertaken in accordance with the system supplier's/manufacturer's instructions (likely to be anything from three monthly to two yearly).

- viii. The compost system maintenance contract should require that regular maintenance be undertaken at the frequency recommended by the supplier/manufacturer and/or maintenance contractor.

Other general design precautions include:

- viii. Wherever practicable, the main on-site wastewater treatment and disposal system should also be sized as if the blackwater (toilet wastewater) is also discharged into the main system, should this become necessary in the future, such as in the event the current or new owners choose to replace the composting toilet with a conventional toilet.

(Wherever the design wastewater flows i.e. size of the main on-site wastewater treatment and disposal system are reduced due to the inclusion of a composting toilet (so that the wastewater flow consists predominantly of greywater), the disposal system reserve allocation should also be increased by an appropriate amount to ensure primary and reserve land is still available to accommodate additional flows in the event the compost system fails and is decommissioned .

Necessary Actions in the event of Inadequate Maintenance:

- xi. Where a homeowner is not prepared to undertake the necessary maintenance requirements on a regular basis, as specified by the system supplier/manufacturer and in conjunction with the relevant safety precautions specified by the regulatory authority, they shall either decommission and replace the composting toilet or enter into a maintenance contract with a professional system maintenance contractor. The maintenance contract should require that regular maintenance be undertaken at the frequency recommended by the manufacturer.
- xii. Should the owner choose to completely decommission the compost toilet system, they should arrange for the wastewater from the replacement toilet to be connected into the on-site disposal system (following approval for any modifications to increase the wastewater system capacity from the relevant regulatory authority). Until the on-site system has been appropriately upgraded, they should arrange for all waste to be collected and disposed off-site by commercial waste removal contractors.]

L 3 COMMENT

If proper effective composting has taken place, the end product should be inoffensive and relatively "safe" to handle but precautions are always necessary due to uncertainty concerning the potential for poorly composted pockets to be present within the humus material and due to ability of some organisms to survive and remain dormant for an extended period following the compost process.

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognised as Australia's peak national standards body.

Standards New Zealand

The first national Standards organisation was created in New Zealand in 1932. The Standards Council of New Zealand is the national authority responsible for the production of Standards. Standards New Zealand is the trading arm of the Standards Council established under the Standards Act 1988.

Australian/New Zealand Standards

Under a Memorandum of Understanding between Standards Australia and Standards New Zealand, Australian/New Zealand Standards are prepared by committees of experts from industry, governments, consumers and other sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian/New Zealand Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement

Standards Australia and Standards New Zealand are responsible for ensuring that the Australian and New Zealand viewpoints are considered in the formulation of international Standards and that the latest international experience is incorporated in national and Joint Standards. This role is vital in assisting local industry to compete in international markets. Both organisations are the national members of ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission).

Visit our Web sites

www.standards.org.au
www.standards.co.nz