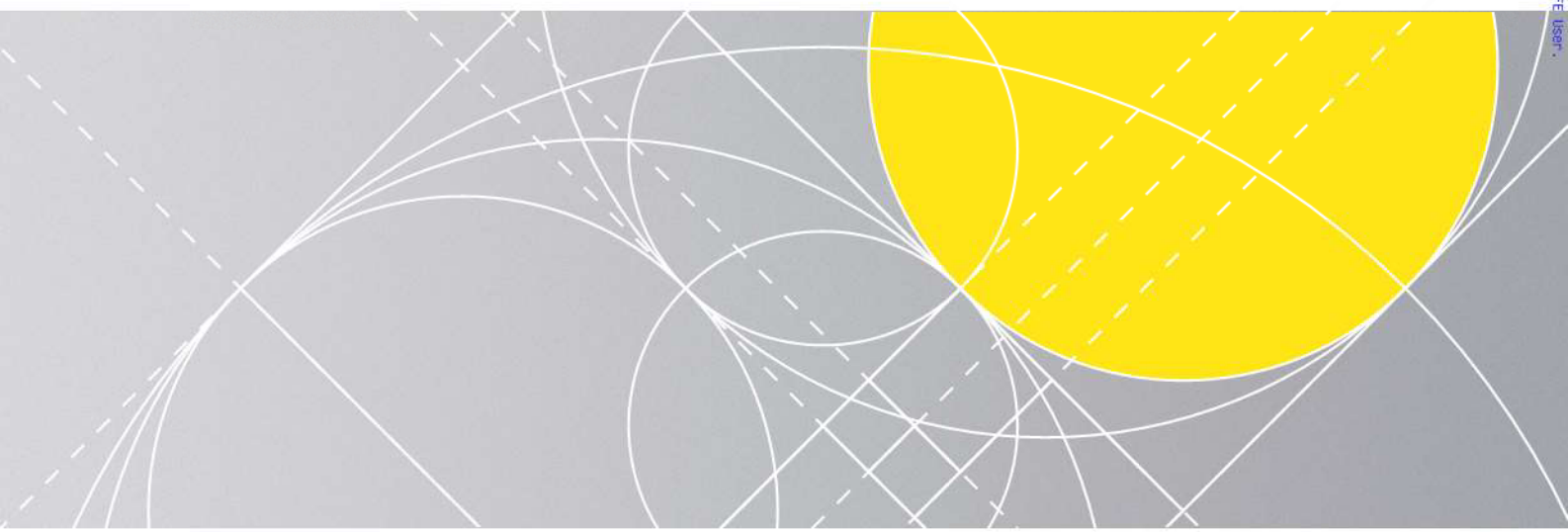
AS 1884:2021

Australian STANDARD®

STANDARDS Australia

Floor coverings — Resilient sheet and tiles — Installation practices



AS 1884:2021

This Australian Standard® was prepared by PL-015, Resilient Flooring. It was approved on behalf of the Council of Standards Australia on 4 January 2021.

This Standard was published on 5 February 2021.

The following are represented on Committee PL-015:

AWTA Product Testing (Testing Interests Australia)
Australian Flooring Industry Alliance
Australian Industry Group
Australian Institute of Building Surveyors
Australian Resilient Floorcovering Association
Building Designers Association of Australia
Carpet Institute of Australia
Cement Concrete & Aggregates Australia
Floorcovering Institute of Australia
Vinyl Council of Australia

This Standard was issued in draft form for comment as DR AS 1884:2020.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:
www.standards.org.au

ISBN 978 1 76113 155 4

Floor coverings — Resilient sheet and tiles — Installation practices

Originated as AS CA37—1966.
Revised and redesignated as AS 1884—1976.
Previous edition 2012.
Fourth edition 2021.

Preface

This Standard was prepared by the Standards Australia Committee PL-015, Resilient Flooring, to supersede AS 1884 — 2012, *Floor coverings — Resilient sheet and tiles — Installation practices*.

The objective of this document is to provide minimum requirements for the installation and application of resilient coverings for Australian conditions to ensure that the installed product is fit for purpose.

Content in Clause 5.9 and Appendix G has been used with permission from Dale Peterson.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

The inclusion of roles and responsibilities in AS 1884:2021 was approved by the Standards Development and Accreditation Committee (SDAC) on 2 May 2019, on a transitional basis of 5 years from the date of publication.

Contents

NOTES

Australian Standard®

Floor coverings — Resilient sheet and tiles — Installation practices

Section 1 Scope and general

1.1 Scope

This document sets out procedures for the preparation, laying and fixing of resilient sheet and tile floor coverings in all forms including flexible PVC, semi-rigid PVC, hybrid modular, linoleum, and rubber. It also applies to self-adhesive tiles.

This document gives details of the work necessary to prepare subfloor surfaces, together with procedures to be adopted for laying the resilient covering.

This document does not apply to the laying of textile floor coverings (carpets), bamboo, laminate, engineered flooring, melamine, timber or cork products.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography

AS 1684, *Residential timber-framed construction (series)*

AS 1860.2, *Particleboard flooring, Part 2: Installation*

AS 2870, *Residential slabs and footings*

AS 3740, *Waterproofing of domestic wet areas*

AS/NZS 1859.1, *Reconstituted wood-based panels — Specifications, Part 1: Particleboard*

AS/NZS 1859.2, *Reconstituted wood-based panels — Specifications, Part 2: Dry-processed fibreboard*

AS/NZS 1859.4, *Reconstituted wood-based panels — Specifications, Part 4: Wet-processed fibreboard*

AS/NZS 2269.0, *Plywood — Structural, Part 0: Specifications*

AS/NZS 2908.2, *Cellulose-cement products, Part 2: Flat sheets*

AS/NZS 4858, *Wet area membranes*

IEC 61340-4-1 ed2.1 Consol. with am1, *Electrostatics — Part 4-1: Standard test methods for specific applications — Electrical resistance of floor coverings and installed floors*

IEC 61340-5-1, *Electrostatics — Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements*

ISO 10581, *Resilient floor coverings — Homogeneous poly(vinyl chloride) floor covering — Specifications*

ISO 10582, *Resilient floor coverings — Heterogeneous poly(vinyl chloride) floor covering — Specifications*

ANSI/ESD S20.20, *ESD Association Standard for the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)*

ASTM E96, *Standard Test Methods for Water Vapor Transmission of Materials*

ASTM F2170, *Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*

1.3 Terms and definitions

For the purpose of this document, the following definitions apply:

NOTE A glossary of other terms used in the resilient flooring industry may be found in Appendix H.

1.3.1
adhesive
1.3.1.1
chemical or moisture cure
single or 2 part reactive polymer adhesive that retains no residual tack once full cure is achieved

1.3.1.2
hard set
adhesive that retains no residual tack once full cure is achieved

1.3.1.3
high grab
fast aggressive grab adhesive that usually retains various degrees of residual tack dependant of formulation type

1.3.1.4
pressure sensitive
soft set adhesive that remains active (tacky) but forms a bond when two surfaces are married together and pressure is applied

1.3.2
alkalinity
pH
value that represents the acidity or alkalinity of an aqueous solution on a scale of 0 to 14 with 7 representing neutral, less than 7 increasing acidity and greater than 7 increasing alkalinity

1.3.3
bight mark
small hump commonly called pole mark found in the centre of a full roll or part rolls of linoleum running across the total width of the sheet

1.3.4
competent person
person who has acquired, through education, training, qualification or experience or a combination of these, the knowledge and skill enabling that person to perform the task required

1.3.5
conditioning
process of placing the flooring products in an environment into which they are to be installed for an appropriate period as recommended by the manufacturer in order to acclimatize

1.3.6
cove fillet
extruded profile made of vinyl, rubber and/or metal in a variety of heights and shapes to allow flooring to be formed in a wide range of sheet goods and tile installations

Note 1 to entry: Installed with adhesive or self-stick.

1.3.7
coving
process used to create a continuous surface between a floor and wall junction

1.3.8
cross join
place where two ends of the resilient floor covering have been joined together

1.3.9
dimensional stability
degree to which a material maintains its original dimensions when subjected to changes in temperature and humidity

1.3.10
double cut
process of overlapping the edges of the material and cutting through both sheets at the same time

1.3.11
elastomeric filler
flexible sealant which does not harden over time

1.3.12
engineered screed
layer of material composed of proprietary mixes containing a hydraulic binder and graded sand and aggregate, which can be interposed between the structural base and the floor finish

1.3.13
factory edge
strip of excess material down the edge of sheet goods for trimming purposes or to provide for overlap for seam cutting

Note 1 to entry: Some are marked with codes for matching and pattern repeat data.

1.3.14
floating floor
method of installing hybrid modular floor covering, without the use of adhesive

1.3.15
flooring contractor
company or person authorized by the purchaser to carry out any necessary preparation of the subfloor surface and/or the installation of the resilient covering

1.3.16
flooring system
combination of flooring components, (e.g. primer, underlay, adhesive, resilient flooring, etc.) working together as parts of a mechanism or an interconnecting assembly

1.3.17
gauge
overall thickness of the tile or sheet goods

1.3.18
groundable point
attachment to a floor covering that facilitates its connection to ground

[SOURCE: IEC 61340-4-1 ed2.1]

1.3.19
hybrid modular flooring
multi layered modular panels with resilient decorative surface layer, polymer-based core construction and often an attached underlayment designed to be loose laid using a locking system

Note 1 to entry: This section includes the following product categories:

(a) Expanded Polymer Core (EPC).

(b) Solid Polymer Core / Stone Polymer composite (SPC).

(c) Wood Polymer Composite (WPC)

1.3.20
linoleum
surfacing material composed of a solidified mixture of linseed oil, pine rosin, fossil or other resins or rosins, or an equivalent oxidized oleoresinous binder, ground cork, wood flour, mineral fillers, and pigments, bonded to a fibrous or suitable backing

1.3.21
loose lay
method of installing resilient sheet, plank and tile either without the use of adhesive or with a minimal use of adhesive

1.3.22
mechanical means
process of surface preparation performed by application of applied physical forces to the substrate surfaces to remove contamination

Note 1 to entry: For the purposes of installations on concrete this refers to the use of diamond grinders, scarifiers and captive shot blasters. For smaller areas this can include chippers and nail gun type scabblers.

Note 2 to entry: When installations are to be performed on timber composite floors, “mechanical means” refers to the use of floor sanders.

Note 3 to entry: Regardless of the means used, the final process in a mechanical preparation is vacuum cleaning

1.3.23
mitre
installation of two pieces of material coming together at an angle (usually a 45° angle)

1.3.24
moisture content
MC%
mass of evaporable water divided by volume of dry material

1.3.25
moisture suppression system
system that is either a coating that is topically applied and sits on the surface of the subfloor or a penetrative treatment that is topically applied and absorbed into the subfloor

1.3.26
open time
maximum time interval after application which resilient flooring can be embedded in the applied adhesive

1.3.27
point-to-point resistance
$R_{P\text{-}P}$
electrical resistance measured between two electrodes placed on the use-surface

[SOURCE: IEC 61340-4-1 ed2.1]

1.3.28
porosity
measurement of open voids in a concrete slab that allow liquid and air to pass through the surface

Note 1 to entry: Porosity enables viscous substances such as screeds, water based primers and adhesives to achieve a serviceable mechanical bond with the subfloor.

1.3.29
primer
substance used as a preparatory coat applied to the subfloor

1.3.30
purchaser
principal to the contract or the person authorized by the principal to superintend the work on his behalf

1.3.31
relative humidity
amount of moisture in the air as a percentage of the amount the air can actually hold

1.3.32
relevant authority
agency authorized by legislation or regulation to issue determinations, orders, or other instructions in respect of any subject covered by this document

1.3.33
resistance-to-ground
R_G
electrical resistance measured between ground or a groundable point and a single electrode placed on the use-surface

[SOURCE: IEC 61340-4-1 ed2.1]

1.3.34
roll curl
anomaly in resilient sheet floor coverings caused by the packaging of the rolls with the wear layer outmost on the roll leaving the resilient sheet bulging off the subfloor, predominately at the roll ends

Note 1 to entry: Roll curl is more predominate in low ambient temperatures when the resilient sheet is laid flat on the subfloor (face-up).

1.3.35
rosin
translucent amber to almost black brittle friable resin that is obtained by chemical means from the oleoresin or dead wood of pine trees or from tall oil

1.3.36
sand-cement screed
layer of material composed of compacted Portland cement and sand which can interpose between the subfloor and the floor finish

1.3.37
scalping
removal of a fine layer of the surface and/or the factory finish of the resilient flooring, when trimming the thermal welds

1.3.38
seam sealing
chemical fusion of two edges of sheet vinyl at the seam

Note 1 to entry: Care needs to be taken to keep seams clean.

1.3.39
straightedge
metal bar with one accurately straight edge, used for testing whether something else is straight (accurate)

1.3.40
subfloor
structural layer intended to provide support for design loadings which may receive resilient floor coverings directly where the surface is appropriate or indirectly via an underlayment or underlay where the surface is not suitable

1.3.41
substrate
any material on the surface of which another material is applied

Note 1 to entry: In this document substrate specifically refers to the floor layer directly on which the resilient covering is to be installed (see Figure 1.1). This may be the subfloor or for where the subfloor surface is deemed unsuitable, an underlay or underlayment.

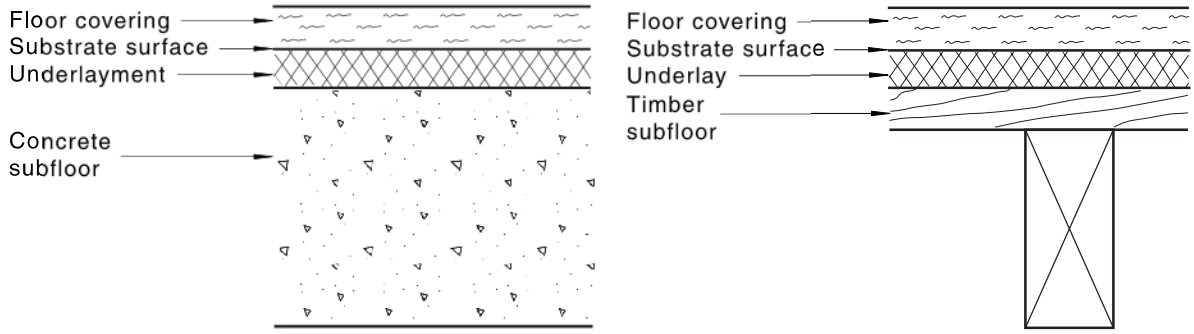


Figure 1.1 — Concrete and wood floors, and explanation of terms

1.3.42
tack time
time required for adhesive to achieve its initial tack before the floor covering is laid onto it

1.3.43
thermal welding
process for filling seams produced by grooving abutting edges of resilient flooring and filling said grooves with heated, fused, or melted material to provide a bonded and sealed continuous surface

1.3.44
tight seam
joins that are true and parallel without gaps and peaking to provide an even and flush finish

1.3.45
topically applied
applied to the surface of the concrete e.g. epoxy based or specialised polymer materials

1.3.46
underlay
purpose-made board applied to a subfloor to provide a smooth, even surface suitable for the installation of a floor covering

1.3.47
underlayment
smoothing compound or a cementicious levelling compound

Note 1 to entry: Underlayments are normally proprietary mixed products.

1.4 Materials

1.4.1 Resilient floor covering

The resilient floor covering shall be agreed between the purchaser and the flooring contractor.

1.4.2 Adhesive

The nature or class of the adhesive used and the manner of use shall be in accordance with instructions for the particular installation by the manufacturer or supplier of the resilient floor covering.

Selection and use of adhesive shall conform to the instructions of both resilient flooring and adhesive manufacturers for the type of adhesive.

1.4.3 Underlay and underlayment

Where a resilient floor covering is to be adhered, unless the subfloor is substantially free from grooves, ridges, gaps, holes and similar imperfections, an underlay or underlayment shall be used.

The underlay and underlayment shall have an estimated service life not shorter than that of the resilient covering. The underlay and underlayment shall be compatible with the resilient floor covering and adhesive(s) to be used and meet the following requirements:

(a) *For timber, plywood and particleboard subfloors* — The underlay shall be any one of the following:

(i) Standard hardboard underlay of Type GP conforming to AS/NZS 1859.4.

(ii) High performance medium density fibreboard (HP MDF) conforming to AS/NZS 1859.2.

(iii) Plywood underlay of Grade C conforming to AS/NZS 2269.0.

(iv) Fibre-cement sheet underlay conforming to AS/NZS 2908.2.

(v) An underlayment specifically designed for timber composite floors.

(b) *For concrete subfloors* — The underlayment shall be non-shrinking so that no evidence of cracks is visible when the resilient floor covering is laid. In addition, the underlayment shall be non-staining, non-exuding and able to withstand the expected traffic load on the floor without indenting and deforming. The underlayment shall be capable of being bonded to the subfloor so that the bonding is not affected by the expected traffic loading.

Section 2 Pre-installation requirements

2.1 Site inspection

2.1.1 Pre-installation preparation

Both concrete and timber composite floors shall be prepared prior to installation of resilient floor coverings to meet the pre-installation requirements of the resilient floor covering manufacturer. At a minimum floor preparation shall include sanding, grinding, or both, and vacuuming.

Where dry clean processes are used, all residual waste materials shall be removed by vacuuming. Where wet clean processes are used, floors shall be dry enough to vacuum waste surface materials before installing resilient floor coverings.

2.1.2 Subfloor information

The flooring contractor shall obtain the site information on the subfloor, outlined in Appendix D, from the purchaser. The flooring contractor shall inspect each of the relevant particulars required in Appendix D. The following shall be determined:

(a) Whether any repairs to the subfloor are required.

(b) Whether the surface of timber subfloors needs to be sanded.

(c) Whether the surface of the subfloor requires cleaning to remove existing floor covering, any deleterious materials such as grease, oil, paint curing or parting agents, or any surface treatment which could adversely affect adhesion.

2.1.3 Report by flooring contractor

Where, after visual inspection, the subfloor is found unsuitable for installation of floor covering, the flooring contractor shall submit a written report to the purchaser, and, where appropriate, the builder.

The report shall state the following:

(a) The subfloor is not in a suitable condition for laying of the floor coverings, with reasons.

(b) All conditions that, in the flooring contractor's opinion, will affect the satisfactory execution of the installation work or impair the durability and serviceability of the resilient floor covering or installation systems.

(c) Whether remedial work is necessary.

2.2 Information

2.2.1 General

The information to be exchanged between the flooring contractor and the purchaser shall include advice as to whether the installation is to be in accordance with the commercial or residential laying requirements of this document.

The measurements and test results reported shall reflect conditions at the time they were taken and do not predict future conditions.

NOTE 1 Heritage listed and National Trust installations are covered by legislated building requirements.

In instances where there is direction to install a floor covering over a subfloor that falls outside of the requirements set out in this document (non-conformance) there shall be a mutual agreement between all invested parties to proceed with this direction.

NOTE 2 It is recommended that an agreement signed by all parties setting out the specifics of the non-conformance is put in place, a copy kept by each party and this agreement noted in any site meeting minutes for future reference.

NOTE 3 The manufacturers of the various products used in the flooring assembly should also be notified of this non-conformance agreement in case of a future warranty claim which may be affected by this decision.

2.2.2 Commercial installations

Flooring contractors shall consult with all relevant parties involved in the specification and installation of the flooring early in the design process and whenever changes occur during the contract regarding the following:

(a) *Site* — Site-specific factors such as location, access, other contractors on site, unloading, hoisting and storage facilities, air-conditioning, heating, lighting and power supply, floor loading and security arrangements.

(b) *Building* — Building-specific factors such as assessment of type and density of traffic, particulars of environmental and subfloor surface conditions or other potentially damaging conditions.

(c) *Specifications* — Specifications for, or details of —

- (i) the floor structure;
- (ii) the damp-proof membrane and its location within the floor construction;
- (iii) results from moisture testing and subsequent requirements for moisture barrier
- (iv) screed curing and drying times;
- (v) floor heating and cooling systems;
- (vi) underlays/underlayments;
- (vii) adhesives and accessories, including floor preservation treatments;
- (viii) resilient floor coverings, including type, classification, supplier, dimensions and repeat pattern size (if applicable); and
- (ix) subsequent maintenance of the resilient floor covering.

(d) *Associated work* — Details of any associated work, including services embedded in or passing through the floor, skirtings and abutments, ducts and junctions with other adjacent floorings.

(e) *Planning and procedures* — Details of the plans and procedures for the installation, including —

- (i) total area, including landings and stairs;
- (ii) number of stair treads and landings;
- (iii) where direction of seams or direction of manufacture are outside normal practice; and
- (iv) method of installation and seaming.

(f) *Protection* — Details of the intended means of protection, including method of and responsibility for the protection of the stored resilient floor covering and the completed work and fabric of building.

(g) *Storage* — The resilient floor covering and ancillary materials shall be stored to manufacturer's instructions.

(h) *Time schedule* — A time schedule for the progress of the work in relation to other trades and services (see Appendix D).

(i) *Time lapse before use* — Resilient floor covering adhesive shall be allowed to cure in accordance with the adhesive manufacturer's instructions prior to being subjected to concentrated foot and wheeled traffic.

(j) *Floor covering plan* — Prior to the installation, the purchaser shall be supplied with a floor covering plan which includes the following:

(i) A scaled drawing or proportional sketch of the areas in which the installation shall take place.

(ii) All dimensions necessary for the installation in accordance with this document, recorded in millimetres and in a manner that enables them to be read from the bottom right-hand corner.

(iii) Where possible, all dimensions recorded inside the scaled drawing or proportional sketch.

(iv) The approximate position of all seams and cross joins.

(v) The manufacturer's description of the resilient floor covering, underlay/underlayment and accessories for the installation.

(vi) Safe work method statements, material safety data sheets, a description of the condition of the subfloor and details of the subfloor preparation required to obtain a substrate or finish that meets the requirement of Clause 3.1.4.

(vii) Results from moisture testing and subsequent requirements for moisture abatement system.

2.2.3 Residential installations

The flooring contractor shall provide the following prior to installation:

(a) The manufacturer's description of the resilient floor covering material, type of underlay/underlayment and, where appropriate, a description of accessories and fittings to be installed.

(b) Necessary subfloor preparation in accordance with Clause 3.1.4, where the condition of the subfloor can be practicably determined by the flooring contractor.

(c) Results from moisture testing and subsequent requirements for moisture abatement system.

Section 3 Subfloors and underlays

3.1 Concrete subfloors

3.1.1 Construction

The surface of concrete subfloors shall be structurally sound to the building design specification and in accordance with building best practice.

NOTE AS 3600 is not an appropriate Standard for installation of resilient finishes as its specified tolerances for smoothness and planeness are too broad in scope.

3.1.2 Dryness

Before subfloor preparation is performed and a floor covering is laid on a concrete subfloor the dryness of the concrete shall be determined as described in Appendix A.

3.1.3 Surface pH

Before subfloor preparation is performed and a floor covering is laid on a concrete subfloor the concrete surface pH shall be determined as described in Appendix C.

3.1.4 Surface quality

The surface of a concrete subfloor shall be thoroughly checked for the following:

(a) *Planeness* — Refer to manufacturer's planeness instructions. Where no manufacturer's instructions are supplied, and a straightedge 2 000 mm long is placed at rest at any two points over a 2 000 mm distance, no part of the surface shall be more than 4 mm below the straightedge.

(b) *Abrupt deviation tolerance*— Where a straightedge 150 mm long is placed at any position at rest at two points on the surface, no abrupt surface deviation shall be more than 0.5 mm below the straightedge.

(c) *Smoothness* — The surface shall be regular with no holes, lumps or sudden rise or fall and with homogenous appearance.

(d) *Soundness* — The surface shall be without cracks, crazing, dusting, rain damage, spalling, efflorescence or blistering.

3.1.5 Surface preparation

Where subfloor repairs form part of the resilient installation contract, all grooves, holes and other concave imperfections shall be filled with a suitable cementitious material. Any ridges or protrusions likely to impair the subfloor surface shall be removed by mechanical means to achieve the required surface quality, see Clause 3.1.4. Any filling or levelling materials used shall be allowed to dry and cure before floor coverings are laid.

Mechanical preparation equipment shall be fitted with effective dust collection devices suitable to capture silica dust, see Clause 4.3. The prepared floor shall be vacuumed only and not swept.

Where a subfloor is so rough or uneven that it is unsuitable for the direct application of the resilient covering, corrective action should be taken (e.g. steel-trowelled underlayment).

Before laying operations begin, the following shall be removed from the subfloor by mechanical means, where present:

(a) Materials such as grease, oil or paint.

(b) Existing floor coverings and adhesive residue.

(c) Curing or parting agents.

(d) Any surface treatment, particularly oxides, markout paints, or wax crayons, which could adversely affect adhesion, or cause discolouration or any other detrimental effect.

3.2 Sand-cement Screed subfloors

Sand-cement screed subfloors shall not be used for the installation of resilient flooring and their preparation products. This form of subfloor does not possess the required tensile and compressive strength for resilient floor covering installation.

3.3 Engineered screed subfloors

In areas where falls to wastes are required, an engineered screed or an appropriate underlayment or repair mortar for that application in accordance with the dry mix powder manufacturer's instructions shall be used or the falls to waste may be formed in the actual concrete slab.

Where the resilient flooring is being installed where falls to waste are required the system installed shall conform to AS 3740.

An engineered screed may also be used for filling set-downs and in unbonded situations.

3.4 New concrete subfloors

3.4.1 General

The general requirements listed in Clause 3.1 shall apply to new concrete subfloors.

3.4.2 Construction

A new concrete subfloor shall be constructed so as to remain free from rising moisture. When in contact with fill, hardcore, or the ground, slabs shall be protected from the entry of moisture by means of a continuous impermeable membrane in accordance with AS 2870. Concrete waterproofing additives and curing compounds shall not be used as replacements for a water-vapour-proof membrane.

Topically applied moisture suppression systems shall have a water vapour transmission rate measured to ASTM E96 of 10 g per m^2 or less in 24 h.

NOTE Testing of moisture barrier performance to E96 is a proof test for manufacturers to show the performance of the product. It is not intended to be a test for site installed products.

3.4.3 Dryness

3.4.3.1 General

The resilient covering shall be laid on a new concrete subfloor only after the concrete has cured and dried sufficiently as indicated by the test procedures described in Appendix A.

If it is determined that the concrete subfloor is not sufficiently dry, resilient floor coverings can be installed over a compatible moisture suppression system, and any associated underlayments, in accordance with the flooring and product manufacturers guidelines.

3.4.3.2 Surface

New concrete subfloors on which floor preparation materials, and the resilient covering are to be laid without underlay, shall be finished to a smooth and porous surface. Burnished concrete surfaces,

waterproofing additives, curing compounds and other types of treatments or coatings will adversely affect the adhesion of the floor preparation and resilient covering to subfloor and shall be removed by mechanical preparation methods. Concrete surface physical defects which compromise adhesion of flooring systems, such as laitance or rain damage to the concrete surface, shall be removed by mechanical preparation methods. All loose materials or dust present, either as building debris or residue from mechanical preparation, shall be removed by vacuum cleaning. Surface cosmetic defects such as score marks, grooves or depressions, shall be removed either by mechanical preparation methods or the installation of an underlayment.

NOTE 1 The porosity of the surface of the concrete may be tested in accordance with ASTM F3191 to ensure the effective initial tack off by water borne adhesives and also achieve correct drying and cure.

NOTE 2 Mechanical preparation methods such as diamond grinding or captive shotblasting create a surface suitable for the subsequent steps in the floor covering installation process. The quality of the surface profiling after surface preparation can be compared against concrete surface profile (CSP),as shown in Appendix E.

NOTE 3 Fine textured profiles normally require a thin skim coat of underlayment for a smooth surface. More aggressive preparation required to correct the surface of damaged or rough and irregular concrete will require a thicker application of an underlayment or topping screed.

3.5 Existing concrete subfloors

3.5.1 General

The general requirements listed in Clause 3.1 shall apply to existing concrete subfloors.

3.5.2 Construction

On some existing slabs there will be insufficient information available to confirm if the slab was constructed to meet the requirements of Clause 3.1.2.

NOTE Moisture testing of existing concrete slabs is equally important as it is for new slabs. It provides an indication as to whether or not, at the time of testing, the slab met the RH/MVER requirements set out in this document, and/or the manufacturer's instructions. A conforming result, however, may not necessarily mean the slab has been constructed to meet the above requirements, particularly in the case of a slab on ground where a damp-proof membrane is either not installed or has been compromised.

Test results shall be recorded in a test report meeting the requirements of Clause A.4.

The resilient flooring manufacturer's instructions for a suitable moisture suppression system for sealing the slab shall be followed. Topically applied moisture suppression systems shall have a water vapour transmission rate measured to ASTM E96 of 10 g per m^2 or less in 24 h.

NOTE Testing of moisture barrier performance to E96 is a proof test for manufacturers to show the performance of the product. It is not intended to be a test for site installed products.

3.5.3 Dryness

The resilient covering shall be laid on an existing concrete subfloor only after the concrete slab has proven to be sufficiently dry, as indicated by the test procedures described in Appendix A.

If it is determined that the concrete subfloor is not sufficiently dry, resilient floor coverings can be installed over a compatible moisture suppression system, and any associated underlayments, in accordance with the flooring and product manufacturer's instructions.

3.5.4 Surface

Existing concrete subfloors on which floor preparation materials, and the resilient covering, are to be laid without underlay, shall be finished in accordance with Clause 3.1.4.

NOTE 1 Mechanical preparation methods such as diamond grinding or captive shotblasting create a surface suitable for the subsequent steps in the floor covering installation process. The quality of the surface profiling after surface preparation can be compared against concrete surface profile (CSP) as shown in Appendix E. The International Concrete Repair Institute publication ICRI 310 provides comparative materials for this purpose.

NOTE 2 Fine textured profiles normally require a thin skim coat of underlayment for a smooth surface. More aggressive preparation required to correct the surface of damaged or rough and irregular concrete will require a thicker application of an underlayment or topping screed.

3.6 Timber, plywood, particleboard and fibre-cement sheet subfloors

3.6.1 New construction

3.6.1.1 General

The building owner shall ensure that timber subfloors conform to the relevant requirements for flooring given in the AS 1684 series.

Plywood used for subfloors shall conform to the relevant requirements of AS/NZS 2269 for Tongue and Groove C/D Grade plywood, and be installed in accordance with the requirements for structural sheet flooring given in the AS 1684 series. Particleboard used for subfloors shall be in accordance with the relevant requirements of AS/NZS 1859.1 for Class 1 particleboard and installed in accordance with AS 1860.2.

All timber framing used to support subfloors shall conform to the AS 1684 series. The moisture content of timber, plywood or particleboard subfloors shall be determined with electrical resistance or capacitance type moisture meters at the time of installation of the floor covering. For moisture content requirements see Appendix A.

3.6.1.2 Dryness

Before subfloor preparation is performed and a floor covering is laid on a timber subfloor the dryness of the timber subfloor shall be determined as described in Appendix A.

3.6.1.3 Surface quality

The surface of a timber subfloor shall be thoroughly checked for the following:

(a) *Planeness* — Refer to manufacturer's planeness instructions. Where no manufacturer's instructions are supplied, and a straightedge 2 000 mm long is placed at rest at any two points over a 2 000 mm distance, no part of the surface shall be more than 4 mm below the straightedge.

(b) *Abrupt deviation tolerance* — When a straightedge 150 mm long is placed at any position at rest at two points on the surface, no abrupt surface deviation shall be more than 0.5 mm below the straightedge.

(c) *Smoothness* — The subfloor surface condition shall be regular with no holes, lumps or sudden rise or fall.

(d) *Soundness* — Where existing timber, plywood or particleboard subfloors are to be used as a substrate worn, rough, cupped or warped surfaces shall be sanded or filled, and retain structural adequacy.

In some circumstances, it may be necessary to re-nail the old floor or to repair it by replacing the worn and unsound sections.

3.6.2 Ventilation

Unventilated spaces shall not be permitted beneath floors constructed from or supported by timber. Particular attention shall be given to subfloor areas which are to be covered with impervious materials.

NOTE 1 Underfloor clearance and the provision of ventilators are subject to additional regulatory requirements.

NOTE 2 Additional information is contained in the NCC under subfloor ventilation.

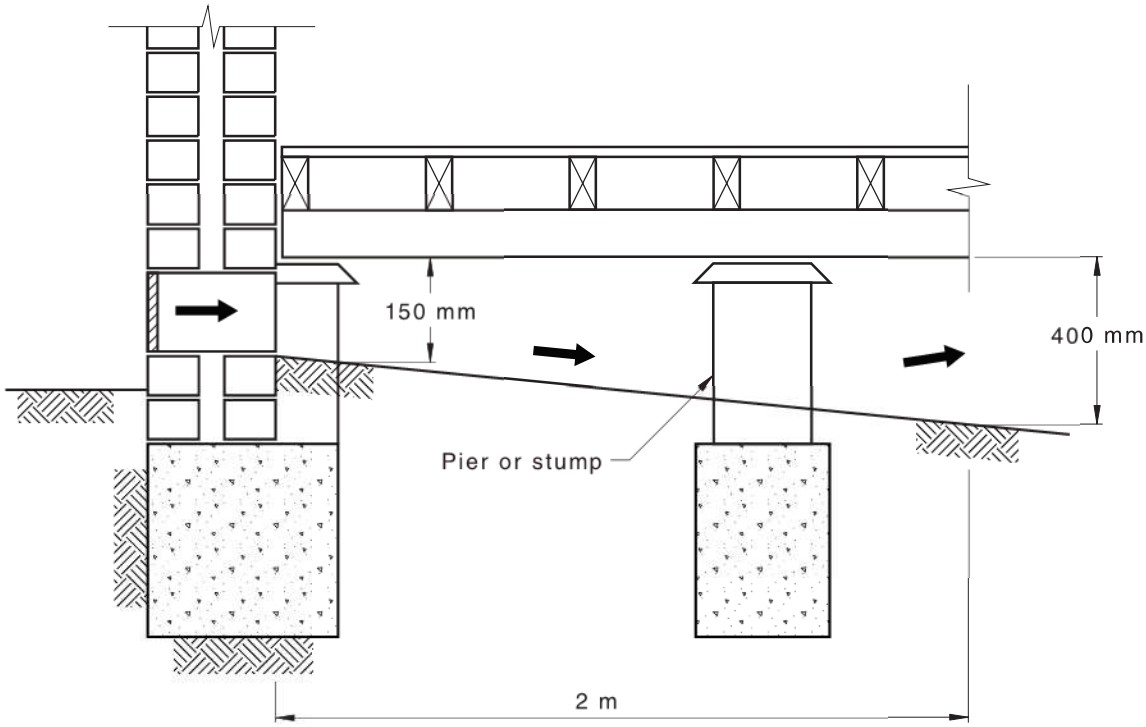
In the absence of other requirements, the precautions in Figure 3.1 shall be observed.

NOTE 3 Particular care should be given to ventilation of internal corners.

NOTE 4 Good ventilation is essential under floors to prevent distortion, possible decay and excessive movement of the subfloor, frame supports and underlay, or subsequent damage to the floor covering material or adhesive system.

NOTE 5 Structural subfloor movement as a result of changes in climatic conditions may adversely affect the installation.

NOTE 6 Subfloor ventilation information is contained in NCC Volume 2 Clause 3.4.1.



[SOURCE: National Construction Code, Copyright © 2019 Australian Building Codes Board, Canberra, Australia. www.abcb.gov.au]

Figure 3.1 — Location of underlay over plywood or particleboard subfloor

3.6.3 Preparation of timber, plywood and particleboard subfloors

When an underlay is to be used or the floor is to be used as a substrate the following requirements apply:

(a) The subfloor shall be inspected for dampness before proceeding with finishing operations. This is particularly important for platform construction where exposure to the weather has

occurred. The underside of the subfloor shall also be inspected for dampness. Damp subfloor surfaces shall be left to dry until a moisture content of less than 14 % is obtained throughout as described in Appendix A.

(b) The subfloor shall be finished to a firm, tight, plane surface, e.g. by sanding or planning. This is particularly important where the subfloor has been exposed to the weather during construction, the entire surface shall be finished to a firm, tight plane surface, e.g. by sanding or planning.

(c) All surfaces shall be mechanically cleaned to remove contaminants which would affect the adhesive bond.

(d) Timber, plywood and particleboard subfloors shall meet the requirements of Clause 3.1.4(a).

3.6.4 Installation of underlay for timber, plywood and particleboard subfloors

3.6.4.1 Underlay joint show-through

Where underlay sheet is applied over timber, plywood or particleboard subfloors, the outline of underlay sheet joins may show through resilient floor covering materials under certain lighting conditions. This show-through may also occur as the moisture content of timber changes in response to variations in atmospheric relative humidity conditions.

At time of installation underlay joins shall be smooth below a 150 mm straightedge when the straightedge is placed on the surface of the resilient flooring.

3.6.4.2 Hardboard underlay

Hardboard underlay (as defined in Clause 1.4.3) is not considered suitable for use in wet areas. In these areas fibre-cement sheet shall be used and installed in accordance with manufacturer's instructions.

Underlay sheets shall be installed to manufacturer's instructions using recommended fasteners and fastener spacing.

Sheets shall be laid closely in a staggered (brick) pattern, perpendicular to the direction of the subfloor. Joins in the underlay sheets shall not coincide with joints in the timber subfloor (a minimum offset of 100 mm is required for sheet flooring substrate). Sheet edges shall be 3 mm back from walls.

Sheets shall be fixed using fasteners and nailing pattern in accordance with the manufacturer's instructions.

Underlay staple fasteners shall be used on hardwood subfloors. Special underlay nails shall be used on all other timber subfloors in accordance with the manufacturer's instructions.

Staples shall be driven so the crown finishes approximately 0.4 mm below the sheet surface. Nails shall be driven flush with the surface of the sheet. Failure to do this can result in nail heads showing through floor coverings.

All joins between sheets shall be sanded flush. Sanders shall be fitted with effective dust collection devices. The sanded floor shall be vacuumed only and not swept.

NOTE Failure to provide an smooth ridge and indentation-free underlay surface will cause unsightly blemishes to appear on the resilient sheet or tile surface, see Clause 3.6.5.

Where hardboard underlay is installed over plywood and particle board subfloors, a compatible timber construction adhesive in accordance with the hardboard manufacturer's instructions shall be used in conjunction with the other fixings to adhere the hardboard sheet to the timber subfloor.

3.6.4.3 Fibre-cement underlay

3.6.4.3.1 General

Fibre-cement underlay shall not be used in conjunction with concrete slabs.

Fibre-cement underlay is designed for use in conjunction with timber subfloors.

Where fibre-cement underlay is used it should be manufactured to conform to AS/NZS 2908.2 and be installed in accordance with the manufacturer's instructions.

The fibre-cement sheets used should be purpose made to accept resilient sheet and tile application.

NOTE Where fibre-cement underlay is used in wet areas additional flashing and waterproofing may be required depending on the application and the requirements of the relevant authority.

3.6.4.3.2 Subfloor preparation

Cross-flow ventilation shall exist under all wood based floors. The area under the floor shall be free from dampness and moisture (see Figure 3.1).

The existing flooring and supporting structure shall be structurally sound. Floorboards or floor sheeting shall be flat prior to installing underlay sheets. A straightedge shall be used to ensure that floors are smooth and plane as specified in Clause 3.1.4.

Where the floor is warped or cupped, the floor shall be rough sanded before the underlay is applied. After sanding, the floor shall be clean from dust and other contaminants before underlay sheets are applied.

3.6.4.3.3 Fibre-cement underlay installation

Underlay sheets shall be installed to manufacturer's instructions using specified fasteners and fastener spacings.

Sheets shall be laid closely in a staggered (brick) pattern, perpendicular to the direction of the subfloor. Joins in the underlay sheets shall not coincide with joints in the timber subfloor (a minimum offset of 100 mm is required for sheet flooring substrate). Sheet edges shall be 3 mm back from walls.

Sheets shall be fixed using fasteners and nailing pattern in accordance with manufacturer's instructions.

Underlay staple fasteners shall be used on hardwood subfloors. Special underlay nails shall be used on all other timber subfloors in accordance with manufacturer's instructions.

Staples shall be driven so the crown finishes approximately 0.4 mm below the sheet surface. Nails shall be driven flush with the surface of the sheet. Failure to do this can result in nail heads showing through floor coverings.

All joins between sheets shall be sanded flush. Sanders shall be fitted with dust collection devices designed for collecting silica and the sanded floor shall be vacuumed only and not swept.

NOTE Failure to provide an smooth ridge and indentation-free underlay surface will cause unsightly blemishes to appear on the resilient sheet or tile surface, see Clause 3.6.1.3.

Where fibre-cement underlay is installed over timber, plywood or particleboard subfloors, a compatible timber construction adhesive in accordance with the fibre-cement manufacturer's instructions shall be used in conjunction with the other specified fixings to adhere the fibre sheet to the timber subfloor.

3.6.5 Plywood subfloors

Plywood subfloors to be used as a substrate shall meet the requirements of Clauses 3.6.1.2 and 3.6.1.3. Where an underlay is not used, joints may show through resilient floor covering materials.

Plywood subfloors shall be prepared in the following manner:

(a) Gaps between panel joins shall not exceed 1 mm to avoid show-through of floor coverings. Splits and holes, including nail holes and knot holes, shall be filled with hardening filler.

(b) The subfloor shall be inspected for dampness before proceeding with sanding and other finishing operations. This is particularly important for platform construction where exposure to the weather has occurred. The underside of the floor shall also be inspected for dampness. A damp plywood subfloor shall be left to dry until a moisture content of less than 14 % is obtained throughout.

(c) Where plywood has been exposed to the weather during construction, the entire surface shall be sanded to a firm, tight level surface using normal timber sanding equipment. The first cut shall be with not less than 60 grit paper. The first cut may be followed with 100 grit paper as a finishing cut.

(d) Joints and filled areas shall be sanded lightly as required by the surface preparation instructions of the manufacturer of the floor covering.

(e) All surfaces shall be vacuum cleaned to remove dust which would affect the adhesive bond.

3.6.6 Particleboard subfloors

Resilient flooring shall not be adhered directly to particleboard subfloors. Where the resilient flooring is to be adhered, an underlay or underlayment shall be used. Particleboard subfloors shall be prepared in the following manner and meet the requirements of Clauses 3.6.1.2 and 3.6.1.3:

(a) All panel joints and nail holes shall be filled with elastomeric filler.

(b) The subfloor shall be inspected for dampness before proceeding with sanding and other finishing operations. This is particularly important for platform construction where exposure to the weather has occurred. The underside of the floor shall also be inspected for dampness. A damp particleboard subfloor shall be left to dry until a moisture content of less than 14 % is obtained throughout.

(c) Where particleboard has been exposed to the weather during construction, the entire surface shall be finished to a firm, tight level surface using normal timber sanding equipment.

(d) Where particleboard has not been exposed to the weather during construction, sanding may be confined to levelling of board joins. Where unsanded particleboard has been used, the whole surface shall be sanded in accordance with (c) above.

(e) The depth of sanded material removed shall not exceed the manufacturer's instructions. A depth of 1 mm in the general sheet area and 2 mm for joins and supported edges is recommended where sanded particleboard flooring has been laid. The depth of sanding may be greater for unsanded particleboard flooring.

(f) All surfaces shall be vacuum cleaned to remove dust which would affect the adhesive bond.

3.6.7 Fibre-cement sheet subfloors

3.6.7.1 General

Fibre-cement sheet subfloors are suitable for resilient flooring.

NOTE 1 The tongue and grooved sheets can be made in such a way that only one face is designed for resilient floor covering.

Where compressed fibre-cement sheet subfloors or low-density tongue and groove fibre-cement sheet subfloors are used they shall be manufactured to conform to AS/NZS 2908.2 and be installed in accordance with the manufacturer's instructions.

NOTE 2 The fibre-cement sheets used should be capable of accepting resilient sheet and tile application. There are differences in the installation practices between standard compressed sheet and low-density tongue and groove fibre-cement sheet, which should be observed when installation is performed. These differences are contained in the manufacturer's instructions.

NOTE 3 Where fibre-cement sheet flooring is used in wet areas additional flashing and waterproofing may be required depending on the application and the requirements of the relevant authority.

NOTE 4 Fibre-cement flooring sheets are not suitable over concrete slabs. Purpose made underlayment should be used in conjunction with concrete slabs.

3.6.7.2 Subfloor preparation

Cross flow ventilation shall exist under all framed and sheeted fibre-cement subfloors. The area under the floor shall be free from damp (the same general detailing as shown in Figure 3.1 applies in this case as well).

The existing subflooring and supporting structure shall be structurally sound. The floor sheeting shall be flat prior to installing the resilient floor covering. A straightedge should be used to ensure that subfloors are smooth and plane as specified in Clause 3.1.4.

Where the subfloor is not smooth and plane or the sheet joints require smoothing, then an underlayment cement may be applied in accordance with the manufacturer's instructions.

3.6.7.3 Fibre-cement sheet flooring installation

Fibre-cement flooring sheets shall be installed to manufacturer's instructions using specified fasteners and fastener spacings.

Sheets shall be laid closely in either squared sheet layout, or staggered (brick) pattern perpendicular to the direction of the subfloor (flooring joists). Joins and joints in the flooring sheets shall coincide with the flooring joists. No joints or joins shall be unsupported.

Sheets shall be fixed using the fasteners and method for drilling and recessing fastener holes in accordance with manufacturer's instructions.

Fasteners shall be driven flush with the surface of the sheet, or the fastener hole filled with a specified finishing product. Failure to do this can result in fastener heads showing through floor coverings.

All joins between sheets shall be filled and sanded flush. Sanders shall be fitted with effective dust collection devices. The sanded floor shall be vacuumed only and not swept. Where the joins are below the level of the sheet flooring, the surface can be smoothed with an underlayment used in accordance with manufacturer's instructions.

NOTE Failure to provide a smooth ridge and indentation-free underlay surface will cause unsightly blemishes to appear on the resilient sheet or tile surface, see Clause 3.6.1.3.

3.6.8 Existing coverings and finishes

Resilient sheet and tile finishes are not considered a suitable surface for adhering resilient coverings.

Precautions shall be taken to identify possible asbestos content in existing resilient floor coverings, adhesives and underlays before any work is undertaken.

NOTE The removal of products containing asbestos is subject to legislation.

Section 4 General conditioning and installation procedures

4.1 Conditioning of floor covering and subfloor

4.1.1 On-site storage and conditioning

Before installation, the floor covering shall be stored and allowed to condition within or near the installation area for a period not less than 24 h or until such time as the product has achieved an ambient room temperature range of 15 °C to 28 °C. Reference shall also be made to the manufacturer's instructions for the floor covering.

In areas that do not have temperature control methods in place and the ambient temperature is below 15 °C, heating devices such as electric radiant heaters or electric heat blowers shall be used. Where LPG gas blowers are used for raising the ambient room temperature, an ambient relative humidity of no more than 60 % shall be maintained.

It is the responsibility of the builder, building owner and/or end-user to provide temperature control devices. In conditions below 15 °C ambient temperature, no underlay or floor covering shall be laid on the subfloor until these devices have been in operation for at least 48 h prior to the material being conditioned. These devices shall remain on during the installation and for a minimum 48 h thereafter.

NOTE Ambient temperatures below 15 °C may result in a subfloor temperature of below 10 °C which could affect the adhesive's cure. Refer to the adhesive manufacturer's instructions.

4.1.2 Air-conditioned areas

Where air conditioning is installed, no underlay or floor covering shall be laid on the subfloor until the conditioning units have been in operation at expected operating temperature and humidity for at least seven days. During this period the temperature and humidity shall not be allowed to fall outside the limits of the instructions of the manufacturer of the floor covering. These conditions shall be maintained during laying and for 48 h thereafter.

NOTE Without such temperature control at this stage, subsequent failure of the subfloor, underlay or underlayment and floor covering may occur.

4.1.3 Heated subfloors

Where underfloor heating units are installed the heating units shall be —

(a) turned on prior to laying of the floor covering for a minimum of seven days to ensure that the moisture condition of the heated subfloor will permit successful laying of the coverings; and

(b) turned off 48 h prior to the commencement of installation to allow the subfloor to return to the temperature range in accordance with instructions of the manufacturer of the floor covering. The heating units shall remain turned off during the laying operations. The heating units shall not be turned on again until 48 h after the laying is completed in order to allow the adhesive to set.

Once the heating unit is turned back on it shall be increased at no more than 2 °C per day until the desired temperature has been achieved. The heating unit shall not exceed a temperature greater than 28 °C.

NOTE 1 Underfloor heating may cause some localized hot spots which may be damaging to a newly laid floor. Maximum heating conditions should be avoided for a period of seven days after installation.

NOTE 2 Where seam sealing is required, special precautions may be necessary and the manufacturer's recommendations should be obtained.

4.1.4 Subfloors in cool rooms and cold stores

For resilient floor coverings to be installed in cool rooms and cold stores the resilient floor covering manufacturer's instructions shall be followed.

4.2 General installation procedures

All overhead work in areas where resilient floor coverings are to be installed shall be completed before floor covering installation commences. The presence of underfloor heating and security systems shall be checked and all preliminary work, such as the fixing of floor sockets for service plugs completed. The base shall be sound, smooth, clean and dry before installation commences.

Before the adhesive has cured and suitable protection has been applied, the floor coverings shall not be subjected to heavy foot traffic, ladders, scaffolding or any wheeled traffic (including scissor lifts, fork lifts and pallet jacks).

NOTE 1 Installing floor coverings before other trades have completed their work may result in problems with overall appearance, visible damage, soiling, adhesive failure, delamination and dimensional stability. These conditions may not be immediately evident.

The floor covering shall be installed by the flooring contractor in accordance with the following procedure:

(a) The material shall be checked to ensure that the correct material (colour, pattern and quantity) has been supplied and for a given area is from the same batch.

(b) The material shall be laid out and inspected for visual defects in a well-lit area before proceeding with installation.

(c) Should the material or batching be incorrect or where defects are apparent the supplier shall be contacted before the material is installed.

NOTE 2 Where possible, sheet flooring with sequential roll numbers should be installed adjacent to each other to minimize visual inconsistencies.

(d) The areas where floorcovering is to be installed shall be adequately lit to allow for proper inspection of substrate and floorcoverings, as well as for installation and seaming of the flooring and for final inspection.

(e) The contractor and purchaser shall agree on the direction and layout of the material and the positioning of joins. All efforts shall be made to position joins away from areas of high stress, such as the centre of walkways and doorways. Areas of installation shall be marked out to ensure there are the least number of joins and that fill pieces are placed away from entrances.

(f) Floor coverings shall not be installed over structural expansion joints or construction joints.

(g) Where an adhesive is to be used it shall be of a type appropriate to the product being installed. The resilient floor covering manufacturer's instructions shall be followed so that the floor covering adheres permanently to the substrate under the conditions of service for which the floor was designed. Further information on adhesives is contained in Appendix F.

NOTE 3 Loose-laid or perimeter fixed floor coverings will have specific manufacturer's adhesive instructions, which should be followed.

NOTE 4 The use of adhesives that are classified as flammable or as hazardous goods is subject to state and federal regulation.

NOTE 5 Adhesives may be difficult to apply at low temperatures and may not set. The correct substrate temperature range for application should be followed and should not be less than 10 °C.

NOTE 6 Adhesives (and primers and sealers if used) should be applied only to dry, clean surfaces and should be as recommended by the adhesive manufacturer.

NOTE 7 Where underfloor heating is installed, care should be taken to ensure that the adhesive used will be suitable for this application.

(h) Any adhesive contaminating the face of the floor covering shall be removed as work proceeds, care being taken to avoid smearing adjacent surfaces. Any surplus adhesive shall be removed from the surface while still wet.

(i) Where floor covering is formed to fit coving or other detail, curvature shall be in accordance with instructions of the manufacturer of the floor covering.

In wet areas condensation migration shall be prevented by sealing the edges of the floor/wall coverings or covings.

(j) For sheet floor coverings requiring welded joins, the instructions of the manufacturer of the floor covering shall be followed.

(k) All exposed edges of resilient sheet and tile floor coverings or edges abutting other floor covering materials shall be protected by means of mouldings or trims.

(l) The installation area shall be kept free of excess materials and trimmings during and after installation.

NOTE 8 On loose-laid or perimeter-fixed floor coverings special precautions should be taken when moving furniture or heavy items.

NOTE 9 Refer to manufacturer's instructions for installation of resilient floorcoverings to stairs.

4.3 Silica dust control

A number of processes associated with building and renovation works can produce hazardous dust. These processes include working on concrete or masonry such as saw cutting and trenching, mechanical preparation including grinding and scarifying, removal of old materials which may contain silica or fine sand, cutting fibre-cement sheeting and the use of some types of Portland cement – quartz sand based underlayments and screeding materials. Processes which abrade, cut, and also include mixing of fresh materials, with a quartz sand or silica content, have the potential to generate dust which contains microfine crystalline silica. Silica dust is insidious because dangerous levels are not necessarily visible to the eye and can miss detection without test equipment.

Silica dust is a controlled hazardous material that, when inhaled into the lungs, can become trapped and over time leads to permanent damage, lowered quality of life, the potential development of cancer and reduced life expectancy. The exposure to silica dust is controlled nationally, and a maximum exposure of 0.05 mg/m^3 of respirable dust averaged over 8 h is the limit allowed for workers.

NOTE 1 This figure was valid at time of writing for Australian jurisdictions, except WA which retains 0.1mg/m^3, and persons need to examine the current legislation.

The control of silica dust falls into two approaches, firstly either elimination or substitution of the process or material producing the dust, or secondly to use of control measures. The practicality of elimination or substitution shall be considered in terms of the processes or materials required to perform the installation, and whether a change is feasible.

The use of control measures shall meet the following requirements:

(a) Areas where dust generating work is occurring shall be isolated from persons not associated with the work (for example exclusion of personnel from, and sheeting or tenting off the work area).

(b) Adequate ventilation of the work area to lower dust levels (unless doing so creates a transported dust problem to other adjacent areas).

(c) Mechanical equipment such as cutting tools, grinders and mechanical abraders, also preparation equipment and mixing equipment, which are fitted with vacuum dust extraction and capture equipment suitable for silica dust shall be used.

(d) All dust residues shall be vacuumed up and not swept or broomed

(e) Where feasible, water damped equipment such as cutters and grinders shall be used

(f) Personal protective equipment such as disposable and sealed overalls with head covers, and respirators with filtration deemed suitable for silica dust shall be used. Powered air respirators are the most effective type.

(g) SDS — safety datasheets shall be made available for all materials used for the installation.

NOTE 2 Refer to relevant legislation for the disposal of captured silica-containing dust.

4.4 Cleaning and maintenance

Refer to manufacturer's instructions for specific care and maintainenance of individual products.

Section 5 Installation procedures for specific flooring types

5.1 Resilient wall and floor sheet

5.1.1 General

Homogeneous and heterogeneous resilient sheet may be installed to floor and wall areas. Where resilient sheet is installed it shall conform to ISO 10581 or ISO 10582 as relevant.

Factory edges shall be trimmed to ensure uniform seams in accordance with manufacturer's instructions.

5.1.2 Setout

Setout shall be approved by the client prior to the installation commencing.

Cut lengths of resilient sheet installed in the same area shall run in the same direction unless otherwise specified and run parallel to the longest straight wall.

Cross joins in multiple widths should be staggered.

"T" joins should not be placed in doorways.

In areas where fill widths are required, the following are recommended:

(a) For fills of a half width, one cross join.

(b) For fills of a third width, two cross joins.

(c) For fills of a quarter width, three cross joins.

5.1.3 Adhesive

Where an adhesive is to be used it shall be of a type appropriate to the product being installed and conditions of service. The resilient floor and wall covering shall be in accordance with manufacturer's instructions. Additional information on adhesives is contained in Appendix F.

Adhesives may be trowelled, rolled or sprayed. The adhesive manufacturer's instructions for the resilient floor and wall covering shall be followed with respect to trowel notch size, application rate and open time. Notch size and application rate shall remain constant for the duration of the installation.

The covering shall be installed into the adhesive, the use of a push board to expel air bubbles and the flooring rolled in both directions with a minimum weighted roller in accordance with manufacturer's instructions.

NOTE The amount of adhesive that may be spread at any one time depends on the prevailing site conditions, such as temperature, humidity and flow through of air, which will affect the open time of the adhesive.

5.1.4 Seaming

The two methods of seaming are as follows:

(a) Scribing joints are where two trimmed edges are joined together.

(b) Double cut or trace cut is where two edges are overlapped and either cut through or followed along an edge or pattern.

Manufacturer's seaming instructions shall be followed.

Seams shall be true and parallel with a maximum gap of 0.5mm without peaking to provide an even and flush finish.

A thermal weld shall be flush, even and impervious, free from burns, scalping, scorches and crazing. Thermal welding shall be carried out at least 24 h after installation to ensure adhesive has cured. Manufacturer's instructions for trimming, routing and grooving shall be followed.

A chemical weld shall be flush, even and impervious with no overflow of chemical residue. Manufacturer's instructions shall be followed.

5.1.5 Coving

When resilient sheet is coved up to a wall or fixture it shall be in continuous contact with the substrate to which it is being adhered. The following are some examples of coving:

(a) A pencil cove is where an integral resilient sheet is coved up a wall or fixture with a maximum 5 mm radius without the use of a preformed base, see Figure 5.3.

(b) A preformed cove is where a cove former is installed to achieve the nominated radius.

(c) A border cove is a separate piece of resilient sheet that is joined at the floor/wall junctions at a minimum distance of 100 mm to form a cove.

Where a preformed cove is used, the resilient sheet shall be in continuous contact with the substrate.

Internal and external corners shall be cut and thermally welded.

The join should be cut at 45° back away from the corner. Where joins in the cove are in such close proximity to where the joins intersect and causing unacceptable aesthetics in the installation, the use of vertical joins to the cove may be acceptable.

5.1.6 Completion

All exposed edges of resilient sheet floor covering or edges abutting other floor covering materials shall be protected by means of diminishing strips or other suitable mouldings.

There shall be no foot traffic for 12 h and no heavy foot traffic for 24 h. Heavy equipment or wheeled traffic shall be kept off the installation for 72 h.

When the installation is completed all scrap material and debris shall be removed from the floor. The floor shall be swept or suction cleaned to remove all dust and debris. All traces of adhesive shall be removed using a method in accordance with the adhesive manufacturer's instructions.

The installed area shall be protected from direct sunlight for 48 h after installation. The recommended ambient room temperature shall be maintained.

5.2 Wet area floor and wall resilient sheet

5.2.1 Floor resilient sheet

5.2.1.1 General

Where wet area floors are covered with resilient floor coverings, the system installed shall conform to AS 3740. Systems applicable to this application shall meet one of the following criteria:

(a) Welded sheet resilient flooring that is classified as waterproof when tested to AS/NZS 4858.

(b) Welded sheet vinyl that is not classified as waterproof, but water resistant and installed over a liquid applied waterproofing membrane, which conforms to AS/NZS 4858 and which is preferably composed of cement and polymer constituents and conforming to AS 3740, compatible with cementitious fairing underlayments.

(c) Welded sheet vinyl that is not classified as waterproof but water resistant and is installed over a sheet membrane conforming to AS/NZS 4858 .

The type of membrane bond breakers installed at wall-floor interfaces, and around penetrations shall be of a configuration not visible under the welded resilient flooring, or potentially comprising the resilient floor bond to the substrate.

NOTE Where wall-floor junctions are between one or more flexible substrates (for example a framed platform floor and wallboard walls, or a masonry floor and wallboard walls) or pod-style constructions, the higher elongation Class III membranes allow greater movement and have small and relatively simple bond breakers that are more easily disguised under resilient flooring.

5.2.1.2 Adhesive

Chemical or moisture cure adhesive, that is waterproof after it has fully cured, shall be used.

This type of adhesive is recommended for areas that will be subject to moisture ingress such as en-suites, kitchens and any other high-stress installation area.

This type of adhesive should be used to the base of the cove and to within 20 mm of the rim of the push-in or clamping waste. A contact style adhesive may be used to aid in the installation into wastes and onto walls.

The covering shall be installed into the adhesive, the use of a push board to expel air bubbles and the flooring rolled in both directions with a minimum weighted roller as per manufacturer's instructions.

5.2.1.3 Seam welding

When installing sheet safety floor coverings, refer to the resilient sheet manufacturer's instructions for wet areas, such as showers and bathrooms. Particular attention shall be given to thermal welding (see Clause 5.1.4). Joins shall be correctly grooved and welded to ensure a water-resistant finish.

Wherever possible joins shall be avoided in the shower floor area. Should a join be necessary it is best practice to place the join as far away from running water as possible. Joins shall not be positioned at floor wastes. Floor covering joins shall be a minimum of 300 mm from a floor waste.

5.2.1.4 Coving

Showers and areas subjected to running water shall be coved up the wall at least 150 mm.

When coving, the internal corner shall be cut from the top of the apex of the radius cove and at 45° to the corner, see Figure 5.3. Welds shall not be made directly into the corner as this becomes a weak point during substrate movement which may lead to a breach of the water-resistant finish.

When using the pencil cove system the floor and wall junction shall be at a 90° angle with no gap between the floor and wall sheeting, see Figure 5.4. Where this is not the case, then in order to achieve a consistent radius, cove fillet should be fitted to the floor/wall junction around the perimeter of the installation before the floor covering is installed, see Figures 5.1 and 5.2.

External corners should be treated in the same way as internal corners, see Figure 5.4. However, where there is a single external corner, both sides may be cut on the wrap of the cove at 45° and a separate infill cut to wrap around the corner.

Push-in vinyl sheet floor waste shall be fitted when installing resilient sheet floor covering in showers and wet areas that are subjected to running water, see Figure 5.5.

NOTE There are various sizes of floor wastes available including one that is fitted with an "O" ring designed to be pushed inside the waste pipe. Push-in or clamping type floor wastes are designed to allow the floor covering to be fitted into the floor waste and be held in place with a fitted flange allowing a waterproof connection to the drain.

5.2.2 Wall resilient sheet

5.2.2.1 General

When fitting resilient wall sheet to showers and wet areas joins shall be avoided in areas which are subjected to running water. Where it is not possible to avoid wall joins in areas which are subjected to running water, the join should not be closer than 200 mm to the internal corner, see Figure 5.4.

Sheets may be fitted using a vertical or horizontal installation system.

5.2.2.2 Adhesive

A high grab adhesive shall be used for wall resilient sheet installation. Pressure-sensitive type adhesives shall not be used. The adhesive shall be applied in accordance with instructions of the manufacturer of the wall covering so that the wall covering adheres permanently to the wall under the conditions of service for which the installation was designed. The wall covering shall be installed into the adhesive and rolled to ensure full transfer in accordance with manufacturer's instructions For application of the adhesive, see Clause 5.1.3.

5.2.2.3 Overlap method

Lengths shall be cut a minimum 75 mm longer than the measurement from the top of the floor cove to the ceiling or the pre-marked required height of the resilient wall sheet. A diminishing strip or water resistant cementitious compound shall be placed or formed to the top of the cove to achieve a gradual transition, see Figure 5.1.

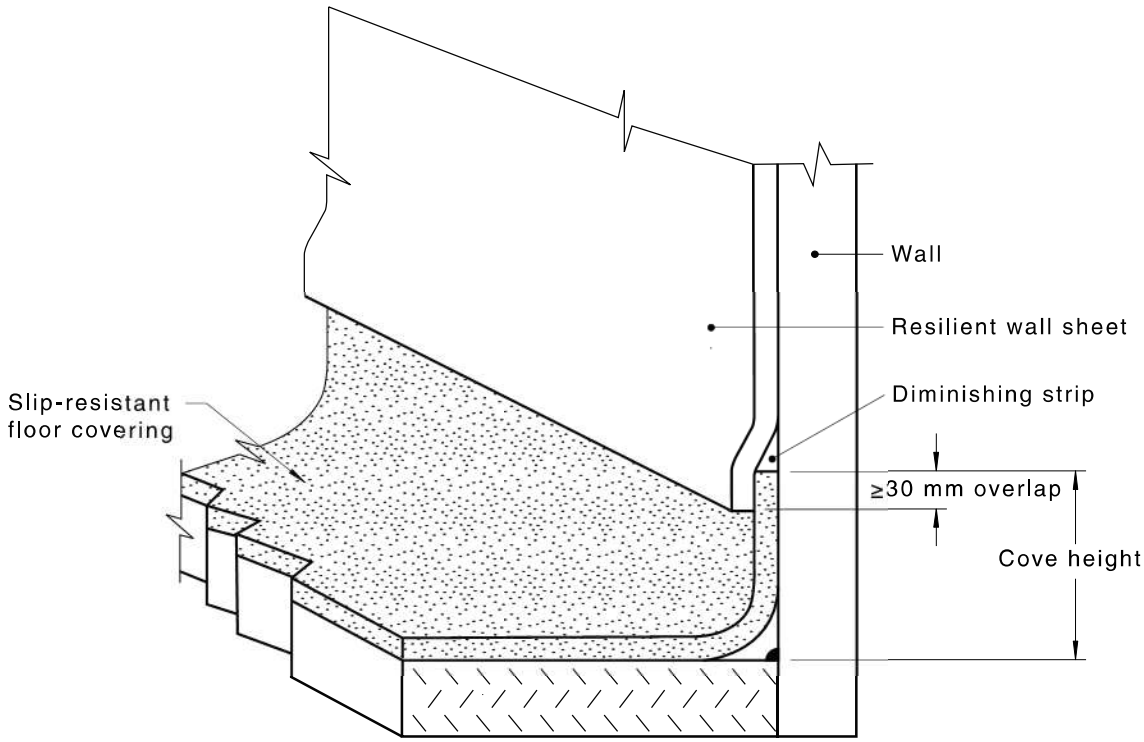


Figure 5.1 — Overlap method

The first sheet should be installed in the corner of the wet area. The width of the sheet should be measured by finding the centre and marking with a pencil. An appropriate contact style adhesive should be applied in a 200 mm band down the centre line of the resilient wall sheet and in the same position on the internal corner. A minimum 100 mm of an appropriate adhesive should be applied across the top of the sheet and on the corresponding wall and allowed to tack off.

The same method may be used on external corners using a hand roller.

An accurate vertical chalk line should be made on the wall the full length of the drop. This will give a straight edge for the next sheet. An appropriate adhesive should be applied as per previous instructions. The first drop is fitted by pushing the material firmly into the corner using a corner roller, making sure that the wall sheet overlaps the cove by at least 30 mm.

The material shall be rolled into the adhesive using an appropriate hand and wall roller working from the top and from the centre to the edge of the drop ensuring full transfer of adhesive to the back of the resilient wall sheet. The next drop shall be fitted using the same method and positioned leaving a 0.5 mm gap between the sheets. This process shall be continued until the installation of the resilient wall sheet is complete. Any excess adhesive shall be cleaned up.

An appropriate adhesive shall be applied to the face of the cove down a minimum of 30 mm and the resilient wall sheet rolled into the adhesive. A heat gun shall be used to assist with the overlap. A straightedge shall be used to trim the overlap to the desired length leaving a minimum of 30 mm overlap, see Figure 5.1.

All joins to wall sheet shall be grooved using a grooving tool to the depth recommended by the wall sheet manufacturer.

Joins shall not be welded until the adhesive has achieved cure. Welds shall not be trimmed until the weld is cool.

5.2.2.4 Welded method

The welded method follows the same installation procedure as the overlap method with the exception that the wall and floor sheets are not overlapped but finished together leaving a gap of 0.5 mm to allow for grooving and welding. A diminishing strip is still required if the wall and floor resilient finishes have different thicknesses, see Figure 5.2.

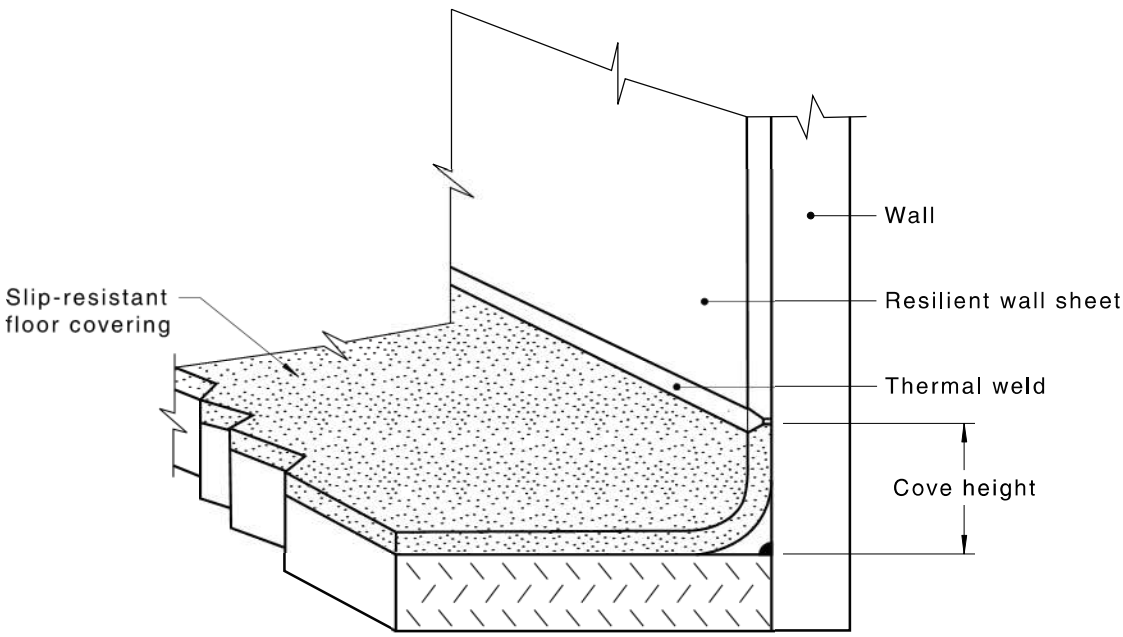


Figure 5.2 — Welded method

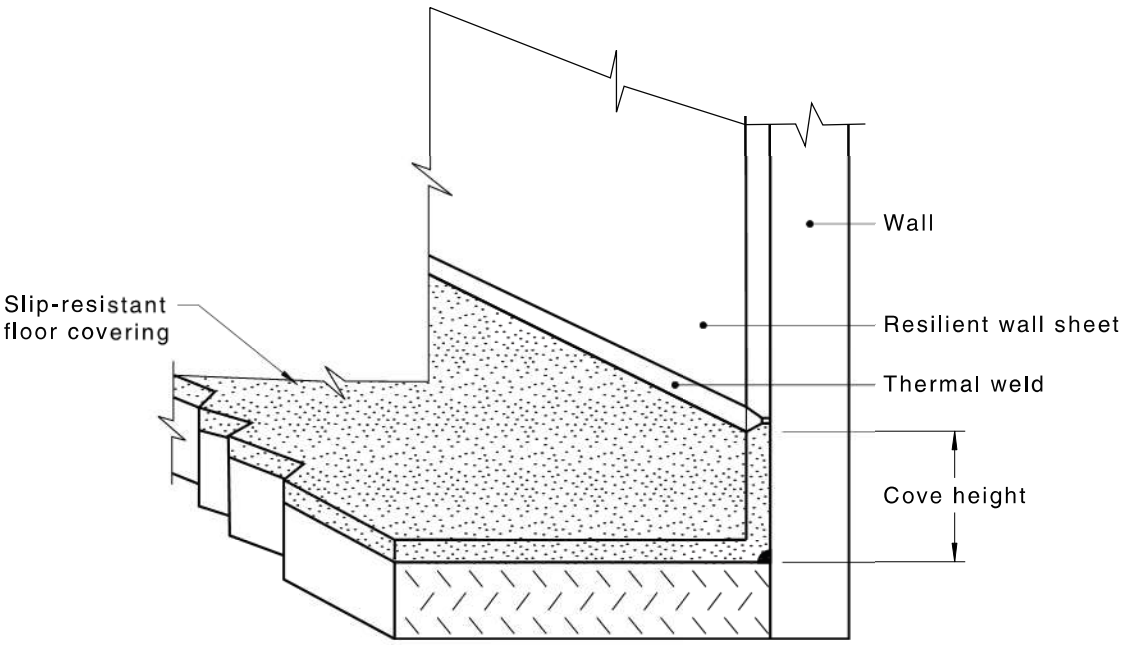


Figure 5.3 — Pencil cove method

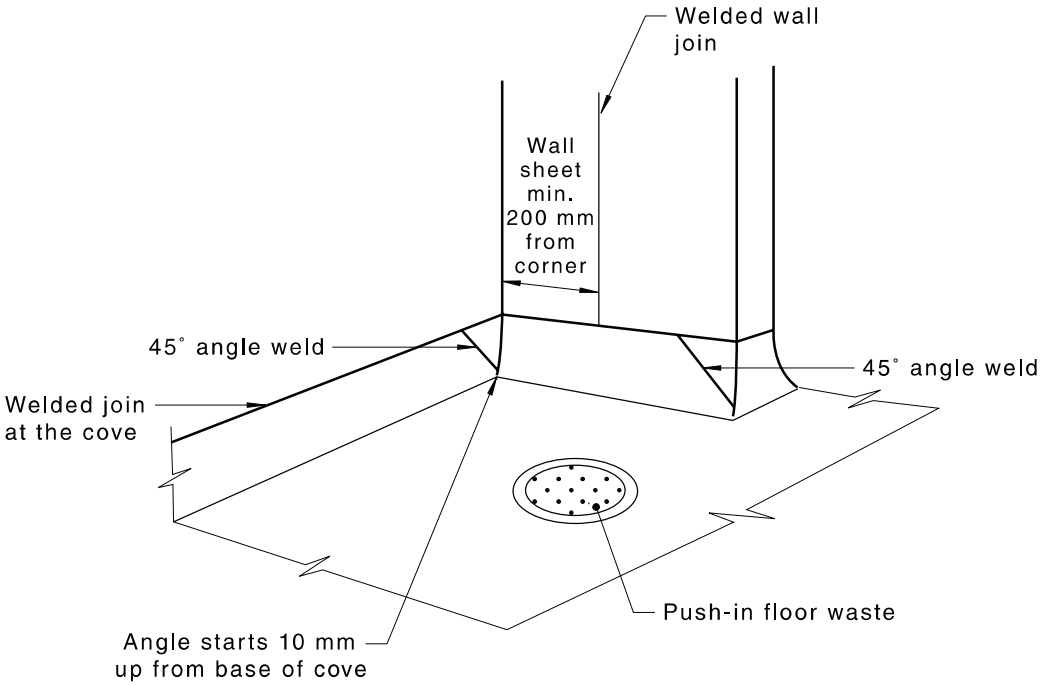


Figure 5.4 — Thermal welded method (internal and external corners)

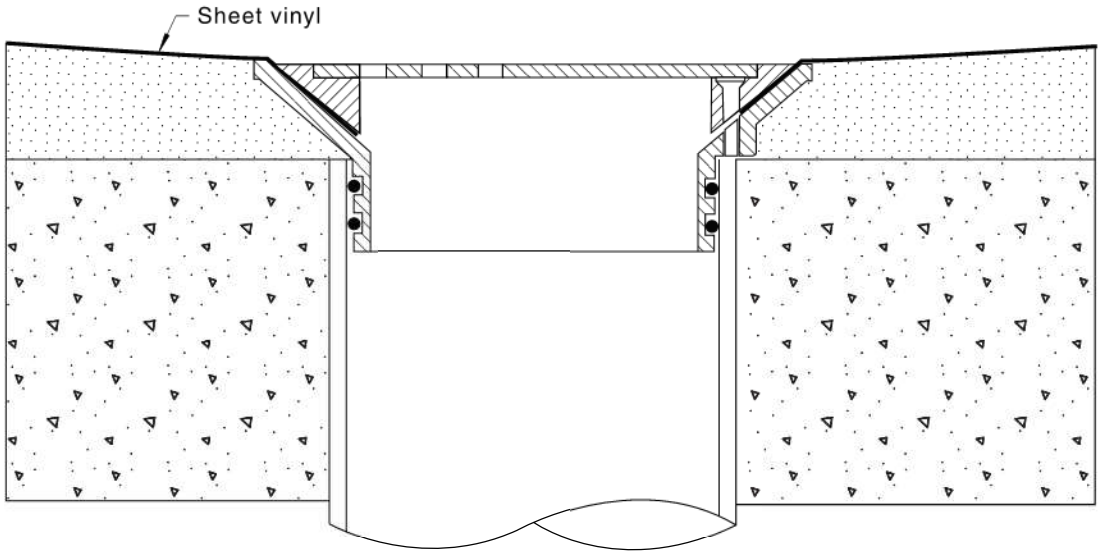


Figure 5.5 — Push-in vinyl sheet waste

5.3 Linoleum

5.3.1 On site storage and conditioning

In addition to the general requirements listed in Clause 4.1.1, the wrapped material shall be conditioned in the same environment for at least 48 h prior to the installation. The materials shall be stored vertically within or near the installation area.

5.3.2 Adhesive

For application of adhesive, see Clause 5.1.3.

5.3.3 Setout

For setout requirements, see Clause 5.1.2.

5.3.4 Installation

Linoleum shall be installed in accordance with Clause 4.2 and the following:

(a) Adjacent sheets shall run in the same direction unless specified otherwise by the linoleum manufacturer.

(b) Manufactured edges shall be trimmed and be true and parallel.

(c) Sheets shall be closely fitted parallel to walls, perimeters and door jams with a minimum gap. No gap shall be greater than 1 mm.

(d) Sheets scribed to fit an area shall be cut to allow for shrinkage of approximately 1 mm per metre of material length.

(e) When tight seams are required, an allowance for expansion of approximately 0.8 mm per width of the material sheet or in accordance with manufacturer's instructions shall be included.

(f) Where tight fit cross joins are prepared and made in the sheet, shrinkage of approximately 1 mm per metre at the cross join, or in accordance with manufacturer's instructions, shall be included.

NOTE Humidity and wet adhesive will cause shrinkage of material length and expansion of material width. Sheets shall be placed into wet adhesive, the air under the sheet expelled and the sheet rolled in multiple directions with a 68 kg articulated roller before adhesive sets up.

(g) The linoleum shall be re-rolled after 20-25 min with the heavy roller to help reduce roll curl.

Where bight marks are identified in sheets, the area of the bight mark and 500 mm each side of the centre of the bight mark backing should be uniformly and smoothly coated with linoleum adhesive applied with a flat, toothless trowel. The sheet should then be placed into the wet adhesive that has been applied to the subfloor and rolled immediately in multiple directions to achieve the correct adhesive transfer to the sheet backing.

5.3.5 Seaming

In addition to the requirements of Clause 5.1.4, seams shall be free from scorches and linoleum surface scalping. Manufacturer's instructions for trimming, routing and grooving shall be followed using purpose-made equipment.

When welding linoleum to PVC floorcoverings (accessories) the seams of materials being thermally welded together shall be prepared and welded together using linoleum weld cable in accordance with the linoleum manufacturer's instructions.

Where two materials of varying thickness are being thermally welded together the abutting material thickness should be no greater than 3 mm thick. Weld trimming should be slightly ramped down to thickness of the thinnest material.

5.3.6 Border coving

Border coving may be manufactured as a preformed product or formed on site. Preformed border cove shall be fitted such that the manufactured lengths of cove are installed using an adhesive in accordance with linoleum manufacturer's instructions with the linoleum cove in continuous contact with the substrate.

Site formed border cove, including internal and external corner joins, shall be installed over a ridged/ semi-rigid preformed cove fillet without excess flexibility to achieve a radius in accordance with manufacturer's instructions. The cove shall be installed using an adhesive in accordance with the linoleum manufacturer's instructions with the linoleum sheet in continuous contact with the substrate.

Joins may be either thermally welded or finished with a tight seam.

5.3.7 Completion

For general completion requirements see Clause 5.1.6.

Damp spot cleaning may be utilized with pH neutral detergent and water mixed to the manufacturer's instructions.

5.4 Rubber sheet and tiles

5.4.1 Conditioning

To achieve best results, site conditions shall be as described in Clause 4.1.1. All sheet and tile rubber flooring shall be placed face upward, taking care not to damage the surface, and cut approximately to size. Allowance of a minimum of 75 mm shall be made for the perimeter of the installation area

for trimming. The sheet and tile rubber flooring shall then be left for 24 h to condition at a minimum temperature in accordance with manufacturer's instructions.

5.4.2 Adhesive

For adhesive requirements see Clause 5.1.3.

In cases where the rubber will be exposed to prolonged high temperatures from direct sunlight, an adhesive resistant to those conditions, as specified in the manufacturer's instructions, shall be used.

5.4.3 Tile setout

The installation from the centre of the area shall be balanced to minimize waste.

The starting point shall be marked out at a perpendicular axis adjacent to the longest straight wall.

Installations containing connecting areas and link-ups may require a number of perpendicular axes.

5.4.4 Sheet setout

For setout requirements see Clause 5.1.2.

5.4.5 Installation

For installation requirements see Clause 4.2.

5.4.6 Seaming

Sheet rubber joins shall be trimmed to form a tight seam. Welding of rubber sheet is not a prerequisite in most installations. However, where there is heavy wet cleaning, or where due to hygiene requirements a continuous sealed surface is required, the joints shall be either thermally or cold welded using the relevant filler.

NOTE Welded external corners are prone to breaking open due to damage from wheeled traffic. To prevent this from occurring, and as an alternative to the traditional mitre, the joint may be cut at an angle of 45° and taken around the corner and welded.

5.4.7 Completion

For general completion requirements see Clause 5.1.6.

5.5 Vinyl composite tiles (VCT)

5.5.1 Conditioning

For conditioning requirements see Clause 4.1.

Tiles should be stored in full boxes no more than five boxes high on site for 24 h.

5.5.2 Adhesive

For adhesive requirements see Clause 5.1.3.

In cases where the VCT will be exposed to prolonged extreme conditions such as high temperatures from direct sunlight or cold condition from entrances, fridges, freezers etc., an adhesive resistant to those conditions shall be used.

NOTE Some manufacturers recommend backrolling of adhesive in the installation of VCT. Refer to manufacturer's instructions.

5.5.3 Setout

The installation shall be balanced from the centre of the area to minimize waste.

The starting point shall be marked out at a perpendicular axis adjacent to the longest straight wall.

Installations containing connecting areas and link-ups may require a number of perpendicular axes.

5.5.4 Installation

For installation requirements see Clause 4.2.

Installation shall commence from the intersection of the perpendicular axis.

Tiles shall be laid true to the axis lines to ensure that they are laid square to each other. They shall be laid in a step or pyramid fashion to minimize tile creep.

Perimeter tiles shall be cut and closely fitted to walls, thresholds and door jams.

The completed sections of the installation shall be rolled in multiple directions with a 68 kg articulated roller in accordance with the VCT manufacturer's recommendations.

Batch numbers of boxes should be checked to ensure uniformity of materials supplied.

Tiles should be taken from cartons to mix/blend when installing multiple boxes of tiles.

5.5.5 Completion

For completion requirements see Clause 5.1.6.

5.5.6 Protection

Protection of the VCT, as agreed between purchaser and flooring contractor, shall be via the application of polish in accordance with the resilient floor manufacturer's instructions. Additional protection may be required where there is heavy traffic or where additional work is to be carried out over the flooring.

5.6 Luxury vinyl tile and plank (LVT, LVP)

5.6.1 Conditioning

For conditioning requirements see Clause 4.1.

The substrate shall not be exposed to direct sunlight for the period 24 h prior to installation, during installation and 24 h after installation. This is to prevent thermally induced dimensional changes of the product.

5.6.2 Adhesive

For adhesive requirements see Clause 5.1.3.

In cases where the LVT/LVP will be exposed to prolonged high temperatures from direct sunlight, an adhesive resistant to those conditions shall be used, in accordance with resilient flooring and adhesive manufacturer's instructions.

The installation area shall be divided into workable sections. Adhesive shall not be applied to the perimeter until the main body of the floor has been laid.

5.6.3 Setout

Tile/plank direction shall be confirmed.

The installation shall be balanced from the centre of the area to minimize waste.

For tiles the starting point shall be marked out at a perpendicular axis adjacent to the longest straight wall. Installations containing connecting areas and link-ups may require a number of perpendicular axes.

For planks the starting point shall be marked out at a perpendicular line adjacent to the longest straight wall.

5.6.4 Installation

For installation requirements see Clause 4.2.

End joints of planks shall be installed with a 150 mm minimum random off-set or by the width of the plank being installed where it is greater than 150 mm.

The decoration of tiles and planks is randomly distributed and can be heavier on some tiles than others. To prevent heavy and light colour shading areas, the tiles should be unboxed and, where necessary, shuffled. Alternating the direction of tiles may be required to avoid repeat patterns.

When a section has been laid, except for the perimeter, the flooring shall be rolled in both directions with a minimum 45 kg articulated roller as specified by the resilient flooring manufacturer.

LVT and planks should be closely fitted and cut flush to any walls and fittings.

5.6.5 Completion

For completion specifications see Clause 5.1.

5.6.6 Protection

Protection of the LVT may be required where there is heavy traffic or where additional work is to be carried out on the flooring.

5.7 Loose lay installation — Sheet, plank and tile

5.7.1 General

Loose lay installation is a method of installation either without adhesive, or with a minimal use of adhesive and for a product specifically designed for this procedure.

Maximum areas to be installed using this method shall be checked against the specific product manufacturer's instructions.

Subfloor preparation or underlay requirements as stated in Clauses 3.1 and 3.2 may not be required. Refer to resilient floor covering manufacturer's instructions.

5.7.2 Conditioning

Although floorings with fibreglass inter-layers are generally quite stable, the manufacturer's instructions should always be followed with regards to conditioning and to the provision of a gap around the perimeter of the installation to allow for the impact of climatic changes. Re-trimming of floorings around the perimeter may be required at a later date once the floorings have relaxed after installation.

5.7.3 Seaming

All joins in loose-lay sheet installations shall be either chemically or thermally welded, in accordance with the requirements of the floor covering.

Chemically welded joins shall be flush, even and impervious with no overflow of chemical residue.

The seam sealer manufacturer's instructions should be followed.

5.7.4 Mechanical fixings

The use of hook and loop tape, and single and double sided tape, at joints and doorways for securing joins and perimeters of loose-lay resilient sheet flooring shall be in accordance with manufacturer's instructions.

5.7.5 Completion

Flooring should be allowed to relax for 24 h before locating furniture and fittings on top of the floor covering. Heavy furniture should never be dragged over any loose-lay installation. Care should be taken when wheeling heavy loads over this type of installation as it may result in damage.

5.8 Hybrid modular flooring

5.8.1 General

This section includes the following product categories:

(a) Expanded Polymer Core (EPC).

(b) Solid Polymer Core/ Stone Polymer Composite (SPC).

(c) WoodPolymer Composite (WPC).

5.8.2 Conditioning

For conditioning requirements see Clause 4.1.

5.8.3 Installation over existing floor coverings

Hybrid modular floor covering products can generally be laid over hard existing floor coverings such as vinyl flooring, ceramic tiles, cork and linoleum flooring which are level in accordance to planeness requirements.

Existing hard floor coverings should be securely bonded to the subfloor to ensure they provide a sound substrate for the life of the hybrid modular floor covering.

Hybrid modular floor covering products should not be installed over soft floor covering like carpet or carpet underlay.

5.8.4 Inspecting the hybrid modular floor coverings before installing

Material shall be checked against customer order for correct colour, pattern and quantity.

Batch numbers of boxes should be checked to ensure uniformity of materials supplied.

The areas where material is to be installed shall be lit to allow for proper inspection for visible faults. Materials showing visible defects or damage to locking systems before installation shall not be used.

Material should be taken from a minimum of three cartons to mix/blend when installing.

5.8.5 Setout

Maximum areas to be installed using these products with floating methods shall be checked against the specific product manufacturer's instructions as installing outside these parameters may in some

instances void the manufacturer's warranty terms. Expansion gap requirements shall be checked against the specific product manufacturer's instructions as installing outside these parameters may in some instances void the manufacturer's warranty terms.

Blocks or wedges shall be used to maintain the required expansion gap and parallel alignment and removed after installation.

Where possible, the material should be laid in the same direction as the main light source and should start along the longest straight wall from the corner of the room as described in the manufacturer's instructions. To achieve a balanced installation, the first row should be scribed and trimmed to achieve a balanced cut on each side of the installation area.

Door frames should be undercut to enable the flooring to be inserted underneath without force, making sure to maintain the required gap.

The end joints should show a random staggered pattern and be separated at a minimum of no less than 200 mm.

5.8.6 Threshold strips, expansion and edge treatments

For all exposed edges, expansion mouldings with sufficient clearance shall be installed.

Where skirting boards or scotia are used to cover the required expansion gaps, these shall not be fastened through the flooring.

5.8.7 Completion

When the installation is completed, all scrap material and debris shall be removed from the floor. The floor shall be swept or suction cleaned to remove all dust and debris.

5.9 Static (electrostatic) control

5.9.1 General

Static control flooring is chosen for its specific properties, the scope of which is to reduce or prevent the generation and retention of an electrostatic charge, and subsequently the effects thereof, e.g. personal discomfort, damage to electronics, fire, explosion, etc.

In accordance with IEC 61340-4-1, IEC 61340-5-1 and ANSI/ESD S20.20, to achieve ESD Protected Areas (EPA) a controlled system is required which is connected to ground.

If a dissipative or conductive floor is not common grounded, it is considered a non-conformance issue and it cannot be used as part of a static control system, e.g. inside an EPA.

5.9.2 Conditioning

For conditioning requirements see Clause 4.1.

5.9.3 Adhesive

For adhesive requirements see Clause 5.1.3.

Unless manufacturer's instructions specify loose-lay or a modified adhesive installation method, conductive or dissipative sheets or tiles shall always be adhered with a floor covering manufacturer-approved conductive adhesive.

5.9.4 Installation

As installation methods vary between adhered, loose lay, sheet and tiled products, each manufacturer's installation instructions shall be followed.

All conductive and dissipative installations shall be common grounded via a groundable point to the designated common ground reference.

Antistatic products dissipate some static electricity but cannot be defined as conductive or dissipative and do not need grounding.

Some flooring specifications require an intensive copper grid, while others only require a simple grounding tag.

The client/builder specifies available "grounding points" prior to installation which will allow the flooring contractor to plan the copper grid placement. All grounding point connections shall be terminated by a competent person.

NOTE An example of a competent person would be a licensed electrician.

5.9.5 Conformance testing

Static control flooring shall meet the requirements of IEC 61340-5-1

Non-conformant static control resilient flooring may compromise the effectiveness of the static control system. Having an ineffective grounding system can lead to a multitude of issues through ESD damage, both latent and catastrophic. Liabilities may be avoided through proper testing of the finished installation and ongoing verification.

NOTE See Appendix G for information on electrostatic discharge control resilient flooring.

Ongoing performance of the installed systems may be adversely affected by several issues, including sub-floor moisture, bonding and performance issues of adhesive, maintenance and earthing connections. Therefore, annual conformance testing is recommended for the maintenance and safety of the installed static control system and its components.

5.9.6 Completion

See Clause 5.1.6 for completion specifications.

Appendix A
(normative)

Testing for moisture content in subfloors — *in situ* probe method

A.1 Background

The primary test method to determine moisture content in concrete subfloors is ASTM F2170. For areas where it can be demonstrated that drilling into the slab could be detrimental to the integrity of underfloor services, e.g. in-floor heating, post tensioned cables etc., testing should be undertaken in accordance with the methodology set out in ASTM F 1869, see Appendix B.

A.2 Principle

The objective of the test is to determine whether the subfloor moisture content is suitable for the installation of resilient floor coverings.

A.3 Testing procedures

A.3.1 General

The instrument manufacturer's instructions shall be followed when undertaking moisture testing of a concrete slab.

All instruments used in the test procedures shall be calibrated and records kept.

A.3.2 Concrete subfloors

A.3.2.1 Test methods

All tests shall be carried out by a competent person.

A.3.2.2 Relative humidity (RH) *in situ* probe test (primary test method)

Concrete subfloors shall be considered suitable for the installation of resilient floorcoverings when measurements taken in accordance with ASTM F2170 do not exceed 80 % relative humidity. Three tests shall be performed for the first 100 m^2, and at least one additional test for each additional 100 m^2 at recommended positions in accordance with ASTM F2170.

Prepared test holes require a minimum of 24 h equilibrium time prior to recording test results.

NOTE The RH of 80 % noted above is the default result where the manufacturer of the resilient flooring, adhesive and preparation materials does not offer a recommended maximum RH in their installation instructions or data sheet. The manufacturer's RH requirements take precedence over the figures noted in this document.

A.3.3 Timber, plywood and particleboard subfloors

Timber, plywood and particleboard subfloors shall be considered dry when moisture content measurements are within a range of 10 % to 14 %. Similarly, as for concrete substrates, a minimum of three tests shall be performed for the first 100 m^2 and at least one additional test for each additional 100 m^2.

Suitable testing procedures for timber subfloors may be found in AS/NZS 1080.1 and for plywood subfloors in AS/NZS 2098.1. For particleboard subfloors similar procedures as for timber, described in AS/NZS 1080.1, may be used.

A.4 Test report

The value of adequate moisture testing is often not realized until a problem arises with an installation some time after completion. Accordingly, written records of moisture testing results shall capture the following:

(a) Physical address of subfloor tested.

(b) Type of subfloor tested.

(c) Testing regime.

(d) Date and time of measurements taken.

(e) Location of testing equipment.

(f) Results of readings taken.

(g) Subfloor temperature and relative humidity at time of test results.

(h) Ambient temperature and relative humidity at time of test results.

(i) Type, make, model and serial number of the test equipment and its calibration status.

Appendix B
(informative)

Moisture vapour emission rate surface test (secondary test method)

B.1 Background

Surface testing of the subfloor will provide an indicative measure of the moisture vapour evaporation rate at the time of testing only. A surface test is carried out on concrete slabs that cannot be tested by drilling (*in situ* probe method)(see Appendix A), e.g. due to in-floor heating or post tensioned cables . Due to the withdrawal of ASTM F2420, which was previously referenced in this document as a secondary test, an alternative surface test has been selected

B.2 Moisture vapour emission rate surface test (secondary test method)

Concrete subfloors may be considered suitable for the installation of resilient floorcoverings when measurements taken in accordance with ASTM F1869 do not exceed 15 g/m^2/24hr (3.0lbs/1 000 Square feet/ 24 hr). Three tests should be performed for the first 100 m^2 and at least one additional test for each additional 100 m^2 at recommended positions in accordance with ASTM F1869.

NOTE The 3.0 lbs/1 000 ft^2/24 h noted above is the default result where the manufacturer of the resilient flooring, adhesive and preparation materials does not offer a recommended maximum value in their installation instructions or data sheet. The manufacturer's requirements for moisture vapour emission rate take precedence over the figures noted in this document.

The site conditions for testing should be at the same ambient conditions anticipated during normal every day use. Should it not be possible to get the test areas to meet these conditions, then the test conditions should be 23.9 ± 5.5°C and 50 ± 10 % relative humidity. These conditions should be maintained for a miniumum of 48 h prior to and during testing.

Test locations should be 500 mm × 500 mm and should have have all existing floorcoverings, adhesives, screeds, etc. removed and the surface lightly ground to produce a Concrete Surface Profile (CSP) equal to CSP-1 to CSP-2, see Appendix E. The test area should be left open to ambient conditions for a minimum of 24 h prior to the placement of the test kit.

Concrete subfloors that have not had a floorcovering, adhesive, etc. installed over them for at least 30 days, or new concrete slabs, can be prepared to CSP-1 or CSP-2 with no waiting period providing the ambient conditions noted in the document have been met.

B.3 Calibration of scale

Calibration of the scales is critical due to the low weights being measured. Therefore, the Gram Scale, capable of measuring in increments of 0.1 g, should be used to weigh the anhydrous calcium chloride dish.

Prior to the commencement of the test, the measuring scale should be calibrated using a standardised calibration weight. Evidence of the calibrated result should be documented with the test results.

B.4 Test report

The value of adequate moisture testing is often not realized until a problem arises with an installation some time after completion. Accordingly, written records of moisture testing results should capture the following:

(a) Physical address of subfloor tested.

(b) Type of subfloor tested.

(c) Testing regime.

(d) Location of testing equipment.

(e) Ambient temperature and relative humidity at time of test results.

(f) Manufacturer of the test kit.

(g) Weight of the dish of anhydrous calcium chloride, including the tape used to seal the container and the container lid prior to testing.

(h) Weight of the dish of anhydrous calcium chloride, including the tape used to seal the container and the container lid at the end of the test, the date, and time the test was stopped.

(i) Duration of test.

(j) Test result (Weight gain between start and completion of test).

Appendix C
(normative)

Testing the pH level in concrete subfloors

C.1 Background

High alkalinity in concrete subfloors is now recognized as being a cause of failure of adhesion between floor coverings and the subfloor. Changes in the materials now used, and the current technology, have made this property of the subfloor a critical factor. Allowable surface pH shall be as specified by the adhesive manufacturer.

C.2 Principle

The objective of the test is to determine whether the subfloor pH value is suitable for the installation of resilient floor coverings.

Concrete subfloors shall be considered suitable for the installation of resilient floor covering and ancillary products when the measured pH does not exceed 10 or in accordance with adhesive manufacturer's instructions.

Three tests shall be performed for the first 100 m^2 and at least one additional test for each additional 100 m^2.

C.3 Testing procedures

C.3.1 Apparatus

Spot tests for pH levels are performed using pH test papers with a reference pH colour chart, or a calibrated pH test meter and distilled or deionized water for wetting the test materials or rinsing equipment.

The measurable pH range required for spot test measurements is pH 6 to pH 13.

C.3.2 Procedure

A section of the concrete floor is mechanically prepared to remove contaminants and burnishing to expose the open matrix of the subfloor. The surface is swept and vacuumed to remove dust and contamination before performing the test.

One pH test should be conducted at each RH% test point. Refer results to the floor covering and adhesive manufacturer's instructions as to whether installation should proceed.

C.4 Test report

The value of adequate pH testing is often not realized until a problem arises with an installation some time after completion. Accordingly, written records of pH testing results should capture the following:

(a) Physical address of subfloor tested.

(b) Type of subfloor tested.

(c) Testing regime.

(d) Date and time of measurements taken.

(e) Location of testing equipment.

(f) Results of readings taken.

(g) Type, make, model and serial number of the test equipment and its calibration status where such equipment is used.

Appendix D
(normative)

Site information to be provided to the contractor

D.1 General

The contractor shall be provided with the following information:

(a) The position and depth of electric power cables and cold and hot water pipes.

(b) The nature of any additives, curing agents, parting compounds, surface treatments or similar used in the construction of the subfloor, as these may have a deleterious effect on any floor adhesive used.

(c) Particulars and location of damp course to ensure that the subfloor is free from rising moisture. Where the subfloor is constructed on fill, hardcore or the ground, the contractor shall be advised as to whether the subfloor has been protected from entry of moisture by the recommended means of a continuous impermeable membrane of minimum thickness of 0.2 mm.

(d) Where the subfloor is concrete, whether the concrete is sufficiently dry when assessed in accordance with Appendix A.

NOTE 1 Concrete waterproofing additives and curing compounds are not considered a substitute for a water-vapour-proof membrane.

NOTE 2 Certain concrete waterproofing additives and curing compounds may adversely affect adhesives used during the installation process.

(e) The location and type of air conditioning, or other type of space heating not mentioned above.

(f) The position and depth of any other structural elements which may affect the work or the quality of the work being undertaken by the contractor.

(g) Assurance that the subfloor on which the resilient floor covering is to be installed shall be provided clear of the tools and goods of other trades.

(h) Assurance that the site meets occupational health and safety requirements.

(i) An agreed time schedule or program for the project.

D.2 Concrete subfloors

In addition, for concrete subfloors, the contractor shall request the purchaser to supply the following information:

(a) The position and depth of heating elements, whether electric or heated water pipes, and whether these have been insulated.

NOTE 1 Unless the heated elements are insulated sufficiently, hot spots can occur which could result, in time, in the failure of the adhesive or the floorh covering.

(b) Particulars of the ventilation under the subfloor.

(c) The details of the concrete subfloor, including the thickness and compression strength of the concrete throughout the installation area.

(d) The date the concrete subfloor was completed.

(e) Whether the surface is plane, smooth and sound.

NOTE 2 Where a subfloor is so rough or uneven that it is unsuitable for the direct application of the floor covering, corrective action should be taken (e.g. steel-trowelled concrete layer) to level the subfloor.

D.3 Timber subfloors

The contractor shall request the purchaser to supply the following details on timber subfloors:

(a) Whether the timber subfloor has been kiln-dried or air-dried in order to achieve a moisture content which is at equilibrium with the environment.

(b) Whether the subfloor ventilation conforms to the AS 1684 series.

NOTE Failure of resilient floor coverings can occur when they are laid over timber subfloors subjected to conditions which might cause the timber subfloor to buckle, rot or otherwise deteriorate.

Appendix E
(informative)

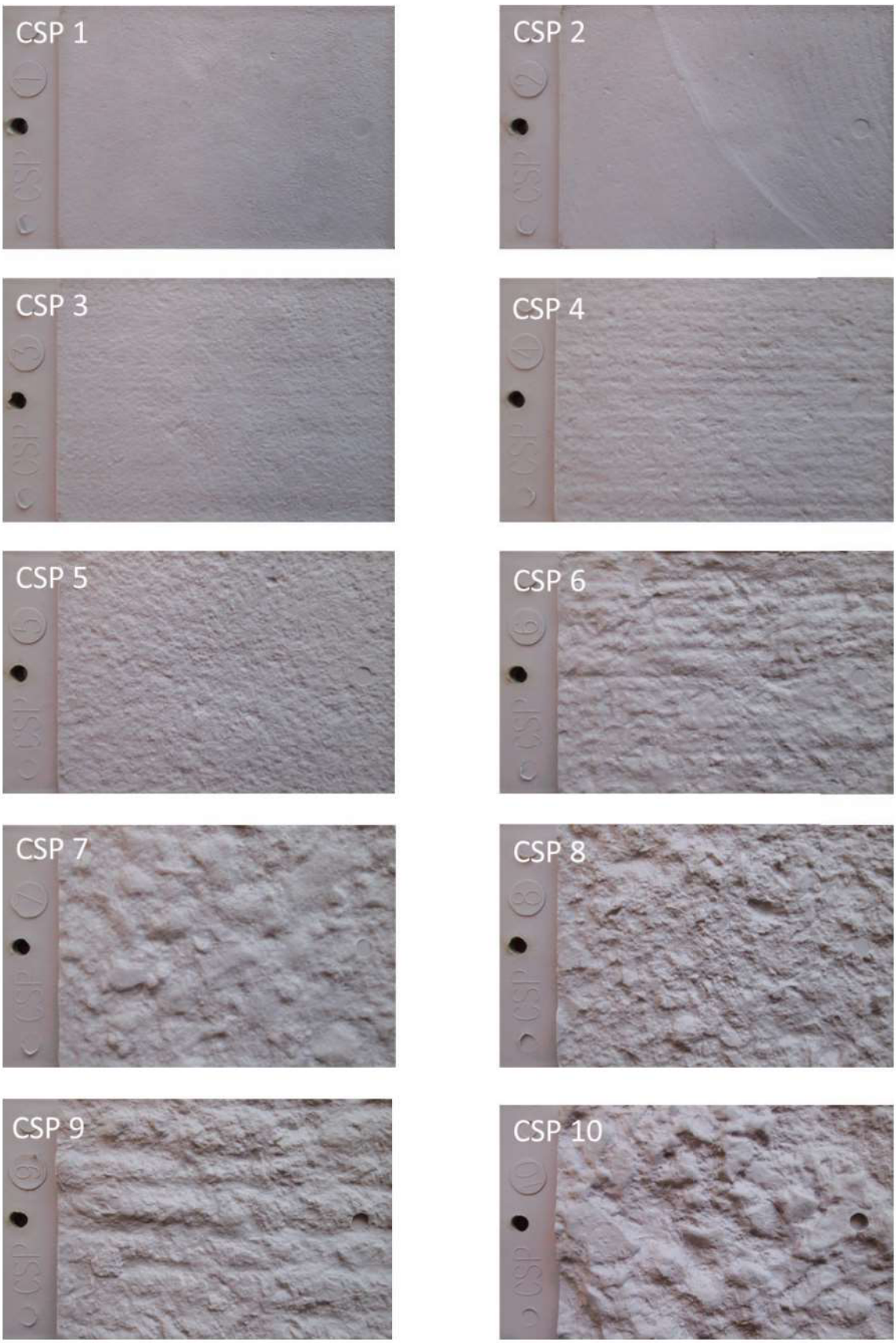
Surface preparation of concrete

Surface preparation to achieve the specific Concrete Surface Profile (CSP) of a concrete slab is critical to the success of any resilient floorcovering installation, whether the slab is new or existing (see Clause 3.1).

Poor subfloor preparation, or the incorrect CSP, contribute to a large portion of resilient flooring failures.

Most adhesive, levelling compound, moisture barrier, etc. manufacturers require a specific surface profile for their products to bond/adhere to. There are 10 distinct surface profiles which are shown in Figure E.1.

The CSP of a concrete subfloor requires the correct mechanical preparation procedures, using the right equipment (i.e. grinder, shot-blaster, sander, etc.), to remove a non-porous surface, laitance, oils, old adhesives, films, paint, curing compounds, dirt, etc. that may affect the adhesion/bond of the products being applied/installed over the mechanically prepared subfloor.



[SOURCE: International Concrete Repair Institute Technical Guidelines 310.2R]

Figure E.1 — Concrete surface profiles

The CSP ranges from 1, which is nearly flat and smooth, to CSP 10, which is very rough.

These CSPs show the difference between the various degrees of roughness required of the subfloor prior to the application of any resilient floorcovering or flooring system. The product manufacturer's instructions and equipment manufacturer's instructions should be followed with regard to the CSP and subfloor preparation.

Appendix F
(informative)

Adhesive

F.1 General

This Appendix identifies resilient adhesive types and uses, basic sub-floor requirements, trowel types, adhesive application techniques and other various advice related to adhesive application for the installation of resilient floorcoverings.

F.2 Adhesive type

Pressure sensitive — This type of adhesive functions by applying pressure to both substrates. For this reason, it is essential the floorcovering is rolled to ensure the VCT backing makes good contact with the pressure sensitive adhesive bonded to the subfloor.

High grab, hard set, chemical or moisture cure adhesive — These types of adhesive require cohesion between the floorcovering backing and the subfloor. For this reason, these adhesive types requires 100 % transference of adhesive to the back of the floorcovering. Complete transference ensures the trowelled adhesive ridges flatten and this promotes a sufficient cohesive bond between both substrates. See Figure F.1 below for the correct rate of transference.

Figure F.1 — Correct rate of transference

There are a number of other emerging technologies including adhesive tapes and water-based contact adhesives which are suitable for the installation of resilient floorcoverings. These products should be used in accordance with manufacturer recommendations.

F.3 Ambient environment, adhesive application and transference

Tack or tack-up is defined as the time required for adhesive to achieve its initial tack before the floor covering is laid onto it. Tack or tack-up time will depend upon atmospheric conditions and substrate absorbency (see Clause 3).

NOTE 1 The porosity of the surface of the concrete may be tested in accordance with ASTM F3191 to ensure the effective initial tack off by water borne adhesives and also achieve correct drying and cure.

Higher temperatures and low ambient relative humidity environments accelerate tack times while lower temperatures and high ambient relative humidity environments will slow tack times.

F.4 Basic subfloor preparation

In most cases, resilient flooring adhesives should not be directly applied to membrane materials. Should subfloor preparation be required, the appropriate levelling compound, primers and moisture barrier products should be used. The minimum subfloor temperature before commencing surface preparation and adhesive application is 10 °C.

F.5 Trowel types

Trowel selection is a vital part of a resilient floorcovering installation. A trowel is a calibrated measuring tool, designed to apply a specific amount of adhesive to a substrate. See Figures F.2 to F.4 for recommended trowel types for most resilient floorcovering installations. Where a trowel is worn or the notching size is incorrect, the right amount of adhesive transfer will not occur.

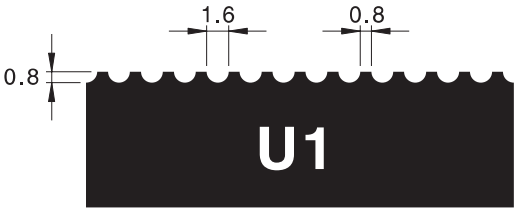


Figure F.2 — "U" notch trowel

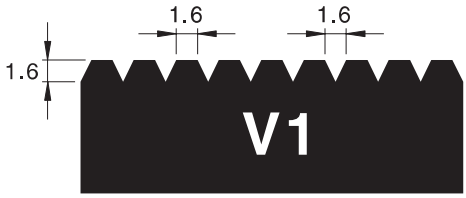


Figure F.3 — "V" notch trowel

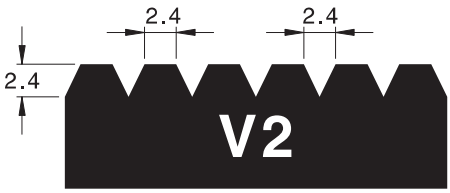


Figure F.4 — "V2" notch trowel

As a guideline, see Table F.1 for adhesive consumption rates.

Table F.1 — Adhesive consumption rates

Trowel	Coverage m^2/L
U1	7
V1	5
V2	3

Appendix G
(informative)

Information on electrostatic discharge (ESD) control resilient flooring

G.1 General

In the manufacturing process, most ESD flooring contains conductive elements, such as carbon, graphite or particles coated with metals, that provide electrical conductivity. A person walking or a wheel rolling across a floor creates a triboelectric effect between the footwear/wheel and the floor surface. Depending on many factors including but not limited to humidity, materials involved and the speed of movement, it is possible for the person or trolley to build up enough static charge to deliver an electrostatic discharge (ESD).

When choosing static control flooring, the following considerations should be addressed.

G.2 Antistatic/low charging floors

Antistatic/low charging floors are intended to reduce the triboelectric effect, e.g. prevent personnel experiencing an ESD from a metal door handle, after walking across a room; a < 2kV Human Body Model (HBM) threshold is typically referenced.

G.3 Groundable floors, conductive or dissipative

Groundable floors, conductive or dissipative, are intended to drain away the static being generated by the person or equipment in a controlled manner via suitable grounding footwear, conductive wheels, etc. They should also be common grounded to an earth/ground reference, enabling effective equipotential bonding between floor, personnel and equipment.

(a) Where a groundable floor is required, what electrical resistance range is appropriate.

Deciding on the appropriate Resistance value e.g. R_G, R_{GP} or R_{P-P} is critical and relevant procedures should be adopted in order to benefit from it.

(b) Groundable flooring typically has an electrical resistance of —

(i) $< 10^6\Omega$ (1 megaohm) for conductive surfaces; and

(ii) between $10^6\Omega$-$10^9\Omega$ (1 gigaohm) for dissipative surfaces.

For details of static control requirements refer to applicable Standards such as IEC 61340-5-1.

(c) Electrical resistance including:

(i) Resistance-to-Groundable Point (R_{GP}).

(ii) Resistance-to-Ground (R_G).

(iii) Point-to-Point Resistance (R_{P-P}).

Further information on electrical resistance testing is contained in IEC 61340-4-1.

(d) HBM Voltage Walking Test to verify that the person/footwear/flooring system is performing as expected.

Further information on the HBM Voltage Walking Test is contained in IEC 61340-4-5.

All conformance testing of groundable floors should be conducted with test results, statistical data, temperature and humidity recorded by a competent person. Refer to relevant Standards, e.g. IEC 61340-5-1 An example of a competent person would be an ESD technician.

Appendix H
(informative)

Glossary of terms

Above grade	Above the surface of the ground, as related to floor location, or above a well-ventilated space with at least 400 mm between the bottom of the lowest horizontal structural member and any point of the ground.
Abrasion resistance	Determined by one of several tests; this shows degree to which the floor withstands foot traffic and daily wear.
Across machine direction	The direction perpendicular to which a product moves through the manufacturing process.
Asphalt tile	An obsolete floor surfacing unit composed of asphalt or hydrocarbon resins, or both, crysotile asbestos fibres, mineral fillers, and pigments. Asbestos containing floor covering could not be manufactured in Australia after 1982.
Below grade	Below the surface of the ground, as related to floor location, part of or the entire floor is below the ground surface level.
Capping strip	Strip installed at the top of the cove where the floor covering is finished up the wall or at the top of the resilient wall sheet fixed to the wall which gives a neat finish to the installation and ensures a continuous, sealed surface, where ease of maintenance and hygiene are of importance. Note 1 to entry: The capping strip, usually metal, but can also be vinyl or rubber, has a flange into which the top edge of the covered floor covering fits.
Chemical resistance	The degree to which the floor covering resists stains and/or corrosive action of various household and industrial chemicals.
Cork tile	A floor surfacing unit made from natural cork shavings compressed and baked to be thoroughly and uniformly bonded together.
Cushioned vinyl flooring	Any vinyl sheet floor covering incorporating a foam layer as part of its construction.
Drop match	A drop match is simply a set match split in half. A drop match pattern is pattern match where there is a vertical drop between the matching design elements repeating diagonally across the floor covering.
Drying room yellowing	A yellowish cast on linoleum resultant from the oxidation process that will go away with light exposure. Without continued light exposure, the cast may reappear.
Embossed	Having a permanently raised, patterned surface produced by mechanical or chemical means.

Feature strip	Special stripping made of rubber, vinyl, or of the floor covering being installed; used to create borders and/or special effects in the finished floor.
Finishing strip	Made of metal, vinyl or rubber and used to finish off raw edge, such as doorways or between two different types of floors.
Full spread	A procedure for installing resilient floor covering whereby it is fully adhered to the substrate.
Grade level	Relationship of a subfloor to exterior ground.
Heterogeneous rubber flooring	A rubber floor surfacing material consisting of layers of dissimilar compositions or colours, or both.
Heterogeneous vinyl flooring	A vinyl flooring surfacing material consisting of layers of dissimilar compositions or colours, or both.
Homogenous rubber flooring	A rubber floor surfacing material, in sheet or tile form, that is of uniform structure and composition throughout. It usually consists of compounded natural or synthetic rubbers, or both, in combination with mineral fillers, pigments, and other additives.
Homogenous vinyl flooring	A flooring surfacing unit in sheet or tile form that is of uniform structure and composition throughout, usually consisting of vinyl plastic resins, plasticizers, fillers, pigments and stabilizers.
HVAC	An abbreviation for heating, ventilation, and air conditioning.
Impact resistance	Tests the degree to which the floor covering recovers from an indentation created by objects being dropped or by static load.
Impact noise rating	The minimum noise level reduction standards for floors in multiple storey housing. The test measures the noise that results from dropped objects, foot traffic and the like.
Inset	The art of insetting a separate colour or pattern into a piece of material, forming a design.
Inlaid sheet flooring	A floor surfacing material in which the decorative pattern or design is formed by coloured areas set into the surface. The design so formed may or may not extend through to a backing.
Light reflective values	The percentage of total light reflected back to the eye from the floor. The colour of the floor covering surface is the influencing factor. Measured with a reflectometer, using standard light source.
Machine direction	The direction in which a product moves through the manufacturing process.
Magnesite	A type of underlayment composed of magnesium oxychloride cement and fillers such as sawdust, cork or sometimes asbestos. This underlayment is unstable to moisture and has been associated with concrete cancer and chloride attack to metal fixtures and reinforcement.
Match marks	Marks on two successive widths of material, usually in the centre. Used to indicate the pattern match alignment.

On grade	A concrete slab that is on ground level.
Pattern repeat	Vertical distance between one point on a design element to the next identical design element.
Pattern scribing	An accurate and convenient procedure for fitting resilient flooring using templates.
Perimeter installation	A method of installation in which the material is adhered by a band of adhesive around the perimeter of the room at the seams and around all fixtures.
Recess scribe	See “underscribe”.
Resilience	Measure of the floor covering’s ability to return to its original shape and gauge after heavy foot traffic, dropped objects or static loads.
Scribe	Procedure for scoring the floor covering to facilitate and achieve accuracy when cutting.
Scribing felt	A saturated or unsaturated felt used for pattern scribing. This is the most accurate method of fitting floor coverings.
Set match	The vertical distance between one point on a design element to the next identical point of the design element of the pattern repeat.
Skiving	The method of cutting the thermal weld rod flush with the surface of the material.
Solid vinyl flooring	See “homogenous vinyl flooring”.
Stair nosing	A metal, rubber or vinyl nosing used on the leading edge of a stair tread. Resilient products are either beneath or scribed to the nosing.
Static load resistance	The resistance of a floor covering to permanent indentions by heavy static loads, such as furniture and appliances.
Straight scribing	The art of scribing resilient products at a right angle to obtain a fit of an irregular surface.
Stringers	The decorative resilient strip that goes down the sides of a stairway. It is normally fitted to the contour of the steps.
Thermal conductivity	The measure of heat flow through the floor covering.
Underscribe	A procedure for seaming resilient flooring. The selvage edge of the first piece is trimmed square and the second piece is placed so that the overlap is over the trimmed edge of the first piece. The adhesive is applied and materials are placed into it. The edge of the top piece is inserted in the underscriber, and with the guide pressed against the squared edge of the bottom piece, the top piece is scored by drawing the underscriber along the edge of the bottom sheet. The needle traces the contour of the lower sheet’s edge, making a guide line for the knife.
Vinyl asbestos tile (VAT)	An obsolete form of resilient tile composed of vinyl plastic binders, crysotile asbestos fibres, mineral fillers and pigments.
Wear layer	The portion of a resilient floor covering that contains or protects the pattern and design.

Bibliography

AS 3600, *Concrete structures*

AS/NZS 1080.1, *Timber — Methods of test, Part 1: Moisture content*

AS/NZS 2098.1, *Methods of test for veneer and plywood, Part 1: Moisture content of veneer and plywood*

IEC 61340-4-5, *Electrostatics — Part 4-5: Standard test methods for specific applications — Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person*

ASTM F1869, *Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride*

ASTM F3191, *Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring*

ICRI 310, *Surface Preparation*

Australian Building Codes Board, *National Construction Code (NCC)*

Further reading

CA 92806, *Moisture Vapor Testing Position Statement*. World Floor Covering Association, 2001

CEMENT CONCRETE AND AGGREGATES AUSTRALIA. *Moisture in Concrete and Moisture-sensitive Finishes and Coatings*. 2007

PNA010-0708, *Advanced research into floor performance issues — Concrete slab moisture and associated ongoing timber performance*. Forest and Wood Products Australia, 2009

RANTALA J., LEIVO V. Drying of in situ cast concrete ground slabs and covering criteria. *Building and Environment.* 2009, **44** (2) pp. 331–337

TN 024 *Concrete and Moisture Sensitive Coverings*. Building and Construction Research and Consultancy, 2009

Standards Australia
Standards Australia develops Australian Standards® and other documents of public benefit and national interest. 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 recognized as Australia's peak non-government national standards body.

For further information visit www.standards.org.au

Australian Standards®
Committees of experts from industry, governments, consumers and other relevant sectors prepare Australian Standards. 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 Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement
Standards Australia is responsible for ensuring the Australian viewpoint is considered in the formulation of International Standards and that the latest international experience is incorporated in national Standards. This role is vital in assisting local industry to compete in international markets. Standards Australia represents Australia at both the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

GPO Box 476 Sydney NSW 2001
Phone (02) 9237 6000
mail@standards.org.au
www.standards.org.au

Printed in Australia

ISBN 978 1 76113 155 4