BRITISH STANDARD

BS 8425:2003

Code of practice for installation of laminate floor coverings

ICS 91.180; 97.150

Confirmed
December 2009

BSI
British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to PRI/60, Resilient floor coverings, upon which the following bodies were represented:

British Adhesives and Sealants Association

British Railways Board

Contract Flooring Association

Cork Industry Federation

Health and Safety Executive

Industrial Cleaning Machine Manufacturers' Association

Institute of Chartered Arbitrators

RAPRA Technology Ltd

SATRA Technology Centre

UK Cleaning Products Industry Association

United Kingdom Resilient Flooring Association

Wood Panel Industries Federation

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 7 July 2003

Amendments issued since publication

Amd. No.	Date	Comments

The following BSI references relate to the work on this British Standard:
Committee reference PRI/60
Draft for comment 03/100121 DC

ISBN 0 580 42114 7

Contents

Foreword

This British Standard has been prepared by Technical Committee PRI/60.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its 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, an inside front cover, pages i and ii, pages 1 to 15 and a back cover.

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1 Scope

This British Standard gives recommendations for the installation of laminate floor coverings in new or existing buildings. Generally, laminate floor coverings are installed as floating floors but, in some applications, they can be integrally glued to the subfloor. This British Standard only details suitable methods for floating floor installation and advises on the selection of materials required for their implementation.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

BS 8102*, Code of practice for protection of structures against moisture from the ground.*

BS 8204-1:2002*, Screeds, bases and in-situ floorings — Part 1: Concrete bases and cement sand levelling screeds to receive floorings — Code of practice.*

BS EN 204*, Classification of thermoplastic wood adhesives for non-structural applications.*

BS EN 13329*, Laminate floor coverings — Specifications, requirements and test methods.*

3 Terms and definitions

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

3.1
fabricated substrate
manufactured board made from wood, wood particles or wood fibres in sheet form, gypsum, etc. to provide suitable a 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 at the appropriate thickness

3.3
levelling layer
layer of compacted material, applied *in situ* to a sound base or screed where there is a need to raise the level of the floor surface to level a floor that is out of true, or to give a uniform absorbency where water-based adhesives are to be used

3.4
underlayment
thin layer of compacted material, applied *in situ* to a sound base, screed or substrate to provide a suitable finish to receive adhesive, the underlay or floor covering

3.5
flowing screed
in situ applied material that sets hydraulically or by chemical cure

NOTE It 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

3.6
anhydrite screed
formulated flowing screed based on calcium sulfate

3.7
membrane
thin flexible sheet, at least 0.15 mm thick, for example of polythene, that is placed directly onto the surface of the mineral subfloor to protect the laminate floor covering from residual damp

4 Exchange of information

4.1 General

In order for the correct floor covering to be installed in appropriate conditions, at the right time, etc., 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 sub-contractors and materials suppliers. This consultation should start early in the design stage but will be necessary throughout the contract, especially should 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 the following (**4.2** to **4.9**) are 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 following layout and specifications, based on building type and occupational uses, should be provided:

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;

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 under floor 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 refurbished 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 surface applied membrane where likely drying times for the base exceed time available in the programme;

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

j) requirements for jointing e.g. direction of material or the position and type of expansion joint profiles;

k) size, position and design of barrier zones.

4.5.3 *Barrier zone*

Entrance flooring systems should be used to reduce the dirt, grit and water carried into the building by foot traffic, hence they will reduce wear and the risk of slipping when the building is in service. The size, position and design of the barrier zone should be considered at the design stage, but preferably should be a minimum of three metres to be effective. Barrier zones should conform to BS 7953.

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.

4.6 Testing

Details of any conformity testing of the base, screed, floor covering, etc. that is to be conducted and the party which is to be responsible for this testing should be given. The implications of this also should be considered 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. In most circumstances, this should be the responsibility of the 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. It is preferable that such instructions should be in clear, written form and cover the recommended maintenance methods appropriate for all the types of floor coverings installed.

5 Sub-floors

5.1 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 covering 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 screed. (These should be determined using the test method given in Annex A);

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.

5.2 Materials

5.2.1 ***Fabricated substrates***

Fabricated substrates may be selected from the following:

a) plywood;

b) particle board (the board should not have any surface treatment which might affect adhesion);

c) oriented strand board (OSB)

d) fibreboard (e.g. hardboard, MDF);

e) gypsum board;

f) others.

The strength and construction of the fabricated substrate should be able to function in use without swelling, delaminating or disintegration.

5.2.2 ***Cementitious based substrates (levelling layer)***

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

The levelling layer may be a cementitious underlay consisting of a specifically formulated blend of cement and binder and both fine and coarse aggregates. The binder is commonly a natural rubber latex or synthetic polymer.

5.2.3 ***Anhydrite screed***

After it has been laid, it is essential that the surface is sanded to remove laitance. It is essential to provide a barrier primer before cement based products are laid over the anhydrite and it is preferable to prime where flooring adhesives are to be applied. The screed manufacturer should be contacted for advice regarding primers.

5.2.4 ***Underlayments***

Underlayments may be selected from the following:

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

5.2.5 ***Edging, dividing strips and nosings***

Edging, dividing strips and nosings are available in wood, metal and plastics. These may be used between similar or dissimilar types, thickness or colours of floor covering, at door openings, or to act as a finish to a floor edge.

5.2.6 ***Adhesives***

The adhesive selected 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 floor covering manufacturer and adhesive manufacturers should be taken into account and followed precisely if they are specific as to the type of adhesive which should be used.

5.3 Concrete and screed bases

5.3.1 *General*

The subfloor should be constructed in accordance with the recommendations given in BS 8204-1:2002.

5.3.2 *Surface treatments*

5.3.2.1 *General*

These treatments are not recommended in general but, in some specific situations, they can give good solutions.

5.3.2.2 *Chemical hardening solutions*

Chemical hardening solutions and resinous seals may be used on bases and screeds, 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.

5.3.2.3 *Curing membranes*

Curing membranes can affect adhesion and should be mechanically removed.

5.3.2.4 *Power floating/power trowelling off directly finished concrete*

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

5.3.3 *Regularity of subfloors*

The evenness of the laminate flooring installation will be determined by the surface regularity of the subfloor. Tolerances recommended by different manufacturers vary but, generally, the maximum permissible departure of the surface of the subfloor from the underside of a three metre straight edge resting in contact with the subfloor should be three millimetres.

5.4 Moisture content of the subfloor

5.4.1 *General*

New work carried out in accordance with BS 8204-1:2002 can be expected to be protected against rising damp by a damp-proof membrane, but the residual damp present in new concrete or screed (cement-based or anhydrite) can prevent successful installation. The moisture content of mineral subfloors (cement screed floor, anhydrite screed floor, etc.) should be ascertained using Annex A, in both existing and newly installed floors and floors already covered (ceramic tiling, natural stone, plastic, etc.).

5.4.2 *Damp-proofing solid floors and eliminating construction moisture*

5.4.2.1 *Damp-proofing solid floors*

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

Materials and methods for damp-proofing solid floors should conform to BS 8102. It should not be assumed that existing ground supported concrete floors are adequately damp-proofed. Where existing structures do not incorporate adequate moisture protection proprietary surface applied membranes should be used. Integral waterproofers incorporated in the concrete or screed will not provide adequate damp protection for the floor coverings and will retard the drying process. Beam and block construction floors whether finished with cement-sand, screed or particleboard should incorporate a vapour control layer.

5.4.2.2 *Eliminating construction moisture*

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

Usually the floor covering is installed on the concrete base slab or on to a screed laid above this. In either case the amount of water used is more that 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.

Estimated drying times are necessarily only very approximate as drying is influenced by ambient conditions, the concrete used, thickness and surface finish.

For cement-sand screed 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 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 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 reduce 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.

5.4.2.3 *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.

5.5 Timber bases

5.5.1 *General*

Timber bases should be sound, rigid, flat, level and dry. The timber should be at equilibrium moisture content, i.e. the stage 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 might be an interaction between the preservative chemicals and the adhesive or the floor covering. Advice should be sought regarding suitable materials and remedial treatment.

Suspended timber floors at ground level should be adequately ventilated.

In situations where the gaps between adjacent boards are wider than one millimetre, consideration should be given to overlaying with a suitable fabricated underlay.

5.5.2 *Particleboard bases*

Particleboard bases should conform to BS 7916. 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. Boards should be tongued and grooved on at least two edges and the joints should be glued.

5.5.3 *Moisture content of wooden subfloors (subfloors of chipboard, oriented strand board, plywood, fibreboard and wooden floorboards)*

When the floor covering is installed, the moisture content of a timber, particleboard or plywood base should be close to the equilibrium moisture content it will have in service. It is normal practice for particleboard to be conditioned to an appropriate moisture content during manufacture, and packed and delivered in this condition. To maintain these conditions, the base should be stored in its original pack, should not be installed until the building is weather-tight and should be protected against residual damp in a concrete base by a damp-proof membrane.

These measures should be observed with particular rigour for floating floors.

5.6 Smoothing and/or levelling compounds

5.6.1 *General*

Levelling layers and underlayments may be used over cementitious and similar bases. No single levelling layer and underlayment is 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.

5.6.2 *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 material should be made after considering the manufacturer's recommendations.

5.6.3 *Powder/water mix*

The properties of these materials very 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 sand/cement screeds or concrete bases.

5.6.4 *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.

5.7 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.

Existing textile floor coverings, however, should always be removed and the subfloor made good before installing laminate floor coverings.

5.8 Preparation of subfloors

5.8.1 *Levelling*

In case of surface irregularities exceeding the values given in **5.3.3**, screeds, flowing screeds and fabricated substrates should be used in accordance with the supplier's recommendations.

5.8.2 *Vapour protection*

In the case of mineral subfloors, a surface damp-proof membrane should be installed to protect the laminate floor covering from residual damp.

In the case of existing floor coverings, the surface should be covered with the membrane as described above and existing textile floor coverings should always be removed.

5.8.3 *Underfloor heating*

When installing laminate floor coverings in rooms with underfloor water heating, irrespective of whether the screed floor involved is old or newly installed, a temperature curve should be recorded for both the heat-up and cool-down phase.

The written report, submitted by a qualified heating specialist, should contain the following heating system data:

— heat-up data including precise flow temperatures;
— maximum peak flow temperature reached on intake side;
— operating conditions and outside temperature at time of commissioning;
— signature of proprietor/architect and installer;
— date.

Designated areas for moisture content measurements should be clearly marked. If such areas are not clearly identified, measurements during the heat-up and cool-down phases should be repeated and the scope of measurements extended in order to minimize risks.

Any misgivings on the part of the heating specialist consulted should be expressed in writing, stating the risk and extent of damage possible. A written report should be handed to the client.

Before starting installation work, a damp-proof membrane should be laid out in the manner previously described.

The floor surface temperature before, during and for at least three days after the installation of laminate floor coverings should be maintained at approximately 18 °C. After three days, the temperature should be slowly raised to the required operating temperature, whereby the surface temperature of the heated subfloor should not exceed 28 °C.

6 Materials

6.1 Laminate floor coverings

6.1.1 *General*

Laminate floor coverings should conform to BS EN 13329. Most laminate floor coverings elements feature a wood-based panel core.

Wood is a natural product and expands and contracts as its moisture content changes. Laminate floor coverings have the same properties, consequently the dimensional stability of a floating laminate floor is influenced by the ambient conditions of the environment.

6.1.2 *Selection*

BS EN 13329 gives details of classification schemes that draw a distinction between the different grades of floor covering available. Recommendations for laminate floor coverings in domestic or commercial premises depend largely on the type and frequency of the traffic to which the floor is subjected.

6.2 Associated materials

6.2.1 *Underlay*

For levelling minor surface irregularities, an underlay should be used. This underlay should have the compressive strength properties to avoid unnecessary deflection.

The appropriate underlay should be chosen according to the manufacturer's recommendations and the intended uses such as sound insulation, underfloor heating, etc.

When sound insulation is required, the underlay should be chosen in order to reach the level of insulation required for the system "underlay with laminate floor covering" and to ensure a relatively stable conservation of this property with time.

In the case of installation on a heating subfloor, the thermal resistance of the system "underlay with laminate floor covering" should not exceed the level required for the correct functioning of the heating system.

6.2.2 *Adhesive for tongue and groove joints*

Where necessary, the tongue and groove should be glued together using a water-resistant adhesive (class D3 to BS EN 204) applied in accordance with the manufacturer's instructions.

6.2.3 *Joint profile*

Expansion or finishing joint profiles should be chosen according to the size and the geometry of the floor surface. The manufacturer's recommendations should be followed.

7 Installation

7.1 General

The installation of laminate floor coverings should only be conducted once the building is watertight (i.e. after the outside walls, windows, doors and roofs are completed), after the measures necessary for subfloors (see Clause **5**) have been conducted and after all overhead work has been completed.

7.2 Conditioning

Laminate floor coverings are affected by variations of climatic conditions. Therefore, conditioning of the product prior to installation is important.

The laminate floor covering elements should be removed from their packaging and separated. Elements should be stored in this condition for at least 48 h. The following conditions should be maintained before and during the installation and at least three days after installation:

Floor surface temperature	min. 15 °C
Ambient air temperature	min. 18 °C
Relative humidity	min. 30 % and max. 75 %

Laminate floor coverings should not be subjected to draughts and the packaging units should not be stood or leaned against walls during the conditioning period. Panels should be stored flat on the floor or on four wide battens at least 0.5 m away from adjacent walls.

7.3 Membrane

Before laying the membrane, the subfloor should be smooth, clean and dry.

Particular care should be taken to ensure that the individual sheets of the membrane overlap by at least 200 mm.

The membrane should cover every vertical part of the building structures (walls, pillars, etc.) to at least 50 mm. The parts outside the surface should be cut off after installation of the laminate floor coverings.

7.4 Underlay

The underlay should be installed over the entire surface of the subfloor avoiding overlaps and openings between underlay sheets. Seams in the underlay should not coincide with joints in the laminate floor covering.

7.5 Installation direction

The overall appearance of the finished surface consisting of individual laminate floor covering elements is highly dependent on the installation direction in conjunction with the incidence of light and the main line of sight. The installation direction can have a significant influence on the perceived size and perspective of a room. The installation direction should be determined together with the client or tenant.

7.6 Installation patterns

Laminate floor covering elements may be installed according to either a regular or an irregular pattern. For irregular patterns, the manufacturer's recommendations should be followed.

7.7 Layout

Before starting installation, the side of the room used to start should be determined. The width of the room should be measured in order to determine the width of the first row ensuring that the last row is more than 50 mm wide. Similarly, the length of the shortest off-cut element should not be less than 200 mm.

7.8 Expansion gaps

Laminate floor covering expands and contracts laterally when subjected to changes in room climate.

To accommodate such changes, an expansion gap should be left around the perimeter of the floor covering and around all other vertical parts of the building structure. The size of the expansion gaps should be at least one millimetre per metre of width or length of the room with a minimum of five millimetres.

There should be no contact between the finished floor and any vertical building structures.

7.9 Assembling of elements

Where the tongue and groove are to be glued together, the application of adhesive should conform to the instructions of the laminate floor covering manufacturer or supplier. Adhesive should be released along the top of the joint when two boards are firmly pushed together under force. Excessive adhesive should be removed.

With mechanically assembled elements, the instructions of the manufacturer or the supplier should be followed.

7.10 Expansion joints

Manufacturers' recommendations regarding maximum uninterrupted flooring sizes vary greatly. The installation instructions relating to the product should be carefully considered.

Normally expansion joints are used in the following circumstances:

— on surfaces greater than 12 m in the direction of the length of the individual laminate floor covering elements;

— on surfaces greater than 8 m in the direction of installation travel;

— in doorways between rooms;

— in porch areas;

— between offset adjoining rooms;

— along the course of expansion joints in the subfloor.

Expansion joint profiles should be installed according to the manufacturer's recommendations.

7.11 Skirting boards

The method used to install skirting boards depends on the type of system. However, irrespective of the system used, the basic principle is that although the skirting should rest on the laminate floor covering, there should under no circumstances be mechanical force or glue used to form a joint between the two. The skirting boards should be fixed only to the wall.

7.12 After installation

The new tongued and grooved glued laminate floor covering should not be subjected to heavy loads or frequent traffic for at least 12 h after installation to prevent any disturbance during the setting time for the adhesive. This does not apply to mechanically assembled elements.

8 Completion

8.1 General

After installation, the floor surface should be carefully inspected and cleaned e.g. from residual adhesive. When the work is finished the installation should be inspected together with the client for agreement. The client should be handed a copy of the cleaning and maintenance instructions of the installed laminate floor covering.

8.2 Final inspection

The inspection of the floor should take place with the persons involved standing upright. An angled source of light, false light or direct light should not be used for the evaluation or to locate blemishes in the panelled surface.

8.3 Uneven joints

Irregularities and tolerances between individual elements can become apparent along the sides and ends. The maximum height difference should not exceed 0.10 mm. Individual incidents of up to 0.15 mm may be accepted.

8.4 Convex/concave warping

After installation the maximum acceptable tolerance for convex and concave, measured across the full width of the installed element should be 0.25 mm.

8.5 Openings

Openings within the floor surface with a maximum width of 0.2 mm are acceptable, providing that the joints are tightly bonded. This includes such irregularities as are inherent in the manufacturing process and the joint gaps that may be the result thereof. These irregularities and tolerances can be deemed to be natural properties of the product and do not therefore constitute a fault.

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 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.1a) and Figure A.1b).

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, two millimetre thick clear acrylic sheet, or two millimetre 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 plasticine.*

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 might 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 8204-1:2002, **6.4.3**b), allow a period of not less than four hours before taking the first reading. Equilibrium can be assumed when two consecutive readings taken at four hour 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 8204-1:2002, **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 considerable longer than one week before moisture equilibrium is established. To prevent edge effects with these very thick constructions, cover the area of one square metre 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. polythene 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 two hours to four hours of placing the instrument but should be left overnight for confirmation.

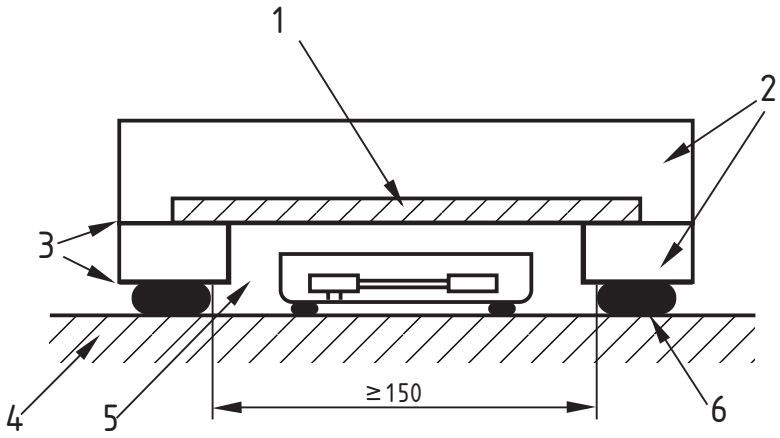
To avoid expensive equipment being left on site, the probe may be removed from the apparatus (shown in Figure A.1b) and the hole plugged before the box is sealed to the subfloor. After allowing time to reach equilibrium, the plug is removed, the relative humidity probe is inserted promptly and time is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

A number of simultaneous measurements might 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

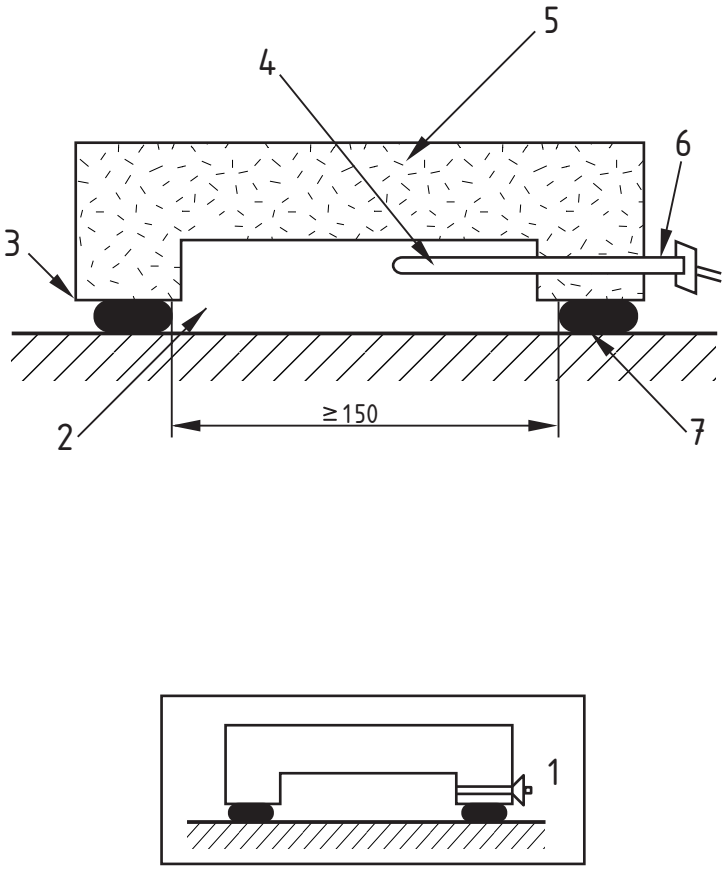
As the accuracy of a hygrometer can drift with time or in transit, it may need to be recalibrated frequently. The accuracy of the hygrometer or relative humidity probe at 75 % rh may be checked by sealing it in a desiccator or humidity cabinet over a saturated solution of analytical or general purpose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



Key

1 Window	4 Floor
2 Insulation	5 Air pocket
3 Vapour barrier	6 Plasticine

Figure A.1a) — Typical apparatus using hygometer



Key

1 Plug
2 Air pocket
3 Vapour barrier
4 Humidity measuring tip
5 Insulation
6 rh probe
7 Plasticine

Figure A.1b) — Typical apparatus using rh probe

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