BRITISH STANDARD

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Code of practice for diagnosis of rising damp in walls of buildings and installation of chemical damp-proof courses

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British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee B/525, Building and civil engineering structure, to Subcommittee B/525/6, Use of masonry, upon which the following bodies were represented:

Association of Building Engineers
Autoclaved Aerated Concrete Products
British Board of Agrément
Brick Development Association
British Masonry Society
British Precast Concrete Federation
British Wood Preserving and Damp-proofing Association
Building Research Establishment
Concrete Block Association
Eurisol — UK Mineral Wool Association
Institution of Structural Engineers
Mortar Industry Association
National House-Building Council
Office of the Deputy Prime Minister (Building Division)
Royal Institute of British Architects
Stone Federation Great Britain

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Contents

Foreword

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 16 November 2005. It was prepared by Subcommittee B/525/6, Use of masonry, under the authority of B/525, Building and civil engineering structure. A list of organizations represented on this committee can be obtained on request to its secretary.

BS 6576:2005+A1:2012 supersedes BS 6576:2005.

Text introduced or altered by Amendment No.1 is indicated in the text by tags 〉 〈. Minor editorial changes are not tagged.

This British Standard gives guidance and recommendations on the diagnosis of rising damp in walls of buildings, in particular to the need to differentiate between rising damp and other sources of damp, and the consequent installation of chemical damp-proof courses (d.p.c.s) in walls of buildings where rising damp has been diagnosed. Structure and cost often preclude fitting of physical damp-proof membranes in these circumstances.

The object of installing a chemical d.p.c. is to reduce rising damp, or the risk of rising damp, to acceptable levels, by creating a horizontal barrier to rising damp at the correct level in a wall.

As well as taking into account legal requirements since 1985, this edition includes additional information on diagnosis of dampness.

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.

In drafting this British Standard it has been assumed that the assessment and diagnosis of rising damp will be conducted by appropriately qualified and competent surveyors and that the installation of the damp-proof course system and the associated replastering will be conducted by trained operatives under the direction of qualified supervisors.

As a wide range of materials and techniques is used in chemical damp-proof coursing, it has not been found possible to draft a specification for the materials.

NOTE *MOAT 39* [1] describes a range of tests which indicate the quality and efficacy of damp-proofing fluids.

This British Standard calls for the use of substances and/or procedures that require adequate precautions to be taken if they are to be used safely. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage (see Annex A).

Suppliers and installers of d.p.c. materials need to take into account the hazards presented by the equipment and materials being used, and need to make, record and act on an assessment of the risks posed by their particular operations.

Specialist advice is obtainable from appropriate organizations represented on the committee (see inside front cover).

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 cannot 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 13 and a back cover.

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1 Scope

This British Standard gives recommendations for the procedures to be used in diagnosing and treating rising damp in walls of existing buildings.

This British Standard:

— emphasizes the need to differentiate between rising damp and other causes for damp conditions in diagnosis;

— gives recommendations for the chemical treatment of rising damp in existing buildings with solid walls, cavity walls (unfilled or filled) and random rubble-filled walls, including associated reinstatement of plaster/dry linings; and

— indicates essential precautions and procedures for installing chemical damp-proof courses.

This British Standard does not cover the treatment of walls where treatment is inappropriate, such as stud walls, or where other treatments are appropriate, such as walls below ground level or under hydrostatic pressure, whose treatment is described in BS 8102.

NOTE The successful treatment of rising damp depends not only on following the recommendations of this standard but also on the effectiveness of the damp-proof course materials. It has been assumed in the drafting of the standard that suitable materials will be used. A number of damp-proof course materials are endorsed by third party certification.

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.

〉A1〈 *Text deleted*

BS 6100-1, *Building and civil engineering – Vocabulary – Part 1: General terms.*

BS 8215, *Code of practice for design and installation of damp proof courses in masonry construction.*

BS 6100-6, *Building and civil engineering – Vocabulary – Part 6: Construction parts.*

BS 8481, *Design, preparation and application of internal gypsum, cement, cement and lime plastering systems – Specification.*

BS EN 13194-1, *Design, preparation and application of external rendering and internal plastering – Part 1: External rendering.*

BS EN 13914-2, *Design, preparation and application of external rendering and internal plastering – Part 2: Design considerations and essential principles for internal plastering.* 〈A1

CP 102, *Code of practice for protection of buildings against water from the ground.*

〉A1 PD CEN/TR 15123, *Design, preparation and application of internal plastering systems.* 〈A1

3 Terms and definitions

For the purposes of this British Standard the terms and definitions given in BS 6100-1 and 〉A1〈 BS 6100-6 〈A1 and the following apply.

3.1
chemical damp-proof course
chemical d.p.c.
continuous barrier to rising damp created in a wall by chemical treatment

3.2
condensation
process whereby water is deposited from air containing water vapour when its temperature drops to or below dewpoint

3.3
rising damp
upward capillary migration of water in masonry

4 Assessment of buildings

4.1 General

Before installing a chemical d.p.c., it is essential to establish:

a) whether rising damp is present (see **4.2**);

b) whether the building is suitable for treatment using the particular system proposed (see **4.3**);

c) whether the building is currently being modified and, if so, the effect of this work on the proposed chemical d.p.c.

Installation should be carried out only if the assessment recommends this and that it has:

a) taken account of all the factors described; and

b) all other necessary remedial measures have been carried out.

NOTE The assessment of buildings is normally carried out by a specialist surveyor, and is often described as a "survey".

4.2 Inspection procedures and diagnosis of damp conditions

4.2.1 *General*

4.2.1.1 When inspecting a structure for signs of rising damp, it is essential to take into account the possible presence of other sources of dampness. Even if the instructions given are limited to the detection of rising damp, other problems should be highlighted if they are present and reasonably obvious.

NOTE 1 Visual observations both externally and internally are important and can provide much of the information needed to arrive at a preliminary diagnosis. Nevertheless, a full understanding of the distribution of dampness in a structure can require the use of various moisture measuring techniques. Surveyors need to be familiar with the use of such equipment and the interpretation of results from them [2].

NOTE 2 An electrical moisture meter is a useful diagnostic instrument; it can be used to discriminate between different explanations for damp conditions, and is non-destructive. The readings it gives are qualitative. Surface moisture measurements alone cannot give proof of rising damp, so further evidence may, where permitted, be obtained by disruptive examination and measurements taken within the depth of the wall. Chemical or gravimetric methods can be used and, generally, moisture contents in excess of 5 % (w/w) in mortar joints at the base of a wall will indicate the need for further investigations [3]. Gravimetric tests give more detail, but require samples to be removed to a laboratory for testing. Chemical tests on site can only show the total moisture content.

4.2.1.2 Damp areas should be clearly identified. If there is any doubt about the occurrence of dampness in general, further investigations should be made.

NOTE Excessive dampness is usually visible, but this does not necessarily indicate the presence of rising damp.

4.2.1.3 All other possible causes of damp conditions should be located. Particular attention should be paid to:

a) condensation;

b) lateral penetration associated with changes of floor/ground level;

c) leaks from roofs, gutters and downpipes;

d) faulty drains;

e) internal plumbing leaks;

f) water penetration through external walls;

g) water penetration around window frames and doors;

h) mortar droppings or debris in cavity walls;

i) history of flooding.

NOTE Further information to discriminate between the possible causes of damp conditions is given in *Understanding dampness — effects, causes, diagnosis and remedies* [4]. Further information on constructions to resist rain penetration is given in BS 5628-3, and on repairing flood damage in *Repairing flood damage* [5].

4.2.1.4 Any existing d.p.c. should be traced around the building to check it is not bridged at any point, externally or internally.

4.2.1.5 If positive evidence of rising damp is being obscured by other faults such as those described in **4.2.1.3**, it is preferable that those faults should first be remedied, and that an appropriate period of time should be allowed to elapse before making further checks to ascertain the presence of rising damp.

4.2.2 *Common causes of dampness and basic diagnostic features*

4.2.2.1 *Condensation*

The assessment should include checks for condensation, which is caused when warm, damp air (often from kitchens and bathrooms) comes into contact with cold surfaces. Physical features that should be noted are liquid water on non-porous surfaces, often associated with mould growth (e.g. Aspergillus sp., Penicillium sp.). The distribution of condensation is usually towards areas of poor air circulation or where cold surfaces are found, which can be in other parts of a building remote from the source of moisture. It can be found on adjacent below ground areas of wall where structural waterproofing has been carried out.

Condensation at low level can be confused with rising damp, although the moisture will usually be superficial. The removal of wall coverings and/or plaster will often reveal a relatively dry substrate underneath.

Where interstitial condensation (i.e. within a wall) poses particular diagnostic problems, the cause should be identified through invasive methods, such as those described in *Interstitial condensation and fabric degradation* [6].

NOTE 1 More detailed guidance on the detection and treatment of condensation is given in BS 5250 and other sources [7, 8].

NOTE 2 "One-off" measurements of atmospheric temperature and relative humidity combined with surface temperature readings can allow a surveyor to demonstrate that conditions are suitable for condensation to occur at the time of inspection. However, to build up an accurate picture of the role of condensation, more detailed information will need to be collected over an extended period.

4.2.2.2 *Penetrating damp*

The assessment should include a check for defects that could lead directly or indirectly to the presence of dampness on internal surfaces.

NOTE Penetrating damp above ground level can be confused with rising damp where it occurs at low levels on external walls. Moisture profiles will generally show an increase towards the source of ingress (i.e. through the depth of the wall). If the only cause of damp conditions in walls above ground level is penetrating damp, hygroscopic salts are unlikely to be present, unless they were already present in the structure (see **4.2.2.4**). Penetrating damp below ground level is covered in BS 8102.

4.2.2.3 *Rising damp*

The assessment should include checks for rising damp that is characterized by high free moisture content in the base of a wall, reducing with increasing height.

NOTE One effect of rising damp is to carry salts from the ground into the body of the wall. As a result hygroscopic salts (particularly chlorides and nitrates) are normally present in walls and plaster suffering from rising damp. These salts often concentrate in a band in the upper area of dampness that creates a visible tide-mark and can cause electrical (conductivity) moisture meters to give spurious readings.

4.2.2.4 *Hygroscopic/deliquescent salts*

The assessment should include checks for the presence of hygroscopic/deliquescent salts.

If necessary, plaster or wallpaper samples should be taken to establish if hygroscopic salts are present before deciding on appropriate action. Where possible, samples should not be taken from areas adjacent to chimney breasts, etc. since hygroscopic salts can accumulate as a result of soot deposits and flue condensation, thereby complicating diagnosis.

NOTE Hygroscopic and deliquescent salts are able to absorb atmospheric water vapour. Consequently, depending on the humidity conditions, structures that contain such salts can be intermittently "damp" even though no external source of liquid moisture is present. Ground salts, such as chlorides and nitrates, can be present as a result of rising damp or penetrating damp below ground level. However, widespread problems with chlorides in walls can indicate:

a) use of unwashed sand in construction;

b) overuse of chloride-based mortar additives;

c) salt-water exposure (e.g. seawater, de-icing salts on roads).

When agricultural buildings are converted for housing use, the walls of the building could be contaminated by animal excreta or by materials (particularly nitrates), leached from stored materials. Consideration needs to be given to isolating the affected wall completely from decorative finishes by erecting dry linings or applying plaster finishes on moulded plastic membrane systems (see **10.4**).

In normal circumstances, contaminated plaster should be removed at the same time as the chemical d.p.c. is installed and replaced shortly afterwards. Where the plaster appears to be in sound condition, the extent of plaster to be removed may be minimized by delaying any decision to replaster until the drying period is complete. In such cases the surveyor should offer clear advice on the risks arising of possible damage to decorations in the future (see **10.3**).

4.2.2.5 *Other considerations*

The structure should be examined for other signs of dampness that can be more or less obvious, depending on a number of seasonal and other variables (e.g. water table height, wall temperatures, rainfall frequency, flooding).

NOTE The problems described in **4.2.2.1** to **4.2.2.4** will normally leave signs of their historical presence even if the building has since dried out. In such cases, although the building was "dry" at the time of inspection, problems could recur in the future.

4.2.2.6 *Fungal decay in suspended timber floors*

Where suspended timber floors exist, joist ends and other timbers in contact with damp walls (e.g. wall plates, sleeper walls) should be inspected to ensure that they are free from fungal decay. If such problems are located, necessary repairs should be carried out, ensuring that any sound retained or replacement timbers are isolated from the masonry. The need for preservative treatments should be taken into account [9, 10]. Even when there is no evidence of fungal decay on the exposed faces of the timbers, the concealed sections should be regarded as being at greater risk. This should be confirmed by taking moisture readings. Isolation of such timbers from masonry is therefore highly recommended.

NOTE Suitable methods for isolating timbers from masonry can include completely rebuilding the floor in line with the guidance in *Design of timber floors to prevent decay* [9].

Where possible, the proposed d.p.c. should be installed below the level of timber joists, and a check made to ensure that the d.p.c. line is not bridged by sleeper walls etc. If a d.p.c. has to be installed above a timber floor, the risk of fungal decay to the floor timbers should be taken into account.

It is strongly recommended that all timber treatment work should be undertaken by specialist contractors.

The installation of a chemical d.p.c., even if installed below joists, does not in itself prevent the development of timber decay. Attention should be given to ensuring adequate sub-floor ventilation [9].

4.3 Condition of building fabric

4.3.1 Most types of wall can be treated using the methods described in **9.2**, but for the following situations particular techniques should be selected from **9.2** as appropriate:

a) walls of exceptional thickness (>600 mm);

b) rubble-filled walls;

c) walls of impermeable materials (e.g. flint, granite);

d) walls bonded in irregular or very narrow mortar courses;

e) walls of perforated or unusually bonded brick (e.g. rat trap bond).

NOTE 1 Walls constructed of local materials (e.g. clay or chalk "cob") can only be treated by treating the plinth on which they are supported.

NOTE 2 Newer brickwork/blockwork where a physical d.p.c. has been omitted or installed at an incorrect level will have an alkaline mortar that can only be treated with an appropriate product.

The quality of the masonry in the area to be injected should be assessed as to whether it is able to withstand drilling and injection to allow a successful d.p.c. treatment and necessary repairs should be recommended.

4.3.2 Remedial action should be taken where the proposed d.p.c. line is bridged, externally by concrete slabs, rubble, etc., or internally by adjacent floors, etc.

4.3.3 Care should be taken that d.p.c. materials do not damage thermal insulants in cavity walls. Walls already insulated with polystyrene insulation should not be treated with solvent-based products.

NOTE Urea-formaldehyde foam and man-made mineral fibre insulation are not normally affected by d.p.c. fluids, and polystyrene insulation can be installed in a wall treated with solvent-based fluids after the solvent has evaporated. Solvent-based products can damage polyethylene and bitumen membranes, adhesives and some flooring materials.

4.3.4 Where the building concerned is statutorily listed or is in a conservation area, the local authority should be consulted before treatment is conducted.

5 Reports

All assessment findings should be comprehensively documented and conveyed in a written report and should include the following:

a) confirmation of the instructions received;

a) any restrictions imposed on the inspection; and

a) the surveyor's observations and recommendations.

If other remedial works are required (and are to be conducted by other parties) a clear unambiguous complete statement of the extent and nature of this work should be made [11].

6 Safety

Suppliers of d.p.c. materials are required to supply safety information on the materials they supply. Installers should use this when they evaluate the hazards presented by the equipment and materials being used, and should make, record and act on an assessment of the risks posed by their particular operations.

NOTE Attention is drawn to the Control of Substances Hazardous to Health Regulations 2002 which require employers to control exposure of employees and other people to hazardous substances to prevent ill health [18].

The hazards that might be presented by chemical damp-proofing products and the associated products, and the procedures that should be taken to minimize the risk include the following.

a) Solvent-based fluids (silicone or poly-oxo aluminium stearate in organic solvent):

1) may be classified as "flammable";

2) precautions should be taken against sources of ignition during storage and installation;

3) advice should be given to owner/occupier and neighbour on odour and flammable nature of product during installation and early service, including posting of precautionary notices;

4) might occasionally give rise to persistent odour, which can be minimized by an adequate assessment to confirm the property to be treated is free from features which could cause odour to persist (e.g. hidden voids, thick walls, restricted ventilation), ensuring proper ventilation; or the use of low odour fluids.

b) Siliconate fluids:

1) may be classified as "irritant" or "corrosive";

2) precautions should be taken during installation against contact with the skin or eyes.

c) Micro-emulsions:

1) may be classified as "irritant/corrosive" and might be flammable in concentrate form before dilution;

2) precautions should be taken during installation against contact with the skin or eyes.

d) Injection mortars, replastering systems:

1) cementitious products should be handled using routine procedures for Portland cement.

e) Ready-to-use thixotropic materials:

1) might be neutral or may be classified as "corrosive";

2) precautions should be taken during installation against contact with the eyes or skin.

7 Party walls

Clients should be made aware of any legal requirements on them to give notice of the work to owners of neighbouring properties and to obtain their consent to the proposed work.

NOTE Attention is drawn to the Party Walls etc. Act 1996 [12] which provides a framework for preventing and resolving disputes in relation to party walls, boundary walls and excavations near neighbouring buildings.

8 Pre-installation measures

8.1 In most circumstances, any one of the materials and techniques described in Clause **9** can be applied equally effectively. However, the following relevant points should be taken into account in the final selection of a system.

— Where treatment in friable substrates is to be carried out, the use of high-pressure injection systems is not recommended.

— Thick walls (particularly if of a random structure) and cavity walls containing insulation, when treated with solvent based systems, can dry slowly causing prolonged odour and fire hazards (see also **4.3.3**).

— Recently constructed walls will contain alkaline mortar, which can inhibit curing of siliconate fluids, and affect the service life of solvent-based fluids.

8.2 Defects in the masonry that would prevent the successful installation of the proposed d.p.c., e.g. mortar too weak for drilling, should be repaired.

8.3 The proposed d.p.c. line on the external walls around the outside of the building should be traced (removing external render where present) and its position checked relative to the d.p.c. on the inside of the walls to ensure they match. Where possible, the d.p.c. should be placed at least 150 mm above external ground level in accordance with BS 8215 for masonry constructions, or CP 102 for suspended timber floors. If the d.p.c. is consequently high with respect to internal floor levels, consideration should be given to reducing external ground levels or implementing special waterproofing measures to deal with lateral penetrating damp below the d.p.c. [13].

8.4 Electrical installations should be isolated from the supply and the locations of any pipework and wiring noted.

8.5 The internal d.p.c. line should be exposed by removing plaster, skirting boards and any other obstacles to effective treatment. Any timber that is in sound condition may be put on one side for reinstatement at a later date; decayed timber should be bagged and removed from site.

8.6 Plaster affected by hygroscopic salts should be removed up to a line not less than 300 mm above the last detectable signs of dampness and/or salt contamination (using an electrical moisture meter) or 1 m above the d.p.c., whichever is the higher.

NOTE Where the decision has been taken to delay a decision on the extent of replastering (see **4.2.2.4**), this step may be omitted at the time of the d.p.c. installation. However, there is a risk of damage to future decorations (see **10.3**).

8.7 Any necessary repairs and treatment to suspended timber floors should be carried out (see **4.2.2.6**).

Where possible, the proposed d.p.c. should be installed below the level of timber joists and a check made that the d.p.c. line is not bridged by sleeper walls, etc. If a d.p.c. has to be installed above a timber floor, the client should be informed (in writing) that the floor is at risk of fungal decay [10].

8.8 Where wall irrigation techniques are being used to combat dry rot, there can be subsequent interaction between the irrigation fluid and the d.p.c. material. In these circumstances, advice should be sought from the manufacturers.

8.9 Where required, safety notices should be posted prominently at entrances to the treatment area.

NOTE Attention is drawn to the Health and Safety (Safety Signs and Signals) Regulations 1996 [21] which requires that employers provide specific safety signs whenever there is a risk that has not been avoided or controlled by other means.

9 Installation of chemical damp-proof courses

9.1 General

9.1.1 The following methods of installing a chemical d.p.c are described in **9.2**:

a) high pressure injection (generally used for solvent-based products);

b) low pressure injection (generally used for aqueous systems, both true solutions of siliconates and microemulsion silanes or alkyl/alkoxy siloxanes);

c) gravity feed (used for aqueous systems, usually siliconates);

d) hand insertion (used for injection mortars and ready-to-use thixotropic materials).

9.1.2 In all cases, the installation of a chemical d.p.c. consists of two distinct stages.

a) Drilling a series of holes in a pattern depending on the thickness and form of construction of the wall(s) and the method of treatment to be employed. In the case of injection mortars, this process may be replaced by partially raking out mortar joints in 115 mm walls.

b) Inserting the chemical damp-proof course material.

NOTE The methods given in **9.2** apply to the majority of chemical systems. Nevertheless, prior to using any system, the application details need to be checked against the manufacturer's specification.

9.1.3 With solid floors, the d.p.c. should be inserted as close to the floor as possible (unless this would place the d.p.c. less than 150 mm above external ground level). The floor membrane should overlap the d.p.c. line. If it terminates below d.p.c. level, appropriate steps should be taken to ensure continuity between the d.p.c. and floor membrane, before reinstatements commence.

NOTE Further guidance on protecting structures against water from the ground is given in BS 8102.

9.1.4 Vertical d.p.c.s should be positioned where the horizontal d.p.c. changes level and to isolate treated walls from adjacent untreated areas, e.g. adjoining semi-detached and terraced properties, fire-place areas where access to the back of the fire is not possible, and abutting garden walls. Vertical d.p.c.s should be installed up to a line not less than 300 mm above the last detectable signs of dampness or 1 m above the d.p.c., whichever is the higher.

9.2 Installation methods

9.2.1 *High pressure injection*

9.2.1.1 Holes (9 mm to 16 mm diameter) should be drilled as follows:

a) in brickwork either horizontally or angled downwards with two holes per stretcher and one per header;

b) in masonry at nominal intervals of 120 mm;

c) in porous masonry at intervals of 120 mm to 150 mm;

d) in the associated mortar course where the masonry is too dense to be injected, provided the mortar is able to accept the high injection pressures.

9.2.1.2 Holes should be drilled to a depth of 65 mm to 75 mm as follows.

a) Solid walls up to 120 mm thick should be drilled and injected from one side.

b) Solid walls up to 230 mm may be drilled from both sides and injected, or may be drilled and injected from one side, with the drill holes being extended and reinjected once.

c) Solid walls over 230 mm thick should be drilled and injected from one or both sides, with the drill holes being extended and reinjected progressively, with incremental drillings of 100 mm to 120 mm in brickwork, or 150 mm in masonry.

9.2.1.3 Cavity walls should be treated as if each leaf is a separate solid wall. If access is only possible from one side, a sequential drilling process should be used. If cavities are filled with debris at or above d.p.c., they should be treated or raked out to prevent bridging of the inserted d.p.c.

9.2.1.4 Random rubble-filled walls should be first treated as for cavity walls. Then the rubble-filled cavity should be drilled and treated separately (in accordance with the supplier's recommendations on pressures etc.).

9.2.1.5 The injection should be conducted at pressures of 700 kPa to 900 kPa (7 bar to 9 bar) until fluid exudes out of the masonry/mortar beds to form a continuous band along the d.p.c. line (and the coverage rates quoted in the manufacturer's technical data sheets are achieved). When the face of the masonry is not visible, either the initial insertion rate and relative depth of each newly drilled section should be used to time subsequent injections at greater depth, or the volume injected should be measured. When double or triple drilling is conducted, the injection lance should be sealed beyond any vertical mortar joints to ensure good pressure retention (sudden drops in recorded pressure usually indicate fluid loss through cracks or fissures).

9.2.2 ***Low pressure injection***

9.2.2.1 Holes (9 mm to 16 mm diameter) should be drilled at nominal intervals of 160 mm, either horizontally in the masonry units/mortar joints or at an angle of depression of up to 45°, to reach the mortar bed joint at the level of the intended d.p.c. The depths of the holes should be as specified in **9.2.1.2**.

NOTE If angled drill holes are used in thicker walls, some adjustments may be necessary to ensure horizontal continuity at the level where the d.p.c. is formed.

9.2.2.2 The d.p.c. material should be injected at a pressure of 150 kPa to 500 kPa (1.5 bar to 5 bar). Each hole should be injected singly, and an even pressure should be maintained.

The volume of fluid injected should be monitored and compared with the manufacturer's recommendations.

NOTE Sudden loss of pressure will usually indicate the need to drill a new hole nearby to ensure even migration of the d.p.c. material throughout the wall.

9.2.3 ***Gravity feed***

9.2.3.1 Holes of up to 25 mm in diameter should be drilled at nominal spacings of 175 mm to depths described in **9.2.1.2** and angles described in **9.2.2.1**.

9.2.3.2 For solid half-brick walls (120 mm thick), holes should be drilled from one side terminating beyond the centre of the wall, within 25 mm of the far face.

9.2.3.3 For solid walls greater than 120 mm, holes should be drilled:

a) from one side to within 40 mm of the far face; or

b) from both sides with holes in line, terminating about 40 mm from the centre; or

c) staggered, with each hole terminating within 40 mm of the far face.

9.2.3.4 Cavity walls should be treated as described in **9.2.1.3**.

9.2.3.5 A measured amount of fluid should be dispensed into a container connected to a tube inserted in each hole. If rapid fluid loss is observed, an alternative hole should be drilled nearby or the fissure/crack should be caulked before continuing.

NOTE In one commercial system, the transfusion tube perforations are covered with sponge-rubber washers to minimize this loss of fluid.

The volume of fluid required to conform to the manufacturer's recommendations for the given wall thickness should be calculated and the process continued until all the material has been absorbed.

9.2.4 ***Hand insertion — Injection mortars***

9.2.4.1 Holes (20 mm in diameter) should be drilled at nominal spacings of 115 mm and at an angle of depression of about 30°, finishing in a mortar bed at the level of the proposed d.p.c. In half-brick walls, the mortar joint should be raked out to between one third and one half its depth.

9.2.4.2 In solid walls up to 460 mm, holes should be drilled:

a) from one side to a depth equivalent to the thickness of the wall; or

b) to the same depth from both sides at staggered centres of up to 230 mm; or

c) to 40 mm beyond the centre of the wall at staggered centres of 115 mm.

Solid walls of between 460 mm and 920 mm should be treated as two separate sections of equal thickness and drilled from both sides at opposite centres at nominal spacings of 115 mm.

9.2.4.3 The drill holes should be cleaned out and pre-soaked with water prior to introducing the cementitious slurry by caulking gun or hand pump. The slurry should be introduced by back-filling each hole, thereby avoiding air gaps, and stopped about 15 mm short of the near face of the wall.

9.2.4.4 In half-brick walls, a bed-joint should be selected, raked out and soaked. The injection mortar slurry should be mixed to a slightly stiffer consistency suitable for trowel application and care taken to ensure joints are fully back filled to within 8 mm of the near face.

9.2.5 *Hand insertion — Ready to use thixotropic materials*

9.2.5.1 In solid walls, holes 12 mm in diameter should be drilled at the base of the perpends and at a spacing of 100 mm to 120 mm in the chosen mortar course to terminate between 10 mm to 40 mm from the far face of the wall being treated.

NOTE Solid walls are normally treated from one side, but may be treated from both sides. Cavity walls may be treated from one side, or both leaves may be treated as if they were separate walls.

9.2.5.2 The thixotropic material should be introduced by cartridge gun, caulking gun or hand pump. The delivery tube should be inserted into the full depth of the hole and the hole filled to within 10 mm of the surface, thus avoiding air gaps, minimizing the risk of bleeding into the plaster, and achieving the manufacturer's recommended dosage.

10 Finishing work

10.1 General

Contractors should be made aware of how to conduct finishing work after the d.p.c installation.

10.2 Drying/curing

The following should be noted in relation to drying and curing after d.p.c. installation.

Carrier solvents [see **6**a)] can take a few days to several weeks to dissipate depending on wall thickness, features of the structure and conditions prevailing, and odours can persist over this period. With water-based systems, curing can occur over similar time periods (microemulsion silanes and alkyl/alkoxy siloxanes only) or longer (up to six weeks in thicker walls, or with siliconates or injection mortars).

In all cases, irrespective of the speed of d.p.c. formation, walls can continue to be damp for some time after the treatment. For example, 225 mm walls can take at least 6 months to 12 months to dry out. External renders and coatings will significantly extend the drying period.

10.3 Plastering

The following should be noted in relation to plastering after d.p.c. installation.

The function of the new plaster is to prevent hygroscopic salts that might be present in the wall from migrating through to its surface, while still allowing the wall to dry.

Such plaster should be damp/water resistant (e.g. should be cement based), but should be permeable to water vapour.

It is preferable to delay replastering as long as possible after the insertion of the d.p.c. and to apply maximum ventilation throughout the treated areas of the building during this period.

NOTE 1 ▌A1⟩ BS 8481, BS EN 13914-2 and PD CEN/TR 15123 ⟨A1▐ and *Plastering in association with damp-proof coursing* [13] provide further guidance on internal plastering.

The d.p.c. system manufacturer's recommendations on replastering should be observed. In general, the plaster undercoat (which may incorporate an additive to increase resistance to hygroscopic salt migration) should not be less than 10 mm thick. On exceptionally uneven walls it might be necessary to have a greater thickness of plaster, which might need to be applied in more than one coat. The finishing plaster coat should be selected and applied in accordance with ▌A1⟩ BS 8481, BS EN 13914-2 and PD CEN/TR 15123 ⟨A1▐. Unless a product which is resistant to lateral moisture movement is used, the finished d.p.c. should not be bridged internally or externally. External renders may be applied above the level of the d.p.c. in accordance with ▌A1⟩ BS EN 13194-1 ⟨A1▐, provided that suitable protection is provided, e.g. bellcasts. The plaster/render system selected should be compatible with the type and condition of the masonry/mortar in accordance with ▌A1⟩ BS 8481, BS EN 13914-2, PD CEN/TR 15123 ⟨A1▐ and ▌A1⟩ BS EN 13194-1 ⟨A1▐ [14].

Impervious wall coatings should not be applied until the walls have dried out. This can take 12 months or longer, depending on wall thickness, permeability, heating, etc. A temporary decorative finish is particularly recommended for use during this interim period (e.g. one coat of trade matt emulsion paint).

NOTE In walls grossly contaminated with hygroscopic salts, "dry" conditions might never be fully established and impervious coatings will therefore perform badly. In particularly severe cases, consideration needs to be given to isolating the affected wall completely from decorative finishes by erecting dry lining or applying plaster finishes on moulded plastic membrane systems.

10.4 Dry lining

Dry lining systems or plaster finishes applied to moulded plastic membrane systems can be used to provide internal finishes after installation of a chemical d.p.c.

Systems consisting of panels fixed to supports, e.g. preservative treated timber or corrosion resistant metal battens or framing, and also those consisting of self-supporting panels or arrangements of panels, should be used. Systems that involve directly bonding panels to the walls using gypsum-based bonding plasters or certain other adhesives should not be used in this type of application.

The dry lining operation should be delayed as long as possible after insertion of the d.p.c. to allow drying out of the treated wall. If this is not possible, adequate ventilation behind the panels should be ensured during the drying period.

Dry linings can be decorated with the minimum of delay after installation of the d.p.c.

10.5 Other finishing work

External holes should be made good (e.g. with cement:sand mortar coloured to match or preformed plastic plugs). This may be as part of a general repointing exercise. Holes drilled internally that will be covered by skirting boards may be left unplugged.

Replacement woodwork should be treated with a suitable wood preservative before reinstatement [10] and/or isolated from the wall if drying times are likely to be lengthy.

Annex A (informative)
Legislation on health and safety at work

An employer's obligations on health and safety are expressed in general terms in the Health and Safety at Work etc. Act 1974 [15], and the employer's obligations on particular hazards are expressed in the Regulations issued under the Act. Attention is drawn to the following Regulations:

a) Management of Health and Safety at Work Regulations 1999 [16];

b) The Manual Handling Operations Regulations 1992 [17];

c) The Control of Substances Hazardous to Health Regulations 2002 [18];

d) The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 [19];

e) The Construction (Design & Management) Regulations 1994 (as amended) [20];

f) The Health and Safety (Safety Signs and Signals) Regulations 1996 [21];

g) The Provision and Use of Work Equipment Regulations 1998 [22];

h) The Construction (Health, Safety and Welfare) Regulations 1996 [23];

i) The Personal Protective Equipment at Work Regulations 1992 [24];

j) The Noise at Work Regulations 1989 [25];

k) The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 [26];

l) The Workplace (Health, Safety and Welfare) Regulations 1992 [27];

m) The Construction (Head Protection) Regulations 1989 [28];

n) The Electricity at Work Regulations 1989 [29];

o) The Control of Vibration at Work Regulations 2005 [30].

Equivalent regulations are in force in Northern Ireland.

This information does not purport to be an exhaustive or comprehensive set of official references. It is correct at the time of publication, but is subject to change and users are advised to consult the appropriate government departments.

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