BRITISH STANDARD

BS 5325:2001

Installation of textile floor coverings — Code of practice

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Committees responsible for this British Standard

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BAMA

BEAMA Ltd. — Industrial Cleaning Machines

British Association for Chemical Specialities

British Institute of Cleaning Science

British Polyolefin Textiles Association

British Shops and Stores Association

British Textile Technology Group

Carpet Cleaners Association

Confederation of British Wool Textiles Ltd.

Consumer Policy Committee of BSI

Contract Flooring Association

Entrance Flooring Systems Association

Fibre Bonded Carpet Manufacturers Association

Society of Dyers and Colourists

Textile Institute

The Carpet Foundation

Trading Standards Institute

Wools of New Zealand

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Contents

Foreword

This British Standard has been prepared by Technical Committee PRI/3. It is a revision of BS 5325:1996 which is withdrawn.

As a code of practice this British Standard takes the form of guidance and recommendations. It should not be quoted as a specification and particular care should be taken to ensure that claims of compliance are not misleading.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, inside front cover, pages i and ii, pages 1 to 31 and a back cover.

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1 Scope

This British Standard gives recommendations for the installation of textile floor coverings in new or existing buildings. It covers all products composed of textile material with a pile or non-pile use surface, and includes the laying of carpet tiles, either with the use of a permanent adhesive or a tackifier. It details suitable methods of design and installation and advises on the selection of the materials required for their implementation.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 5557, *Textile floor coverings — Vocabulary.* (ISO 2424)

BS 5808, *Specification for underlays for textile floor coverings.*

BS 7916, *Code of practice for the selection and application of particleboard, oriented strand board (OSB), cement-bonded particleboard and wood fibre boards for specific purposes.*

BS 7953, *Entrance flooring systems — Selection, installation and maintenance.*

BS 8204-1:1999, *Screeds, bases and in-situ floorings — Part 1: Code of practice for concrete bases and screeds to receive in-situ floorings.*

BS EN 312-2:1997, *Particleboards — Specifications — Part 2: Requirements for general purpose boards for use in dry conditions.*

BS EN 312-4:1997, *Particleboards — Specifications — Part 4: Requirements for load-bearing boards for use in dry conditions.*

BS EN 622-2:1997, *Fibreboards — Specifications — Part 2: Requirements for hardboards.*

BS EN 622-4:1997, *Fibreboards — Specifications — Part 4: Requirements for softboards.*

BS EN 622-5:1997, *Fibreboards — Specifications — Part 5: Requirements for dry process boards (MDF).*

BS EN 636-1, *Plywood — Specifications — Part 1: Requirements for plywood for use in dry conditions.*

BS EN 1307, *Textile floor coverings — Classification of pile carpets.*

BS EN 1470, *Textile floor coverings — Classification of needled floor coverings except for needled pile floor coverings.*

BS EN 12825, *Raised access floors.*

BS EN 13297, *Textile floor coverings — Classification of needled pile floor coverings.*

IEC/TS 61340-4-1, *Electrostatics — Part 4: Standard test methods for specific applications — Section 1: Electrostatic behaviour of floor coverings and installed floors.*

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

3 Terms and definitions

For the purposes of this British Standard the following terms and definitions apply.

3.1
fabricated underlay
fabricated substrate (non-preferred)
manufactured board made from wood, wood particles or wood fibres in panel form, or calcium sulfate (gypsum), to provide a suitable surface to receive the specified floor covering

3.2
screed
layer of well-compacted material, commonly a mixture of cement and aggregate, applied in situ to a concrete base

3.3
mastic asphalt
mixture of bitumen and an inert mineral aggregate

3.4
impregnation
treatment of a base or a screed by application of a liquid product intended to penetrate the pores without forming a continuous layer on the surface

3.5
levelling layer
layer applied to compensate for unevenness and differences in height in the base, to accommodate services, or to give a uniform absorbency where water-based adhesives are to be used

3.6
flowing screed
in situ applied material that sets hydraulically or by chemical cure

NOTE This is normally a proprietary compound to be used in accordance with manufacturer's recommendations. It is poured or pumped directly to the concrete slab to form a smooth level surface, ready to receive most floor coverings.

3.7
anhydrite screed
formulated flowing screed based on hydraulically setting calcium sulfate

3.8
underlayment
thin layer applied to a screed to provide a smooth and/or flat surface to receive the floor covering

3.9
interlay
thin flexible sheet, supplied in 1 m to 2 m wide rolls

NOTE This interlay is laid below foam backed carpets to facilitate easy removal and to stop foam adhesion to the subfloor. Dust and other subfloor contamination are stopped from being transferred onto the underfelt or floor covering. The interlay gives enhanced thermal insulation properties to the floor covering.

3.10
carpet underlay
a coherent layer of textile or other material placed beneath an exposed floor covering

NOTE 1 It may be fibrous, non-fibrous or combined. It provides underfoot comfort, sound absorbing and energy absorbing properties.

3.11
electrostatic discharge sensitive device
ESDS
a discrete device, integrated circuit or assembly that may be damaged by electrostatic fields or electrostatic discharge encountered in routine handing, testing or transit
[IEC/TS 61340-5-1]

3.12
electrostatic protected area
EPA
area in which an ESDS can be handled with accepted risk of damage as a result of electrostatic discharge or fields
[IEC/TS 61340-5-1]

3.13
crotch
junction of the lower edge of the riser with the rearmost edge of a stair-tread

3.14
shading
general description given to a number of optical effects in the appearance of textile floor coverings due to localized alterations in the orientation of the fibres, tufts or loops

NOTE This is not a real change in hue, but a difference in light reflection.

4 Exchange of information

4.1 General

In order for the correct floor covering to be installed in appropriate conditions, and at the right time, it is essential that all parties have a clear understanding of the requirements of the project, e.g. new build or refurbishment, and of the implications for all concerned. To ensure that this is achieved, it is essential that there is wide consultation between all parties involved in the project, including subcontractors and materials suppliers. This consultation should start early in the design stage but should continue throughout the contract, especially if requirements or time-scales change and as new sub-contract work is initiated.

As each project will be unique it is impossible to give a definitive list of the information to be exchanged, but **4.2** to **4.9** give typical examples.

4.2 Project

The name and location of projects and personnel involved in pre-contract negotiations should be identified.

4.3 Contract conditions

A programme for commencement and completion of work should be defined, including any specific requirement for sequenced completion.

4.4 Special attendance

Access, unloading, hoisting and storage facilities, heat, light and power and any additional items considered necessary to expedite the work should be provided.

4.5 Design

4.5.1 *General*

The flooring layout and specifications, based on building type and occupational uses, should be provided, for example:

a) type of use — building, rooms;

b) type and density of foot and/or wheeled traffic;

c) specific requirements: fire resistance period, acoustic absorption level, slip resistance;

d) particulars of use — staining, potentially abrasive conditions.

4.5.2 *Floor details*

The completed drawings/specification should provide comprehensive information on:

a) whether upper floor, ground floor or below ground level;

b) whether ground-supported or suspended construction;

c) particulars of any underfloor heating installation or security installation;

d) position and treatment of expansion joints;

e) curing and drying times of screeds and bases likely to be required before the installation of floor coverings;

f) screed or base with finished floor level, permissible departure from datum and class of surface regularity required;

g) in refurbishment work, the type and condition of existing base or floor finish and any type of treatment required;

h) type of damp-proof membrane and position within the floor construction, in particular, the need for a surface applied membrane where likely drying times for the base exceed the time available in the programme;

i) choice of substrate, underlayment, adhesives, intermediate products and floor coverings;

j) requirements for jointing, e.g. seam welding, direction of material and position of seams; or the position and type of expansion joints profiles;

k) size, position and design of entrance flooring systems (see BS 7953).

4.5.3 *Entrance zone*

The size, position and design of the entrance zone should be considered at the design stage, in accordance with BS 7953.

NOTE Entrance flooring systems will reduce the dirt, grit and water carried into the building by foot traffic, and hence will reduce wear and the risk of slipping when the building is in service.

4.5.4 *Associated details*

Details of abutments, skirtings, services (embedded or sleeved), movement joints, separating strips, pattern or border details and junction with other adjacent flooring should be provided.

4.5.5 *Shading*

"Shading" (see **3.14**) cannot usually be attributed to a fault of manufacture or installation, but architects and specifiers should be aware of this phenomenon in certain styles of carpets.

4.6 Testing

Details of any conformity testing of the base, screed and floor covering that is to be conducted, and the party to be responsible for this testing, should be provided. The implications of this also have to be considered in the programme defined in **4.3**. For instance, it is essential that the responsibility is defined for ensuring that bases or screeds meet the specified standards of level, smoothness, dryness and soundness (impact crushing resistance) before any subsequent or finishing trades are called to commence work.

NOTE In the case of new-build installations, this will be the responsibility of main contractor.

4.7 Health and safety

Arrangements for liaison and cooperation on health and safety requirements between the different parties in the contract should be established.

4.8 Responsibilities

Responsibilities for cleaning the construction on completion and giving it initial protection should be defined.

4.9 Maintenance

The customer should be left with adequate details of the maintenance required to enable the floor covering to perform satisfactorily in use. The recommendations should include details of the various types of cleaning and maintenance needed and the time scales at which they should be carried out.

NOTE It is preferable that such instructions be in clear, written form, and cover the recommended maintenance methods appropriate for all the types of floor coverings installed.

5 Materials

5.1 Fabricated underlays (see also **6.6**)

Fabricated underlays may be selected from the following:

a) plywood conforming to BS EN 636-1;

b) particle board Type P2 conforming to BS EN 312-2:1997, or if improved bending strength and stiffness are required, Type P4 conforming to BS EN 312-4:1997 (see **6.7.3** of this standard);

c) fibreboard: hardboard Type HB conforming to BS EN 622-2:1997, high density medium board Type MBH conforming to BS EN 622-4:1997 and medium density fibreboard Type MDF conforming to BS EN 622-5:1997 (see **6.7.4** of this standard);

d) gypsum board;

e) others.

The strength and construction of the fabricated underlay should be such that it is able to function in use without swelling, shrinkage, delamination or disintegration.

5.2 Cementitious based substrates (levelling layer)

A levelling layer should be used where a conventional cement-sand screed is considered unsuitable because of thickness or other limitations.

The levelling layer may be a cementitious underlay consisting of a specially formulated blend of cement and binder and both fine and coarse aggregates.

NOTE The binder is commonly a natural rubber latex or synthetic polymer.

5.3 Anhydrite screed

It is recommended that moisture content is measured according to the manufacturer's instructions, e.g. by the method of Annex A. It is essential to abrade the surface to remove laitance if a flooring adhesive is to be applied, and to provide a barrier primer if cement based products are to be applied. The screed manufacturer should be contacted for advice regarding primers.

5.4 Underlayments

Underlayments may be selected from the following:

a) cementitious underlayment consisting of a specially formulated blend of cement, binder and fine aggregate;

NOTE The binder is commonly a natural rubber or synthetic polymer dispersion.

b) powder/water mixes based on casein/cement or polymer/cement and fine aggregate;

c) epoxy or other resin compounds (e.g. primer);

d) compatible underlayments that are available for direct contact with an anhydrite screed.

5.5 Interlays

Interlays may be of the following types:

a) dry felt paper, manufactured as a thin, flexible sheet, approximately 0.5 mm to 1.0 mm thick;

b) sheet manufactured from lightweight melded textile materials;

c) sheet manufactured from spun-bonded fibres;

d) release or delaminateable interlays.

5.6 Carpet underlays

Carpet underlays should be as defined, described and classified in BS 5808.

NOTE Carpet underlays usually improve the walking comfort, impact sound insulation, thermal insulation, carpet life and can smooth minor surface irregularities of subfloors. Work on developing a standard for minimum requirements is in progress in CEN/TC 134.

5.7 Textile floor coverings

For details of the types of construction that are available see BS 5557. For assistance on the selection of textile floor coverings for various areas of use, reference should be made to BS EN 1307, BS EN 1470 and BS EN 13297.

NOTE Different types of floor coverings require specific methods of installation, see Table 1.

5.8 Adhesives

5.8.1 *General*

The selection of adhesive should be considered at the design stage because it can influence the performance during installation, in use, or later during removal. The recommendations of the textile floor covering manufacturer should be taken into account, and followed precisely if they are specific as to the type of adhesive which should be used.

Adhesives may be used to enable carpet tiles to be moved without damage, using a semi-permanent or tackifier adhesive, or for the permanent installation of the floor covering. When the textile floor covering is being laid by a method involving total adhesion to the substrate, alone, with a carpet underlay or in a strippable system, the adhesives used should be compatible with both the materials used in the system and the substrate. In addition to installation with liquid adhesives, textile floor coverings may be fixed by the use of double-sided tapes, which are normally of the self-adhesive type, and release systems (net).

NOTE 1 Fabric reinforced hot melt tapes can be used for joining or seaming certain types of carpet suitable for installation on grippers.

NOTE 2 None of the adhesives can be considered effective as a damp-proof membrane.

5.8.2 *Use of adhesive*

Recommendations on the suitability of laying various types of textile floor coverings using different systems of adhesion are given in Table 1.

A health and safety risk assessment should be made before using any adhesive. Any special requirements such as ventilation, limited access or other appropriate action to protect either the installer or those individually involved should be agreed with the main contractor before installation.

The adhesive manufacturer's instructions for the use of the adhesive should be followed with particular emphasis on the application tool, e.g. notched trowel (including the correct size, shape and number of notches) or roller, the coverage rate and any follow on process, such as rolling.

NOTE Conductive adhesives are available for static sensitive areas. These contain carbon black, metalized fibres or particles.

6 Subfloors

6.1 General

The appearance and performance of the floor coverings covered by this British Standard are determined to a large extent by the quality of the prepared base or screed.

Those responsible for the design and construction of the subfloor should ensure that it meets the requirements, i.e. should ensure that it has the necessary characteristics to allow the floor coverings to be installed successfully before the installer of the floor covering is asked to commence work. These characteristics include:

a) regularity of concrete floors and screeds;

b) moisture content of concrete floors and screeds;

c) integrity of screeds;

d) cracks made good;

e) construction joints treated;

f) gaps and changes of level;

g) moisture content of wooden subfloors;

h) presence of asbestos in an existing floor covering;

i) the position and depth of cables, heating elements and water pipes (see BS 8201:1987, **6.6.7** and BS 8204-1:1999, **6.4.5** and **A.6**.)

6.2 Damp-proofing solid floors and eliminating construction moisture

6.2.1 *Damp-proofing solid floors*

As the floor coverings included in this British Standard together with many adhesives and smoothing compounds used with them may be adversely affected by moisture, subfloors should be constructed so that they protect the floor covering installation from moisture or water vapour from the ground.

Solid floors should be damp-proofed in accordance with BS 8204-1:1999. It should not be assumed that existing ground supported concrete floors are adequately damp-proofed. Beam and block construction floors whether finished with cement-sand screed or particleboard should incorporate a vapour control layer. Where existing structures do not incorporate adequate moisture protection proprietary surface applied membranes should be used.

NOTE Integral water proofers incorporated in the concrete or screed will not provide adequate damp protection for floor coverings and will retard the drying process.

6.2.2 *Eliminating construction moisture*

Before the floor covering installation is commenced, it is essential to ensure not only that the floor is constructed to prevent moisture transmission from the ground but also that any excess water used in the construction is eliminated.

Usually the floor covering is fixed directly to the concrete base slab or on to a screed laid above this. In either case the amount of water used is more than that required for hydration of any cement used because extra water is normally required to give adequate workability to the mix. It is essential that the excess water be allowed to evaporate and the time for this to happen should be taken into account at the planning stage.

NOTE Estimated drying times are, of necessity, only very approximate as drying is influenced by ambient conditions, the concrete use, thickness and surface finish.

For cement-sand laid directly over a damp-proof membrane, one day should be allowed for each millimetre of thickness for the first 50 mm, followed by an increasing time for each millimetre above this thickness. It is thus reasonable to expect a screed 50 mm thick drying under good conditions to be sufficiently dry in two months.

For thick concrete bases laid directly over a damp-proof membrane, long drying times are required. The time/thickness relationship used to predict the drying time of cement-sand does not apply to concrete bases. In practice it has been found that even under good drying conditions concrete bases 150 mm thick often take more than one year to dry from one face only. Moderate and heavy use of power-float/power-trowel finishing methods further delays drying.

Suspended concrete bases laid on to permanent metal shuttering or other impermeable materials will have similar drying times to those laid over damp-proof membranes. For slabs that can dry from both sides, about half the thickness can be considered to dry downwards.

Where screeds are laid directly on to the concrete bases, without damp-proof membrane between them, account should be taken of the time required to dry the total thickness of the construction.

Commonly, where floor coverings are to be laid, time schedules do not permit extended drying times for concrete bases. The use of sandwich damp-proof membranes between the base concrete and the screed significantly reduces the time that needs to be allowed for drying.

Proprietary systems either based on admixtures for normal screed and concrete mixes or special cements are available to produce early drying screeds and concrete.

6.2.3 *Protection against construction moisture*

Where schedules do not allow sufficient drying times and the use of a sandwich damp-proof membrane is inappropriate, the need for a surface damp-proof membrane to control the excess construction moisture in the subfloor should be taken into consideration at the design stage.

6.2.4 *Testing*

Cementitious subfloors should be tested by the method described in Annex A and the floor covering not laid until readings have been obtained that indicate a relative humidity of 75 % or less.

6.2.5 *Chemical hardening solutions*

Chemical hardening solutions and resinous seals may be used on bases and screed but there is a risk of interaction between the hardener and the floor covering adhesives. In cases where they have been used, it is essential that the treated surfaces are mechanically removed.

6.2.6 *Curing membranes*

Curing membranes may affect adhesion and should be mechanically removed.

6.2.7 *Power-floating/power-trowelling of directly finished concrete*

Power-floating/power-trowelling of directly finished concrete may affect adhesion and the advice of the adhesive manufacturer should be sought regarding the specification for surface preparation.

6.3 Timber bases

6.3.1 *General*

Timber bases should be sound, rigid, level, properly secured, and dry. The timber should be at equilibrium moisture content, i.e. the state of dryness it will attain in normal service conditions, at the time it is covered.

In buildings where the wooden floors have received an in situ treatment for preservation, there may be an interaction between the preservation chemicals and the adhesives or the floor coverings. Advice should be sought regarding suitable materials and remedial treatment.

Suspended timber floors at ground level should be adequately ventilated.

6.3.2 *Board and strip floors*

Where plain edged boards or tongued and grooved boards have been nailed to joists or battens, the use of one of the fabricated underlays listed in **5.1** is essential.

NOTE This will act as a buffer and thereby help to minimize movement in the boards which might affect the appearance of the floor covering.

Uneven timber floors should be levelled by sanding, planing or by patch-filling with a suitable cement underlayment before fabricated underlays are laid. Boarded floors nailed into joists secured by clips set in concrete or dovetailed battens set in concrete, or board nailed direct into concrete at ground level should be adequately ventilated and protected by a damp-proof membrane.

6.3.3 *Wood blocks*

The laying of textile floor coverings over bases of wood blocks may lead to problems. Any installation should not be attempted unless the wood blocks conform to the following:

— the surface of the wood blocks is clean and free from wax;

— the condition of the floor is such that the blocks are sound and firmly bonded;

— the wood blocks are adequately protected against moisture.

If the textile floor covering is to be totally adhered, consideration should be given to the possibility that the blocks could lift from the subfloor during the life of the floor covering and when the floor covering is lifted for renewal.

The fixing of fabricated underlays may help to provide a smooth level surface. However, it is often found that the action of installing the underlay causes the blocks to fracture, or the wood block adhesive to fail, particularly if it is embrittled by age. Serious consideration should be given to the removal of the wood blocks and repair of the base prior to installation of the textile floor coverings. If any doubts exist regarding any of the conditions set out above, the wood blocks should be removed and the floor screeded or a mastic asphalt floor laid to produce a damp-proof membrane.

6.3.4 *Particleboard bases* (see also **6.7.3**)

When the floor covering is to be adhered to particleboard, the particleboard should be free from surface sealers such as wax, polyurethane or other types of seal and contaminants. A grade appropriate for the construction of the floor, nature of the building and the expected design loading should be selected and fixed in accordance with BS 7916.

Boards should be tongued and grooved on at least two edges and the joints should be glued.

In situations where the gaps between adjacent boards are wider than 1 mm, consideration should be given to overlaying with a fabricated underlay (see **4.1**).

If the base is oriented strand board (OSB), it is essential that this be covered with a fabricated underlay (see **6.7**). All particleboards should be primed as recommended by the adhesive manufacturer.

6.4 Particleboard floating floors

Particleboard type, grade and installation should conform to BS 7916.

It is permissible to sand off any raised areas not exceeding 1 mm. If raised areas exceed 1 mm then additional levelling materials will be required.

6.5 Raised floor panels

Raised floor panels should conform to BS EN 12825. They may have a textile floor finish permanently bonded on before installation of the panels. In this case the floor covering is generally supplied oversize and then trimmed down to the panel size after the adhesive has fully set.

For carpet tiles installed after the raised floor is in place, the following are examples of the most used methods.

EXAMPLE 1

Carpet tiles installed by the use of a release adhesive (tackifier) either applied directly to the middle of the raised floor panel or to the back of the carpet tile by the use of a brush or paint roller. Care needs to be taken to avoid adhesive going between the gaps in adjacent panels, which can lead to floor panels being difficult to lift without damage.

EXAMPLE 2

Carpet tiles installed by locating devices on the carpet tiles and panel such as pin and socket, hook and loop strips, or magnetic strips on the back of the tile in the case of steel surfaced raised panel.

It should be noted that even with 600 mm × 600 mm panels and 600 mm × 600 mm carpet tiles it is impossible to keep in register due to different manufacturing tolerances (and differing, thermal changes) between textile carpet tiles and raised floor panels.

Carpet tiles laid across the joints between the raised access floor panels will assist in preventing dust contamination.

6.6 Other bases

Some existing bases such as clay tiles, concrete tiles or terrazzo are unaffected by dampness, but may be sufficiently permeable to allow moisture to pass through to the back of the floor covering. These bases, which should be otherwise sound, should be damp-proofed when necessary by covering with a surface damp-proof membrane. Joints between tiles may cause problems with thin surface damp-proof membranes.

Existing bases on polyvinyl acetate/cement, gypsum-based screeds (anhydrite screeds), magnesium oxychloride and wood blocks, are adversely affected by dampness rising through concrete from the ground and should not be covered with a damp-proof layer or with relatively impervious floor coverings. Unless it can be established that there is an effective damp-proof course below these materials, they should be removed.

Existing floor coverings and residual adhesive should be removed and the necessary actions should be taken to enable the subfloor to receive the floor covering. The dryness of the base with regard to both moisture from the ground and residual moisture should be in accordance with the provisions of this British Standard.

6.7 Fabricated underlays

6.7.1 *General*

Fabricated underlays should be laid where required over existing bases. They should be chosen taking into account the prevailing moisture conditions. All fabricated underlays should be primed as recommended by the adhesive manufacturer.

NOTE Fabricated underlays are hygroscopic and expand on absorbing moisture. If the moisture content of the material is in equilibrium with the surrounding air there will be no further movement of the board. In centrally heated buildings, with a low moisture content, the boards will reach equilibrium by exposure to the surrounding air. However for hardboard, in damp buildings or new constructions, conditioning by water application is preferable.

6.7.2 *Plywood*

Plywood should conform to BS EN 636-1, be at least 4 mm thick and have a density of not less than 450 kg/m^3. Where, owing to the irregularity of the base, improved rigidity is required, the use of 6 mm or thicker material should be considered.

6.7.3 *Particleboard*

Particleboard should conform to BS EN 312-2:1997 or to BS EN 312-4:1997 [see **5.1**b)], have a density of not less than 650 kg/m^3 or be at least 9 mm thick and be free from surface sealers such as wax, polyurethane or other types of seal and contaminants.

Tongued and grooved joints should be glued with a wood grade polyvinyl acetate adhesive.

6.7.4 *Fibreboards*

Hardboard, Type HB conforming to BS EN 622-2:1997, high-density medium board (MBH) conforming to BS EN 622-4:1997 or medium density fibreboard (MDF) conforming to BS EN 622-5:1997 at least 3 mm thick are recommended [see **5.1**c)]. Where, owing to the irregularity of the base, improved rigidity is required, the use of material greater than 3 mm should be considered.

Fibreboards have a very strong water absorptive power and are not recommended for use in commercial areas.

6.7.5 *Gypsum board*

Gypsum boards of different thickness (up to 40 mm) may be used for rapid set up of dry floors in renovating or refurbishing of old buildings as well as for new buildings.

Irregularities of the floor may be treated by levelling layers up to 15 mm, by wooden joists or by patch filling with a manufacturer-recommended patch filler. The boards are usually glued together.

This type of floor should only be used in areas with low humidity. This type of floor may also be used in underfloor heating systems because of its low heat resistance. Manufacturer's recommendations should be followed.

6.8 Interlays

Interlays should be used to help in the elimination of contamination from dust migrating through irregular or gapped floorboards. Interlays will not prevent the transfer of floor irregularities to the materials laid over them and they should not be used for this purpose.

6.9 Smoothing and/or levelling compounds

6.9.1 *General*

Levelling layers and underlayments may be used over cementitious and similar bases. No single levelling layer and underlayment will be the most suitable for all conditions and selection will depend on site conditions and occupational use.

Levelling layers should be adequately tapered smooth when necessary at edges so as to ensure no ridge exists at the point where the levelling layer converges with surrounding surfaces which are to receive the same floor covering.

6.9.2 *Polymer dispersion/cement or latex/cement (aggregate filled)*

The properties of these materials vary widely in respect of, for example, water and solvent resistance and resistance to point loading. The choice of materials should be made after considering the manufacturer's recommendations.

6.9.3 *Powder/water mix*

The properties of these materials vary greatly in respect of, for example, rigidity and resistance to point loading. The choice of material should be made after considering the manufacturer's recommendations. This type of underlayment is normally only used on rigid, uncontaminated cement-sand screeds or concrete bases.

6.9.4 *Epoxy and other resin compounds*

Proprietary underlayments based on epoxy and other resin compounds are available for specific applications. They should be used in accordance with the manufacturer's recommendations.

WARNING. This can adversely affect the properties, performance and safety of the new installation.

6.10 Existing floor covering

With some materials and in some circumstances an existing floor covering in good condition may be retained and the new floor covering installed over it, rather than being removed.

Resilient floor coverings to current European Standards do not contain asbestos, but asbestos has been used in some resilient floor coverings in the past, and may be present in the existing floor covering. In these circumstances, the product should be handled and disposed of in accordance with the appropriate national requirements.

Interlays should not be used in conjunction with a carpet underlay system where the underlay is adhered to the floor and the textile floor covering subsequently totally adhered to the underlay.

6.11 Carpet underlays

When choosing underlays for use in either domestic or commercial installations reference should be made to BS 5808 which defines the types of underlay available and details the areas of suitability for all types as an aid to their selection. Care should be taken in the choice of a carpet underlay and it should always be matched to the area in which it is to be laid. Carpet underlays are not suitable for carpet tiles (see Table 1).

NOTE There may be certain products or situations for which the manufacturer may recommend no carpet underlay, e.g. fibre-bonded materials.

Manufacturers of textile floor coverings sometimes stipulate that their products should be installed by overall adhesion. In such cases the benefits of the use of a carpet underlay can be retained by the use of one of the proprietary systems in which the underlay is adhered to the substrate and the carpet to the underlay. Any recommendations by the carpet manufacturer or the underlay manufacturer should be followed. Adhesives should be chosen which are compatible with both the materials used in the system and the substrate. Advice in the case of secondary backed carpets, especially for possible delamination, should be obtained from the manufacturer. This method is of particular value in installations which include borders since it eliminates many of the problems involved in laying these combinations.

Where it is expected that a seam on the textile floor covering may produce a ridge, throwing the seam into prominence, the underlay should be chosen to allow bedding in.

7 Installation

7.1 General

Before starting to lay a textile floor covering, installers should check the site conditions to ensure that they are suitable for the planned installation.

The consequences of any deviations should be made clear to the client/customer during exchange of information prior to the commencement of the installation.

All relevant recommendations from the following list should be followed:

a) all bases and subfloors should be sound, firm and dry;

b) floors should be cleared of all debris and dusty concrete swept;

c) if the preparation work involves water-based materials it should be finished in good time to allow for the setting and drying of any materials used;

d) when textile floor coverings are to be used completely adhered, porous bases should be primed as recommended by the adhesive manufacturer;

e) when textile floor coverings are used over underfloor heating systems, the thermal resistance should be chosen so that correct transmission is guaranteed. The underfloor heating should be switched off 48 hours prior to laying the floor coverings. Since most adhesives which are used for floor laying do not achieve maximum bond strength immediately, the heating should not be turned on until at least 48 h after laying and peak temperature should be avoided for a further seven days;

NOTE BS EN 1264-3 and BS EN 1264-4 provide additional guidance.

f) a general room temperature of at least 18 °C and a subfloor temperature of at least 10 °C should be maintained in the installation area before laying commences and during the actual period of laying. Ideally, ambient humidity levels during laying should be between 50 % and 65 % relative humidity since large changes in humidity may affect the textile floor covering and high humidity levels can affect the drying of adhesives and primers. Humidity can be reduced by increasing the temperature and improving ventilation or by the use of dehumidifiers. Care should be taken in the selection of temporary heating methods since gas and oil fired heaters, for example, produce large quantities of water vapour during use and can increase humidity levels;

g) in all cases, the textile floor covering should be rolled out in a minimum room temperature of 18 °C for 24 hours to allow acclimatization and recovery from any residual tensions introduced by rolling or handling. Handling tensions should be given particular consideration when the textile floor covering is to be installed by perimeter fixing. Boxes of tiles should be opened 24 hours before installation to allow acclimatization.

7.2 Workmanship

Care should be taken to ensure good workmanship and efficient supervision. Operatives with the necessary skill, tools and knowledge should be employed.

7.3 Storage

All flooring materials should be stored in a clean, warm, dry, well-ventilated place. Boards should also be stored in flat and supported conditions (see clause **5** for the treatment of subfloor, and **6.1**f) and **6.1**g) for the treatment of the textile floor covering materials).

NOTE Special storage conditions are required by law for flammable and highly flammable liquids including some adhesives. Many products are subject to the various petroleum regulations and require a licence to store.

7.4 Fabricated and other underlays

7.4.1 *Fabricated underlays*

7.4.1.1 *General*

Plywood, particleboard or hardboard underlays should be laid across the line of the boards of the bases and securely fixed to the subfloor after hollows have been brought level by sanding, planing or filled with latex cement or similar material. All screws should be finished flush and filled as necessary to give a smooth finish.

Fabricated substrates should not be laid on uneven timber floors without previous levelling by sanding, planing, or the use of natural rubber latex/cement, or synthetic polymer underlayment for patch filling only.

Boarded floors nailed into joists secured by clips set in concrete or dovetailed battens set in concrete at ground level should be adequately ventilated and protected by a damp-proof membrane.

7.4.1.2 *Plywood*

Fixing, preferably using screws, should commence at the centre of one side of the sheet. Each sheet should be secured at not more than 100 mm intervals around the sides, with the fixing line 12 mm from the edge, and at 150 mm intervals at intermediate centres across the sheets. Joint lines should be staggered and every effort should be made to avoid coincidence of joints in the sheets and the timber base. To allow for possible expansion due to atmospheric change, a gap of 0.5 mm to 1.0 mm should be left between adjacent sheets.

7.4.1.3 *Particleboard*

Particleboard sheets should be countersunk and screwed at 300 mm centres in each direction to within 12 mm of the edges. Provision should be made for the possible expansion of the particleboard by allowing a gap between the free edges of the boards and the perimeter wall or other abutment. The gap should be calculated as 1 mm per linear metre of flooring, should not be less than 10 mm, and should be filled with a flexible non-silicone sealing compound.

7.4.1.4 *Fibreboard*

Fibreboard should be laid using twisted shank or ring shank nails, or serrated staples. Fixing should commence at the centre of one side of the sheet. Each sheet should be secured at not more than 100 mm intervals around the sides, with fixing line 12 mm from the edge, and at 150 mm intervals at intermediate centres across the sheets. Joint lines should be staggered and every effort made to prevent the coincidence of joints in the sheets and the timber base. To allow for possible expansion due to atmospheric changes, a gap of 1.0 mm to 2.0 mm should be left between the sheets. The gaps should be covered with an interlay.

Hardboard sheets should be conditioned by sponging with water on the mesh side, using approximately 0.5 litre of water for a 1 200 mm × 1 200 mm sheet, at least 24 hours but not more than 72 hours before fixing, or alternatively conditioned in air by placing the boards, preferably in the rooms in which they are to be laid, with separators between each board to encourage free air circulation over all surfaces, for not less than 72 hours. When it is laid damp, the hardboard should be allowed to dry out fully before the textile floor covering is installed.

Consideration should be given to the properties of the opposed surfaces of hardboard sheets, i.e. rough, absorbent surfaces and smooth, less absorbent surfaces. The preferred orientation depends upon the materials and adhesive being used and the finish required. Hardboard is frequently laid with the absorbent, rough face uppermost to give maximum adhesion, but with certain release systems it is desirable that adhesion be to the smoother, less-absorbent side. Reference should be made to the manufacturer of the release adhesive system.

7.4.2 *Mastic asphalt*

Where a textile floor covering is to be bonded to asphalt, it is recommended that a suitable underlayment compound should be laid on the asphalt to ensure adequate drying of water based adhesives or alternatively adhesives that are suitable for direct application to asphalt should be used.

7.4.3 *Cementitious underlays (levelling layer)*

Proprietary cementitious underlays should be laid in accordance with the manufacturer's instructions.

7.4.4 *Underlayments*

Proprietary underlayments should be laid in accordance with the manufacturer's instructions.

7.5 Interlays

Before laying an interlay, the base should be smooth, clean and dry. Dimensionally stable interlays should be cut exactly to size, but dry paper felt should be cut oversize and all joints taped. If it is necessary to fix the interlay, this should be done by full adhesion. If the interlay is being laid over boards, the direction of the length of the interlay should be at right angles to the direction of the boards.

7.6 Carpet underlays

Before laying a carpet underlay, it is essential that:

a) the base should be smooth, clean and dry;

b) the base should be compatible with the carpet underlay, i.e. the material with which it comes in contact;

c) any adhesive used should be compatible with the base and/or interlay, carpet underlay and textile floor covering;

d) if a double adhesive system is being installed where the textile floor covering is totally adhered to the upper surface of the carpet underlay, the manufacturer's recommendations should be followed exactly.

When laying, the underlay should be lightly smoothed by hand so that it will lie flat to the floor leaving no bubbles or wrinkles on the surface of the underlay. The underlay should be secured so that it will not move when the textile floor covering is installed on top of it. In certain cases, manufacturers may make other recommendations and these should be observed.

The coincidence of seams in the underlay and the textile floor covering should be avoided. If possible the direction of lay of the strips of underlay and the textile floor covering should be at right angles to each other. Where there is a likelihood of dust migration from beneath the floor due to gaps in the floorboards or between the skirting and the edge of the floorboards, the seams in the underlay should be taped over and gaps between the floorboard and skirtings should be sealed with a suitable flexible sealant in addition to the use of a suitable paper felt interlay.

Carpet underlays should be secured at the perimeter of the area by stapling or adhering, as appropriate, to the base or under surface used. All seams should be stapled, adhered or top-taped to provide a flat, tightly butted joint.

7.7 Planning and layout

7.7.1 *Position of seams*

Consistent with the clear understanding by all parties on the implications of increases in the amount of materials usage, the number of seams should be reduced to a minimum. They should be unobtrusive and so positioned that wherever possible, and in order of importance:

a) the seams and cross-joints are placed away from areas subject to heavy and twisting wear, doorways, lift entrances, stair noses and areas of narrow access, unless protected by proprietary finishings, [see **7.8.1**d)];

b) traffic flow is along rather than across the seam;

c) the seams run the length of the area;

d) the incident light does not strike across the seam;

e) seams or joints should not be positioned directly above joints.

7.7.2 *Direction of pile-lay*

Where two or more pieces of the same textile floor covering are adjacent in the same area, the direction of pile-lay must be the same. Where a textile floor covering is being installed in more than one area and/or level, the direction of pile may vary and full discussion with all parties to decide pile direction is essential at all times.

The direction of pile-lay should be discussed with the client during the planning stage (see **7.11** for stairs).

7.7.3 *Direction of pattern*

When patterned textile floor coverings are being installed it is recommended that the layout of the pattern should be discussed with the client during the planning stage and wherever possible they should be laid in accordance with the following:

a) the line of the pattern should be installed with reference to datum lines, e.g. the longer walls or perimeter of an area;

b) patterns should be matched and held in permanent register throughout interconnected areas, including hall, stairs and landings;

c) the major motif should be centred within an area, doorway, or staircase, if it is large, dominant, geometric or panelled;

d) if the pattern has a natural direction, it should relate to the major viewpoint, the stair-foot, doorway or entrance to an area.

7.7.4 *Domestic installations*

In the majority of domestic installations the consumer is unlikely to be an expert and will not be aware of the materials required and procedures which should be carried out in order to make a satisfactory installation, therefore additional guidance may be required. It is essential that the need for extra materials to ensure pattern matching is made clear. All carpet laid in the same area should be from the same carpet batch. At the planning stage care should also be taken to advise on the use of the optimum width of textile floor covering in order to avoid wastage and also the introduction of unnecessary seams into the floor covering.

7.7.5 *Commercial installations*

At an early stage a clear understanding should be reached with the client regarding the amount of extra material that is necessary for pattern matching, centring of major motifs and fitting purposes and the dimensional variations that exist or may occur in textile fabrics.

The recommendations of **7.7.3** should be followed, with particular attention being paid to the amount of extra material which may be required to ensure that pattern matching, centring of motifs, and other matters can be taken care of. It should be kept in mind that manufacturer's quoted dimensions are nominal and are subject to both tolerance and ambient condition variations. Dimensions may be accurate when materials leave the manufacturer but may be affected by changes in atmospheric conditions, in transport or during storage prior to installation.

It is recommended that the carpet be installed with the consecutive pieces from the same dyebath. Using offcuts for fitting some small areas is not recommended.

7.8 Textile floor coverings

7.8.1 *General*

It is recommended that in all cases the textile floor covering should be installed so that:

a) it is wholly flat and at an even tension, this tension being such that it will not be displaced by the movement of people or objects on its surface to the point where permanent slackness, rucking or rippling is caused;

b) the hemmed, turned, whipped or sealed edges are accurately and closely fitted to all skirtings, architraves or other site perimeters;

c) at doorways, any necessary joints are made within the thickness or closure of the door;

d) doorway terminations are secured by sealing, whipping or binding prior to seaming or finishing with the appropriate edging or dividing strip, particularly if the materials are dissimilar or mismatched;

e) cross-joints and raw edge seams are correctly matched, strengthened with cross-straps and secured by sealing, whipping or binding prior to seaming;

f) if textile floor coverings are continued up the wall to skirting height, provision is made for covering and for protecting the exposed top edge of the materials;

g) wherever a substrate has to be drilled and plugged for the purpose of installing textile floor coverings, carpet grippers, finishing strips, nosings or pins, the interval between plugs should not be greater than 100 mm and the depth should not be greater than 32 mm.

7.8.2 *Methods of installation*

7.8.2.1 *General*

For compatibility of the installation methods with the type of floor covering, see Table 1.

Table 1 — Compatibility of textile floor covering type with method of installation

Textile floor covering type	Carpet gripper (7.8.2.2)	Full adhesion (7.8.2.3)	Release systems (7.8.2.4)	Full adhesion with carpet underlay (7.8.2.5)	Perimeter fixing (7.8.2.6)
Woven (non-foam-backed)					
Flat-woven	no	yes	yes[e]	yes	no
Wilton	yes	yes	yes[e]	yes	no
Axminster	yes	yes	yes[e]	yes	no
Face to face	yes	yes	yes[e]	yes	no
Tufted					
unbacked	no	yes	no	yes[e]	yes[a,e]
secondary-backed	yes[f]	yes	yes[d,e]	yes	yes[a,e]
felt-backed	yes[e]	yes[e]	yes[d,e]	yes	yes[a,e]
foam-backed	no	yes	yes[e]	no	yes[a,e]
Non-woven					
Flat needlefelt unbacked	no	yes	no	no	yes[b]
Flat needlefelt secondary-backed	no	yes	no	no	yes[b]
Flat needlefelt foam-backed	no	yes	yes[e]	no	yes[a]
Pile needlefelt unbacked	no	yes	yes[e]	no	yes[b]
Pile needlefelt secondary-backed	no	yes	yes[e]	no	yes[b,e]
Pile needlefelt foam-backed	no	yes	yes[e]	no	yes[a]
Other					
Fusion bonded secondary-backed	yes	yes	yes[d,e]	yes	yes[a]
Flocked	no	yes	yes[e]	yes	yes[a,e]
Knitted	yes	yes	yes[e]	yes	yes[a,e]
Tiles	no	yes[c]	yes[c,e]	no	yes[a]

[a] Suitable only for domestic areas of 5 m by 4 m or less and without seams.
[b] Suitable only for temporary use (e.g. trade fairs).
[c] See BS EN 1307 for the specifications on dimensional stability.
[d] Size of area according to manufacturer's recommendations.
[e] Only as recommended by the manufacturer. In particular, the use of release systems for a wall-to-wall installation of a felt-backed carpet is not appropriate if seams have to be made.
[f] Not suitable for wheeled traffic, e.g. castor chairs, heavy trolleys.

7.8.2.2 *Carpet gripper method*

The textile floor covering is anchored by small angled pins projecting from a preformed strip that is itself fixed to the subfloor. The length and number of pins required depend on the type of textile floor covering being installed but normally should be 4 mm above the carpet underlay. The gripper should be fixed around the perimeter of the area close to the wall so that it leaves a gap. For most textile floor coverings, a gap of 6 mm to 8 mm is appropriate, and nothing should obstruct the void so formed. The edges of the textile floor covering are pushed down into the void so that they are securely trapped between the gripper and the vertical surface. The points of the pins should always lie towards the wall.

It is essential that the grippers are firmly fixed to the floor, so as not to lift during the life of the carpet. On timber subfloors, the carpet gripper should usually be nailed down using ring-shank nails. On solid floors, hardened steel pins, drilling and plugging, hot-melt adhesive systems, gun-applied adhesives or contact, epoxy or two part adhesives may be used. When using adhesive systems, the grippers should be installed in 200 mm lengths. Provision can also be made for nailing the strip down by inclusion of a timber insert let into the screed. The angle between the wall and the floor should be a right angle to allow the correct positioning of the carpet gripper strip. Radius beading or quarter-round mouldings secured at the perimeter should be removed before fitting the gripper.

When using the carpet gripper method, the textile floor covering should always be fitted under tension. In smaller areas a suitable tension can be achieved by the use of a knee kicker. In larger areas and particularly those installations over 5 m long or wide stretching should be achieved by use of a power stretcher. A knee kicker may also be used in conjunction with the power stretcher. In very large areas stop tacking and/or the use of a double-headed power stretcher will be needed to maintain the tension throughout the laying process. When heavy contract textile floor coverings are used, particularly in large areas, architectural carpet grippers or double strips of normal grippers fixed in parallel should be employed.

It is essential that stretching is in both directions and the textile floor covering should not lift when it is fixed and in use under tension. It is important that the underlay abuts the edge of the carpet gripper.

7.8.2.3 *Full adhesion method*

When using the full adhesion method, the following recommendations are applicable:

a) the floor should be sound, dry and free from contaminants which will prevent adhesion;

b) dusty surfaces should be brushed and then treated with an appropriate primer (impregnation) which should be allowed to dry completely prior to the application of the adhesive or release sealer;

c) the textile floor covering should be cut oversize by approximately 50 mm to allow for trimming at the perimeter of the area;

d) a chalk-line should be used to ensure the straightness of the seams;

e) all edges to be seamed should be cut straight and square before adhesion, using the appropriate tool. For all woven and tufted styles all seams should be adhered with seaming cement unless otherwise recommended by the manufacturer;

f) the textile floor covering should be adhered in accordance with the adhesive manufacturer's instructions, the choice of adhesive depending upon the type of textile floor covering being installed and upon the substrate (see **5.8**). The waiting time and the open time of the adhesive should be respected.

NOTE This is particularly important for textile floor coverings in natural fibres (e.g. sisal, coir).

g) a flooring trowel notched and spaced in accordance with the adhesive manufacturer's instructions should be used to spread the flooring adhesive evenly. Notch size and spacing should be maintained throughout the installation. With the trowel held at an angle of 60°, the adhesive should be applied only to an area that can be bonded within the open time of the adhesive, which will be dependent on the ambient temperature, humidity, ventilation and the absorbency of the subfloor and textile floor covering being laid;

h) seams should be made in accordance with the textile floor covering (see **7.7.1** and **7.10**) and adhesive manufacturer's instructions;

i) when foam-backed textile floor coverings are being installed, a firm brushing or pressure from a smoothing glider should be used to ensure maximum adhesive contact and a secure bond and to remove any air bubbles which may be trapped. It is essential that the manufacturer's recommendations regarding the suitability of the foam-back for this type of installation be ascertained;

j) textile floor coverings other than foam-backed materials may be rolled in both directions with a minimum 40 kg roller, or in accordance with the carpet and adhesive manufacturer's instructions;

k) the textile floor covering should be trimmed at the perimeter before the adhesive dries [see item g)];

l) any adhesive contaminating the face of the textile floor covering should be removed in accordance with the manufacturer's instructions as the work proceeds, taking care to avoid the smearing of adjacent surfaces;

m) when textile floor coverings are to be fully adhered on heated floors, the heating should be turned off 48 hours before the installation. The heating should remain off for 48 hours after completing the installation. Peak temperature should be avoided until 7 days after laying. In all installations a general room temperature of at least 13 °C to 18 °C should be maintained in the laying area for 24 hours before and after laying. During the laying period, a minimum ambient temperature of 18 °C should be maintained in the laying area at a floor temperature of at least 15 °C. Alternative forms of heating may be required;

n) the textile floor covering once adhered should be left for 24 hours at least before normal traffic and/or installation of furniture.

7.8.2.4 *Release systems*

A number of installation systems are available which are designed to assist the removal of the textile floor covering when this becomes necessary. They include release sealers with which the base is primed prior to the application of adhesive, the use of release interlays, the use of pressure sensitive adhesives, and tackifier adhesives, which do not produce a permanent bond. They are proprietary systems and should be used strictly in accordance with the manufacturer's instructions. Some systems are specific to certain types of qualities of textile floor covering being installed.

The use of release systems is not appropriate for a wall-to-wall installation of felt-backed carpet if seams have to be made.

If release sealers or adhesives and tackifiers are used, it is necessary to respect the open time before starting the installation of the textile floor covering. Beside this, all principles of full adhesion method are valid.

Alternatively installation can be by using hook and loop tapes (e.g. velcro®[1)]) or anchor fibres, which are embedded in a levelling layer or sealer (e.g. texlifter®[2)]). The use of these systems is limited to carpet constructions with a felt backing. Manufacturer's recommendations should be strictly followed.

Magnetic adhesion can also be used to fix a textile floor covering on the floor. This type of installation needs a magnetic backing of the floor covering in combination with a ferritic interlay or levelling layer. Manufacturers recommendation should be strictly followed.

In those cases where the existing floor is unlikely to be affected by the installation of textile floor covering it is possible to protect it by use of a special interlay. This type of interlay is usually a felt, coated on both sides to prevent the adhesive penetrating the felt and coming into contact with the floor. This interlay is not glued to the floor but the floor covering is fixed onto it, usually using an adhesive. This method is suitable for smaller (e.g. domestic) areas only.

[1)] Velcro® is a trade mark owned by Velcro Industries B.V, Hoekenrode 6, 1102 BR Amsterdam, Netherlands, and is an example of a suitable product available commercially. This information is given for the convenience of users of this standard and does not constitute an endorsement by BSI of this product.

[2)] Texlifter® is a trade mark owned by Deutsche-Industrie Gmbh, Langstrasse 245, 11456 Rosstadt, Germany, and is an example of a suitable product available commercially. This information is given for the convenience of users of this standard and does not constitute an endorsement by BSI of this product.

7.8.2.5 *Full adhesion systems with a carpet underlay*

A number of installation systems are available which are designed to fully adhere the textile floor covering to the base, but with the interposition of the carpet underlay. They involve the adhesion of a proprietary underlay to the base by a permanent bond or a release system. This is followed by the total adhesion of the textile floor covering to the top surface of the underlay. This method is of particular value when borders are to be included in the installation. These are all proprietary systems and the installation should be carried out strictly in accordance with the manufacturer's recommendations.

Before recommending this method of installation consideration should be given to the fact that some designs may be difficult to correctly align, owing to the possibility of underlay movement during stretching.

7.8.2.6 *Perimeter fixing method*

This is not a preferred method, and should only be used in domestic locations of 5 m × 4 m or less and without seams. This method may also be used in commercial areas for temporary uses (e.g. trade fairs).

Double-sided tape or adhesive may be used for securing textile floor coverings in the following ways.

a) Adhesive: perimeter fixing only. Applied continuously around the perimeter, the width of the adhesive application should not exceed that of standard double-sided tape. Adhesive should not be used in a grid pattern.

b) Double-sided tape:

1) around the perimeter;

2) for seaming, where necessary in accordance with the manufacturer's instructions.

Loose and dusty surfaces should be treated with the appropriate primer prior to the application of double-sided tape.

The selection of the tape or adhesive should be in accordance with the manufacturer's recommendations for the base, primer and textile floor covering used. If it is to be used on a surface or backing containing plasticizers, then a special tape or adhesive made for this purpose should be selected, since if this is not done migration of the plasticizers may take place and cause a breakdown of the adhesive bond.

In all cases, the textile floor covering should be rolled out flat in a room temperature of at least 18 °C for 24 hours to allow recovery from any residual tensions introduced by rolling or handling, before installation by double-sided tape or adhesive.

Tension should not be applied to a foam-backed textile floor covering secured by double-sided tape or adhesive, during the laying process at any time, or by any means.

The textile floor covering should be firmly smoothed by hand on to the double-sided tape before cutting at the perimeter of the area. This is particularly important in the case of foam-backed materials where no tension of any type should be introduced during the laying procedure.

7.8.3 ***Installation in domestic areas***

Not all the methods of installation of textile floor coverings set out in **7.8.2** are suitable for use in domestic locations, and care is needed when choosing an appropriate method.

When installing woven or secondary backed tufted carpets by the carpet gripper method, it is of the utmost importance that an even tension is applied throughout the material. This means that care is needed when using a knee kicker to tension the carpet to ensure that it is done on an even basis. In smaller areas its use may be of advantage to ensure the evenness of, and adequate tension in, the textile floor covering. When using a knee kicker or a power stretcher in laying a secondary-backed tufted carpet care should be taken to ensure that the teeth of the tool fully penetrate the backing.

7.8.4 ***Installation in commercial areas***

Not all the methods of installation of textile floor coverings set out in **7.8.2** are suitable for use in commercial locations and care should be taken in the choice of method which is to be used. Any recommendation given by the manufacturer should be strictly adhered to, otherwise any warranty may be invalidated and consequent liability for problems passed from the supplier to the installer.

The most frequently used methods for installations in commercial areas are the carpet gripper method or laying by total adhesion. The latter may be either by direct adhesion to the substrate with a permanent bond, by the use of a release system or by full adhesion over carpet underlay using one of the proprietary systems available. The use of methods of total adhesion of textile floor coverings have increased in popularity partly to offset the problems of dimensional instability in commercial areas, and also because of the increasing use of borders which can be more easily installed using this method.

The use of a release system is to be recommended if it is envisaged that the installation will be difficult to lift at the end of its proposed life span, however, some release systems lose their power after a long period of heavy use. If such problems are envisaged then the use of a release system incorporating an interlay would be recommended.

Installation using double-sided adhesive tape should not be used in commercial areas (except for temporary purposes, e.g. trade fairs) since a sufficiently strong bond will not be formed for the heavy traffic density which may be anticipated.

When installing woven or secondary-backed tufted textile floor coverings in commercial locations by the carpet gripper method it is of the utmost importance that an even tension is applied throughout the material. This will be most readily attained by the use of a power stretcher in all cases, but its use is essential in larger areas with a dimension of 5 m length or over any direction. In very large areas stop tacking should be used, or if this is not possible, the use of a double-headed power stretcher is recommended. The use of knee kickers can be of assistance when combined with the use of a power stretcher but should not be regarded as a substitute for one. When installing secondary-backed material care should be taken to ensure that the teeth of the power stretcher or the knee kicker fully penetrate the backing.

Unbacked tufted and needlefelt textile floor coverings are usually installed by full adhesion forming either a permanent or release bond. They are therefore not laid under tension but should be smoothed out gently to give a level surface. In all cases the manufacturer's recommendations for installation should be followed.

When laying by total adhesion any recommendations of both the adhesive manufacturer and the manufacturer of the textile floor covering should be followed. Many adhesives are spread by notched trowel to ensure even coverage of the substrate at a correct thickness. The details of the trowel and the method of use of the adhesive are normally specified by the adhesive manufacturer having regard to the type and thickness of the textile floor covering and the adhesive being used. Recommendations regarding the trowel notching by the adhesive manufacturer should be followed and the depth and spacing of the notches maintained constant throughout the installation.

Some adhesives, particularly tackifiers and other types used in release bond systems are designed for application by either roller or a notched trowel. These methods rely largely on the judgement of the operative for the control of the amount applied. The manufacturer's instructions regarding the type of roller or notched trowel to be used should be followed, and attention paid to the amount being applied, ensuring that it is in accordance with the manufacturer's recommendations on coverage.

7.9 Installation in ESDS protected areas (EPA)

7.9.1 *General*

Special requirements are necessary for protection where electrostatic discharge sensitive devices (ESDS) and assemblies are being used. These requirements are not related to personal safety.

7.9.2 *Materials*

Floor covering materials for installation in an EPA should conform to the requirements specified in IEC/TS 61340-5-1 i.e. the resistance to EPA ground or groundable point, as measured by the method specified in IEC/TS 61340-4-1, should not exceed $1 \times 10^9\ \Omega$.

7.9.3 *Installation of floors*

The installation procedure for floor coverings in an EPA is the same as the standard procedure except that conductive adhesive is used.

The conductivity of the adhesive used should be such as to ensure that the resistance to EPA ground or groundable point of the installed floor covering meets the requirement specified in **7.9.2**.

When the footwear/floor system is used as the primary means of grounding personnel, the resistance of the combination should be determined by the ESD coordinator, and is recommended to be between $7.5 \times 10^5\ \Omega$ and $3.5 \times 10^7\ \Omega$.

7.9.4 *Validation*

The resistance to a groundable point of flooring materials prior to installation and after installation should be determined according to the methods specified in IEC 61340-4-1.

Floors should be kept clean and tidy. Only cleaning materials that do not degrade the properties of ESD protective flooring materials should be used.

7.10 Seaming

7.10.1 *General*

Whenever two or more pieces of textile floor coverings are mechanically joined, edge to edge, the seams should be:

a) straight and flat;

b) laid with the textile floor covering pattern, where applicable, in match for the full length of the seam and pile-lay in the same direction;

c) strong enough so as not to break down under traffic;

d) strong enough to withstand stretching where this is required by the material and method of installation;

e) tightly butted, with no trapping of surface pile between the edges;

f) jointed as appropriate to the material.

For tufted textile floor coverings it is recommended that the seam edges should be cut overlapped with a sharp knife. For woven textile floor coverings it is preferable that the selvedges are joined without cutting; however, should they require cutting/trimming, then it is essential to seal the edge with an appropriate seam sealant.

7.10.2 *Methods of seaming or joining*

7.10.2.1 *General*

Not all of the methods given in this subclause are suitable for all types of textile floor covering. At all times it should be ensured that all materials used are mutually compatible and are also compatible with the expected maintenance requirements of the textile floor coverings.

7.10.2.1.1 *Machine or hand sewing*

All seams should be sewn to maximum length and be properly locked off. To ensure that the carpet will lie perfectly flat after laying, adjustments for the correct thread tension and bight should be made. The stitching should be of an even tension. With most types of textile floor covering it is necessary to protect the raw edges to prevent loss of pile along the seam.

It is recommended to finish the cut edges by oversewing by hand and sealing with an application of seam adhesive.

7.10.2.1.2 *Reinforced tape and adhesive (cold applied)*

This method consists of a reinforced strip used in conjunction with a cold applied adhesive. It is only suitable where the seam can be made in areas that are away from pedestrian or wheeled traffic, and where the textile floor covering can be laid without stretching.

7.10.2.1.3 *Heat bonded tapes*

This method uses a tape pre-coated with a hot-melt adhesive. Seaming is usually carried out on site by applying heat to the tape either by means of a special iron or by passing an electric current through specially prepared tape. The joint is made by firmly pressing the edges of the textile floor covering into the molten adhesive, ensuring that no seam areas are overlooked. Adequate penetration of adhesive into carpet backing is achieved by ensuring that the adhesive is heated to within the correct temperature range when the carpet is pressed into the adhesive tape.

7.11 Stairs

7.11.1 *General*

It is the responsibility of the builder to ensure that the stairs are prepared to a finish ready to receive the floor covering. Existing stairs should have the treads levelled and prepared wherever possible to receive the flooring in a manner similar to the main body of the floor. Where it is not possible, when for example the stairs are heavily damaged or where the construction of the stairs differs from that of the floor, specific preparation work should be carried out so that the stairs are brought up to the same quality of finish as the prepared floor. Existing floorings and floor coverings should be removed and the stairs brought up to the required quality of finish to receive the new coverings.

It is recommended to have a stair with a tread of 25 cm and the rounding at the front of the step should have a diameter of at least 25 mm. The measurement of the stairs is not within the scope of this document.

A stair nosing is an extreme friction location, which can cause carpet to wear up to five times faster than surrounding surfaces. It is therefore recommended that commercial installations have a protective stair nosing to prolong carpet life and to give enhanced safety. (See **7.11.7**.)

7.11.2 *Carpet underlays*

Special care should be taken in the selection of carpet underlays to be used on stairs in both domestic and commercial installations since they represent one of the most demanding areas of use (see BS 5808).

When installing underlay on stairs, it is recommended that the underlay should cover both tread and riser and be tightly butted to the carpet gripper, if used. If the textile floor covering does not closely fit the perimeter, the underlay should be cut undersize by 10 mm less than the width of the floor covering. It is important that the underlay is fixed so that it is secured over the nose of each step.

7.11.3 *Planning and layout*

The textile floor covering to be used on stairs should meet the requirements for the equivalent flat location use and, in the case of loop pile carpets, should have a surface pile thickness of less than or equal to 10 mm.

NOTE Thicker carpets can be potential tripping hazards.

When installing textile floor coverings on stairs without nosings, it is recommended to install the floor coverings so that the pile direction runs down the stairs (see Figure 1). This ensures that the pile leans over the nose of the step, and that the colour and design are shown in their best light at eye level. The carpet design should be centralized on the stairs. Whilst the design should be continuous it is not practical when change of direction occurs, i.e. at half landings. Where multiple widths are used on stairs care should be taken to avoid joints falling in the walk area of the steps. A suitable underlay which allows protection to sewn seams should be used (see BS 5808). It is recommended that carpet should be laid in one continuous length, landing to landing.

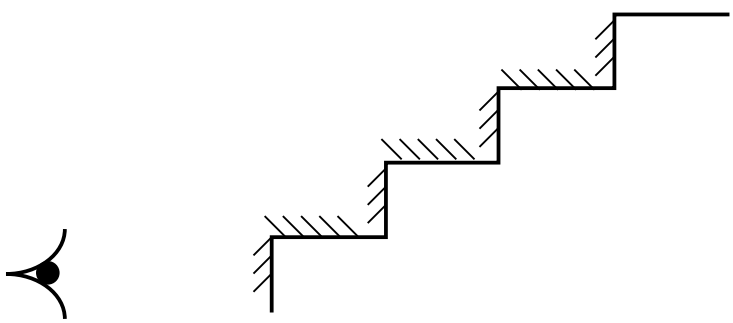


Figure 1 — Recommended pile direction on stairs

An additional length of material (continuous with the existing length) should be allowed to enable periodic shifting of the floor coverings to equalize wear. Where shifting is not possible, consideration should be given to the retention of sufficient materials for subsequent replacement of areas of high wear.

Foam-backed carpets used on stairs should conform to the classification systems of BS EN 1307, BS EN 1470 or BS EN 13927 and meet the requirements for stair suitability of BS EN 1963:1997, Annex A. The carpets should be fully adhered and, for contract installations recommended proprietary stair nosing should be used.

7.11.4 *Seams*

Consideration should be given to the positioning of seams. Longitudinal seams should be placed away from the traffic area. Cross seams should be located in the crotch (see **3.13**) of the stairs and not on either the riser or the tread of the step.

Exposed edges on open plan stairs and runners should be overlocked or bound. All cut edges should be sealed.

7.11.5 *Installation of carpet on stairs by the carpet gripper method*

The textile floor covering should be taken over the nose and secured by two lengths of carpet gripper fixed at each crotch on the stairs, one on each riser and one on each tread. When textile floor coverings are installed on stairs by this system, the gap between the carpet gripper and crotch of the stairs should be twice that used around the perimeter of an area, and the point of the pins should lie towards the crotch. If this system is being used in conjunction with stair nosings a contract quality single naplock should be inserted behind the nosing to receive the textile floor covering.

The textile floor covering should be stretched tightly over each step and securely anchored on to the grippers and nosings, if fitted. It should be driven into the gap between the grippers at the crotch of the step.

7.11.6 *Installation of carpet on stairs by the direct stick method*

The adhesive manufacturer's recommendations should be followed at all times. When a direct stick method is used appearance retention at the nose of each step may be affected when compared to other areas, the use of stair nosings is therefore advantageous.

7.11.7 *Nosings*

Various types of nosing are available and suitability and detailed fixing recommendations of the manufacturer should be adhered to.

To ensure continuity of level between the textile floor covering and the nosing, the stair nosings should where necessary be installed onto hardboard or plywood strips. The stair nosings, and the hardboard/plywood strips if used, should be fixed with both adhesive and screw fixings. In direct stick applications the hardboard/plywood strip should be 10 mm to 15 mm narrower than the nosing to allow the textile floor covering to be trapped under the nosing. Textile floor coverings should not be fitted over the nosings.

Wherever possible nosings between 60 mm and 100 mm deep should be used to ensure adequate fixing, and to avoid rocking under heavy traffic.

7.12 Tiles

7.12.1 *General*

It is not recommended that carpet tiles are laid without adhesive tackifier or double-sided tape. Installations which include areas of light traffic may be installed with a retaining grid of tiles to hold the remaining tiles in place. Traffic density and flow should be taken into consideration, as should the configuration of the floor layout. The manufacturer's instructions should be followed in all cases.

7.12.2 *Installation*

7.12.2.1 *General*

Site measurements should be carried out since plans cannot always be guaranteed to sufficient accuracy for tile installation.

Before cutting and installation of carpet tiles, opened boxes should be allowed to condition for at least 24 hours in the atmospheric conditions which will prevail during use. This is particularly important if the carpet tiles have been stored or transported in conditions of extreme temperature or humidity.

The pile direction in carpet tiles is usually indicated by arrows on the back of the tiles, these being either printed onto, or embossed into the backing (see Figure 2). Carpet tiles may be laid in one direction for a conventional "broadloom" effect. Alternatively tiles may be installed at right angles to one another for a chequer-board effect.

The manufacturer's recommendations should be followed.

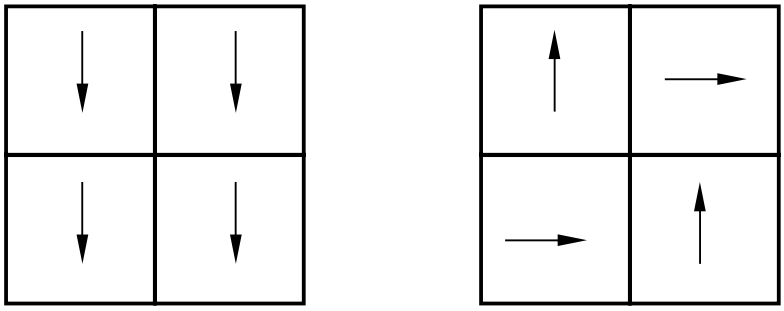


Figure 2 — Indication of pile direction

7.12.2.2 *Setting out*

The location of the starting point in an installation of carpet tiles is determined by the installer to maximize the perimeter and cut module size. It may be anywhere within the room, but should normally be located as near to the true centre of the room as possible.

After the true centre of the area has been determined a right angle with its apex at this point is introduced. Adjustment of the right angle about this point allows the optimum direction of lay to be arrived at with due reference to features such as borders, motifs and general room layout. Once this direction of lay has been agreed with the customer, datum lines can be set on the skirtings. It is important that the edge tiles are cut to be as near to the same size as possible and that narrow strips be avoided since these are unsightly and may tend to lift (especially in doorways or lifts).

The coincidence of seams in the subfloor and the textile tiles should be avoided.

7.12.2.3 *Laying of tiles*

It is important that the tiles in the completed installation are correctly butted together. Continual checks should be carried out to ensure that the tiles are placed together with correct firmness, neither so loose as to allow gaps, nor so tight as to compress the tiles and cause them to buckle. When placing tiles, brush the face pile back from the tile edge and slide the tile into place ensuring that pile yarn is not trapped in the joint.

7.12.2.4 *Balancing the installation*

Tiles cut into the walls should be as near as possible the same width on all four sides in order to balance the installation. This is especially important when a two-colour effect is being utilized. The tile at the starting point may be repositioned by half a tile in any direction to achieve the desired effect if the starting point proves to be not precisely correct. Trial runs set out along the chalk lines prior to the spreading of adhesive will show whether the tile at the starting point is correctly positioned. Corridor installations and stairs may be balanced from one central guideline.

7.12.2.5 *Edge finishes*

All unprotected edges open to traffic should be protected using tile-edging strip.

The carpet tiles should not be walked upon and no heavy furniture moved over them, until the installation is completed. Furniture and other heavy objects should be moved after laying sheets of hardboard or plywood over the tiles to prevent the tiles being dislodged by the movement over them.

7.13 Plasticizer migration

This should be considered only in the case of polyvinyl chloride subflooring and/or polyvinyl chloride carpet tiles.

NOTE In all areas it is possible for plasticizer to migrate and cause problems. If plasticizer migrates out of a textile floor covering or its backing it may lead to shrinkage and/or embrittlement. If it migrates into a textile floor covering or backing it may lead to unacceptable softening and weakening of the material. If the plasticizer migrates into an adhesive, either from the floor covering being fixed or from an existing polyvinyl chloride floor covering to which it is being fixed, the adhesive may be unacceptably softened and weakened so that it no longer holds the textile floor covering adequately.

8 Completion

The whole working area should be cleared of tools and waste, and be left clean and tidy. The textile floor covering should be carefully inspected to ensure that it is totally flat and free from blemishes. All stay-tacks should be removed and all pieces of partly loose warp or face yarns should be removed with sharp napping scissors. This is particularly important in domestic situations when the consumer will immediately inspect the result and will only be impressed by finding a correctly laid floor covering in pristine condition. It also applies to commercial installations where the client, the main contractor and any professional inspectors employed will expect to find everything in order.

The areas surrounding the work should be examined to ensure that no accidental damage or contamination has occurred during the installation.

It is essential that the site fabric and contents are not affected by:

— negligent or poor workmanship;

— irregular installation procedures.

The main contractor or the person who made the instructions is responsible for the protection of the carpet in any following operations.

For cleaning and maintenance, manufacturer's instructions should be followed.

Annex A (normative)
Dampness testing

A.1 Principle

The basis of the test is to use a hygrometer or probe to measure the relative humidity of a pocket of air entrapped between an impervious thermally insulated housing and the surface of the screed or concrete base. Sufficient time is allowed for moisture equilibrium to become established between the pocket of air and the base.

Concrete under normal conditions will never be completely dry. Those responsible for laying floor coverings require to know when the moisture level of the concrete has been reduced to a value where flooring can be safely laid. Water in the coarse pores of concrete is relatively mobile and can lead to damage to flooring whereas water in the fine pores is relatively immobile and harmless.

When concrete is allowed to dry, the coarse pores become empty first because water in coarse pores exerts a higher vapour pressure, and hence evaporates more quickly, than water in fine pores. Because the size of the pores controls the vapour pressure that arises in them, it also controls the vapour pressure of a small volume of air entrapped between the concrete surface and an impervious housing (or box). The vapour pressure determines the relative humidity of that entrapped air so a hygrometer reading indicates the extent to which harmful moisture is still present.

Experimental evidence has shown that when the measured relative humidity falls to 80 %, the water has evaporated from the coarse pores and the screed is sufficiently dry to allow installation of textile floor coverings. If some allowance is made for errors in determining the relative humidity, it is reasonable to recommend that the concrete be considered dry when the relative humidity falls to 75 % or less.

For these reasons the hygrometer method for dampness measurement is recommended over and above invasive methods.

A.2 Apparatus

A.2.1 *Insulated impermeable box*, which can be sealed to the floor surface to create an enclosed pocket of air which is isolated from the humidity and fluctuations in temperature of the outside air. (Examples of suitable equipment are shown in Figure A.1.)

It is essential that the insulated box is sealed to the floor using a preformed butyl sealant tape and that readings can be taken while the apparatus is in position on the floor without breaking the seal and releasing the trapped pocket of air.

NOTE Other forms of apparatus may be suitable but the width of the area should not be less than 150 mm and it is essential that the principles of thermal insulation and vapour barrier are followed, so that an insulated vapour-proof space is created.

Suitable vapour barrier materials are sheet metal, glass, 2 mm thick clear acrylic sheet, or 2 mm thick PVC-U, and the apparatus should have a maximum U-value of 1.0 W/(m^2·K).

A.2.2 *Hygrometer or relative humidity (rh) probe,* for measuring relative humidity to an accuracy of 3 % rh. This can be a hair, paper or synthetic fibre hygrometer of the clock type, or an electronic relative humidity probe.

A.2.3 *Preformed butyl sealant tape.*

A.2.4 *Adhesive tape.*

A.2.5 *Protective mats (rubber or polyethylene).*

A.3 Suitability

This method of test is appropriate for measurement of percentage relative humidity values above porous surfaces such as screeds and concretes. Low porosity surfaces such as power floated concrete will require extended testing periods before true readings can be achieved, and any surface treatment such as concrete curing compounds or waxes should be removed. The method may not be suitable for use on proprietary screeds and is not suitable for performance assessment of surface applied moisture barriers.

A.4 Procedure

Turn off any artificial aids used for accelerating drying at least four days before final readings are attempted. Accelerated drying should not be used for screeds.

Seal the apparatus firmly to the floor and allow sufficient time for the entrapped air to reach moisture equilibrium with the screed or base.

For an unbonded screed, where the damp-proof membrane is placed between the base and screed as described in BS 8204-1:1999, **6.4.3**b) allow a period of not less than 4 h before taking the first reading. Equilibrium can be assumed when two consecutive readings taken at 4 h intervals show no change.

For very thick constructions, i.e. direct finished base slabs or bonded screeds, i.e. where the damp-proof membrane is placed below the base slab as described in BS 8204-1:1999, **6.3.2** or **6.4.3**a), allow a period of at least 72 h to elapse before taking the first reading. Equilibrium can be assumed when two consecutive readings taken at 24 h intervals show no change. Constructions with thickness greater than 200 mm can take considerably longer than one week before moisture equilibrium is established. To prevent edge effects with these very thick constructions, cover the area of 1 m^2 surrounding the instrument with an impervious sheet material during the test.

To minimize the time required for the instrument to be in a position on the floor the following technique can be applied. Cover the positions to be measured with impervious mats (e.g. polyethylene sheet, rubber mats) not less than 1 m × 1 m, taped to the floor at their edges. Leave in position for at least three days in the case of screeds and seven days in the case of thick constructions. After removing the mat, immediately seal the instrument to the centre of the covered areas. Experience has shown moisture equilibrium is usually attained within 2 h to 4 h of placing the instrument but should be left overnight for confirmation.

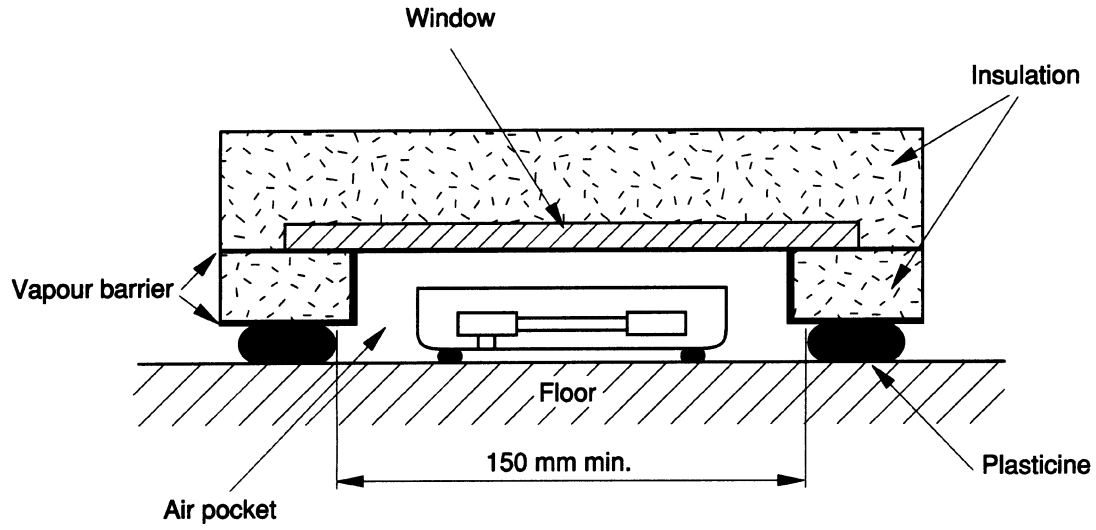
To avoid expensive equipment being left on site the probe may be removed from the apparatus shown in Figure A.1b) and the hole plugged before the box is sealed to the subfloor. After allowing time to reach equilibrium the plug is removed, the rh probe inserted promptly, and time is allowed for this to reach equilibrium before readings are taken.

A number of simultaneous measurements may be necessary to give a representative survey. This should take into account the size and layout of the installation, as well as any variation in the subfloor construction.

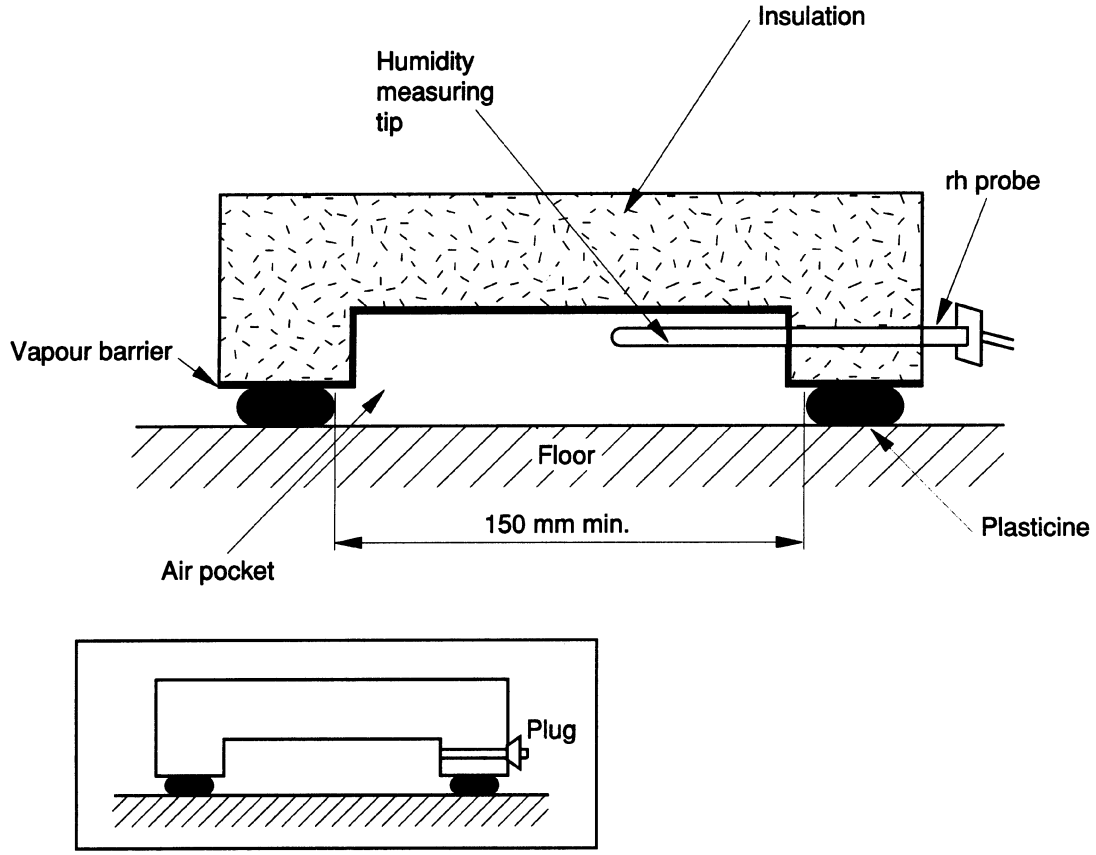
If readings greater than 75 % are obtained the equipment should be removed and the floor be allowed to dry further before more readings are attempted.

A.5 Verification of hygrometer or probe

As the accuracy of a hygrometer can drift with time or in transit it may need to be recalibrated frequently. The accuracy of the hygrometer or rh probe at 75 % rh may be checked by sealing it in a desiccator or humidity cabinet over a saturated solution of analytical or general purpose reagent grade sodium chloride, at a constant temperature of (20 ± 2) °C for a minimum of 12 h.



a) Typical apparatus using hygrometer



b) Typical apparatus using rh probe

Figure A.1 — Typical apparatus

Annex B (informative)
Organizations that are available to help with enquiries

The following organizations are available to help with enquiries.

British Adhesive and Sealants Association
33 Fellowes Way
Stevenage
Hertfordshire
SG2 8BW

Wiratec
Wira House
West Park Ring Road
Leeds
West Yorkshire
LS16 6QL

The Carpet Foundation
MCF Complex
60 New Road
Kidderminster
Worcs
DY10 1AQ

British Shops and Stores Association
Middleton House
2 Main Road
Middleton Cheney
Banbury
Oxon
OX17 2TN

Contract Flooring Association
4c St Mary's Place
The Lace Market
Nottingham
NG1 1PH

Fibre Bonded Carpet Manufacturers' Association
3 Manchester Road
Bury
Lancashire
BL9 0DR

National Carpet Cleaners' Association
126 New Walk
De Montford Street
Leicester
LE1 7JA

National Institute of Carpet and Floor Layers
4d St Mary's Place
The Lace Market
Nottingham
NG1 1PH

The Royal Institute of British Architects
Technical Services Division
66 Portland Place
London
W1P 4AD

Bibliography

Standards publications

BS EN 1264-3:1998, *Floor heating — Systems and components — Part 3: Dimensioning.*

BS EN 1264-4:2001, *Floor heating — Systems and components — Part 4: Installation.*

Further reading

BS 3870-1:1991, *Stitches and seams — Classification and terminology of stitch types.* (ISO 4915:1991)

BS 3870-2:1991, *Stitches and seams — Classification and terminology of seam types.* (ISO 4916:1991)

BS EN 923, *Adhesives — Terms and definitions.*

Building Research Establishment Digest No.54.

Health and Safety at Work etc. Act 1974.

Control of Substances Hazardous to Health (COSHH) Regulations.

Mind your back, Health Education Council, 78 New Oxford Street, London WC1 1AH.

Statutory Instrument 1972/917 Factories. *Highly Flammable Liquid and Liquefied Petroleum Gases Regulations*

HSE Guidance Note EH 40.

Safe Handling of Adhesives in Industry. British Adhesives and Sealants Association.

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