

BS 6150:2019



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Painting of buildings — Code of practice

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 March 2019. It was prepared by Technical Committee STI/28, *Paint systems for non-metallic substrates*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 6150:2019 supersedes BS 6150:2006+A1:2014, which is withdrawn.

Information about this document

This is a full revision of the standard, and it has been restructured and prepared to reflect changes in legislation and coating material technology, and to provide a document that is more accessible and appropriate for the sector.

Attention is drawn to the Construction (Design and Management) Regulations 2015 [1] and the Construction (Design and Management) Regulations (Northern Ireland) 2016 [2] which set out the responsibilities of those involved in construction work, including clients, designers, contractors and workers (available from <http://www.legislation.gov.uk/ukxi/2015/51/contents/made>¹).

Product references indicated in the text by figures in parentheses, e.g. (B.1/2), refer to the products listed and described in the tables within the annexes.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

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.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

1 Last accessed 20 March 2019.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

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.

Introduction

BS 6150, *Painting of buildings – Code of practice*, provides recommendations and guidance concerning paint application on buildings. All parts of a building to which paint and coatings are to be applied need to be designed to avoid, as far as possible, the creation of features or conditions that can cause difficulties in application, impair the performance of coatings, or promote decay or corrosion of structural materials.

Many modern building materials do not require painting. If, however, building materials are chosen which require painting for aesthetic or protective reasons, then design factors need to be considered by the architect at the earliest possible stage. Specifiers need to consider design aspects from the perspective of paint selection, maintenance and expected service life. Opportunities for design change after construction are very limited. For some new build components, e.g. window frames, initial painting is best carried out industrially prior to installation.

Correct selection of paint systems and clear, precise specifying of methods and processes are essential. However, this alone does not ensure that the chosen systems perform satisfactorily, and it is equally important that consideration is given to the factors described in [Table 1](#), including substrate, location and exposure conditions. The influence of design and detailing, proper organization and supervision is of particular importance, and, in some circumstances, an effective inspection procedure. Exposure conditions are the consequence of construction and climatic factors (e.g. see BS EN 927-1:2013, Table 2). The guidance on typical life to maintenance is system specific and applies to mild and moderate exposure conditions. Service life is generally shorter under more severe conditions.

Hazards to health and safety that might be encountered in the painting of buildings and the precautions that need to be taken are described in [Annex A](#). Reference is also made to applicable legislation. These aspects are to be considered in terms of a safe system of work. The health and safety of all persons involved in the building during the painting process, including client, occupier, painter, supervisory and inspection staff, need to be ensured. [Annex B](#) gives more information on paints and coatings. [Annex C](#) describes the effect of temperature and humidity on paint types and environmental exposure. [Annex D](#) gives information on fire. [Annex E](#) to [Annex I](#) give more information on particular substrates. [Annex J](#) provides information on anti-graffiti treatments.

1 Scope

This British Standard gives recommendations for good practice in preparation, initial painting and maintenance painting of buildings (e.g. dwellings, offices, light industrial buildings, schools, hospitals, hotels and public buildings generally) internally and externally, in which decoration is a significant and often the major factor. This British Standard takes into account the need to protect many building materials against weathering or other forms of attack normally encountered. Detailed information is given on wood, metal, masonry and other typical substrates found in buildings.

The paints and coating materials referred to in this British Standard are principally those in common use, with limited reference to specialist coating materials and factory-applied coatings. Some materials have been excluded because of their obsolescence, limited or specialized usage or, in the case of newly developed products, lack of experience of their performance in service.

This British Standard does not cover:

- a) the protection of structural steel elements (see [BS EN ISO 12944](#), and [BS 5493](#) for iron structures), including hot spray application;

- b) decorative processes and other work usually carried out by specialists, such as asbestos encapsulation, the maintenance of lead surfaces, resin flooring, polymer renders or waterproofing of flat roofs;
- c) the particular requirements of listed or historic buildings which are protected by law;
- d) limewash and distemper coating materials;
- e) preservative treatments for structural timber;
- f) reactive coating materials for passive fire protection and systems consisting of these materials (see [BS 8202-1](#), BS EN 16623 and BS 476); and
- g) general safety hazards of access for painting (see [BS 8210](#)).

The recommendations made in this British Standard are intended to facilitate achievement of standards of finish which, when inspected as described in [Clause 10](#), will be of a generally acceptable commercial standard for the intended types of buildings, providing that the work of other trades has been completed to a satisfactory standard. Where especially high standards of finish are necessary, more elaborate processes and systems than those described in this British Standard might be necessary.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions 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 476 (all parts), *Fire tests on building materials and structures*

[BS 1336](#), *Specification for knotting*

[BS 5493](#), *Code of practice for protective coating of iron and steel structures against corrosion*

[BS 7664](#), *Specification for undercoat and finishing paints*

[BS 7956](#), *Specification for primers for woodwork*

[BS 8221-1](#), *Code of practice for cleaning and surface repair of buildings — Part 1: Cleaning of natural stones, brick, terracotta and concrete*

BS EN 927 (all parts), *Paints and varnishes — Coating materials and coating systems for exterior wood*

BS EN 1504-10, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 10: Site application of products and systems and quality control of the works*

BS EN 12811-1, *Temporary works equipment — Scaffolds — Part 1: Performance requirements and general design*

BS EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

BS EN 13914-1, *Design, preparation and application of external rendering and internal plastering — Part 1: External rendering*

BS EN ISO 4618:2014, *Paints and varnishes — Terms and definitions*

BS EN ISO 8501-3, BS 7079-A3, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, edges and other areas with surface imperfections*

BS EN ISO 14713 (all parts), *Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures*

BS EN ISO 12944 (all parts), *Paints and varnishes — Corrosion protection of steel structures by protective paint systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in BS EN ISO 4618 and the following apply.

3.1 ancillary materials

additional materials other than paint and coating materials used in the painting of buildings

NOTE Ancillary materials include, for example, cleaning agents, sterilizing washes, knotting, stoppers and fillers, mastics and paint removers.

3.2 arris

sharp edge formed by the intersection of two surfaces

NOTE Used particularly in respect of edges in a moulding.

3.3 bring forward

prepare and prime to bring repaired or bare surfaces up to or near the visible appearance of adjacent completed paintwork

3.4 broad wall

large interior wall area, plaster or dry-lined

3.5 checking

form of cracking characterized by fine cracks distributed over the surface of a dry film or coat in a more or less regular pattern

[SOURCE: BS EN ISO 4618:2014, 2.42 – modified, Note 1 to entry removed]

3.6 coating

<noun> layer formed from a single or multiple application of a coating material to a substrate

[SOURCE: BS EN ISO 4618:2014, 2.50.1]

3.7 coating

<verb> process of applying a coat

NOTE The use of the term “coating” for “coating material” is deprecated.

[SOURCE: BS EN ISO 4618:2014, 2.50.2]

3.8 cut in

using a brush or small roller to paint areas that are not accessible by other application methods without encroaching onto an adjacent surface

3.9 damp-proof course

barrier through a structure designed to prevent moisture rising by capillary action

3.10 denib

remove fine particles/contaminants that have dried within or on the coating during the drying process by fine abrasion methods in between coats of paint

3.11 drip-moulding

detailing/projection for building components to divert rainwater away from a building

3.12 fat edge

formation of a ridge of accumulated paint often caused by over application

NOTE It can be the result of over application or overlapping areas that have already started to film form, or dry. See 5.7.2.3.

3.13 flashing

<building> strip of an impervious sheet of material which protects a joint, usually from the entry of rainwater

[SOURCE: BS ISO 6707-1:2017, 3.3.5.58]

3.14 flashing

<paint> non-uniform appearance of a coating applied to walls or other surfaces, where there are noticeable variations in colour or levels of sheen

NOTE This is usually caused by excessive film builds when areas of overlapping occurs in brush or roller application and the wet edge has not been maintained. It may be described as a halo effect. Absorbent surfaces or painting in high humidity/warm conditions can be factors.

3.15 flow

extent to which a paint is able to level out after application

3.16 lay off

lightly apply final brush or roller strokes on any surface in one direction immediately after the paint has been applied to even out the surface

NOTE This helps to eliminate brush or roller marks.

3.17 mock-up

prepared example or required standard of specified works

3.18 patch-painting/patch-priming

part painting/priming particularly bare areas prior to applying mid or undercoats or areas prone to higher levels of wear or contamination

3.19 pattern staining

staining from convection currents carrying dust through poorly insulated areas

NOTE Primarily affects ceilings highlighting joists, seen in the form of stripes.

3.20 roller stipple/orange peel effect

textured appearance created during and after application by roller

NOTE It can also be created by spray application.

3.21 paint

pigmented coating material which, when applied to a substrate, forms an opaque dried film having protective, decorative or specific technical properties

NOTE Commonly used in the general sense, which includes all organic and inorganic coating materials such as enamels, varnish, emulsions, oil-based and water-based paint.

[SOURCE: BS EN ISO 4618:2014, **2.184** – modified, note added]

3.22 snag

areas of completed surfaces not up to the standard expected that need addressing before the project can be signed off

NOTE This term can also be used as a verb to describe the remedial work.

3.23 spray

3.23.1 air-assisted airless spray

modification of airless spray system with the addition of pressurized air at the sides of the spray tip to give greater control and a finer finish

3.23.2 airless spray

spray system that requires no air, using hydraulic pressure to atomize the paint as it is forced through the spray tip

NOTE This usually results in high opacity and film build.

3.23.3 high volume low pressure (HVLP) spray

more conventional spray system using low pot pressure [35 kPa to 70 kPa (5 psi to 10 psi)] combined with a high volume stream of air to atomize and propel the material onto the surface

NOTE Normally used when a fine finish or high transfer efficiency and low wastage and overspray is required.

3.24 mottle

decorative finish with particles of one colour appearing in a uniform background of another colour or shade

[SOURCE: BS EN ISO 19496-1:2017, **3.152**]

3.25 stippled finish

slightly uneven pebbly textured decorative finish due to application or incorporation of aggregates

[SOURCE: BS EN ISO 19496-1:2017, **3.239** – modified]

3.26 tack rag

piece of lint impregnated with a non-drying oil used to remove dust from a surface immediately prior to painting

3.27 thixotropic paint

paint with the property of changing reversibly from a gel or semi-liquid state when undisturbed to a more liquid consistency when brushing, stirring or rolling

3.28 throating

groove in an under-surface that prevents water from running across it

[SOURCE: BS ISO 6707-1:2017, **3.3.5.10** – term changed from 'throat' to 'throating']

3.29 undercoat

relatively highly pigmented matt or mid-sheen materials, applied to primed or previously painted surfaces before the application of finishing coats

3.30 vapour barrier

layer of material intended to restrict the transmission of water vapour

[SOURCE: BS ISO 6707-1:2017, 3.3.2.5]

3.31 wet edge

undried progressing front of paint application that allows blending in of the next stroke

4 Defining the project**4.1 General**

Whether the project relates to painting a new building or maintaining an existing building, the following parameters should be taken into account at the outset to ensure that the most appropriate paint system(s) and application process(es) are selected:

- nature and condition of the substrate;
- location of the surface (inside or outside);
- environmental exposure resistance requirements;
- function of the paint;
- conditions for application;
- paint availability and use;
- sustainability aspects;
- costs and future maintenance; and
- any special constraints.

[Table 1](#) provides further detail on the questions that should be considered with respect to each parameter, what actions should be taken, and the specific subclause for supporting information.

Table 1 — *Parameters to consider at the design stage*

Issue	Question	Comment and action
Substrate	What substrates are involved?	Establish nature of the substrate.
	What is the condition of the substrate(s), especially the nature of previous paint layers, and whether the substrate will be coarse?	Inspect, refer to 5.10 .
	Which characteristics are key?	Confirm and detail, refer to Clause 9 for specific information on different substrate types.
	Are there any specific issues related to substrate preparation that need to be considered?	Establish preparation required, including use of any specialist equipment, and waste control.

Table 1 (continued)

Issue	Question	Comment and action
Location	Is the surface internal or external?	Identify location.
	Is the surface easily accessible, or is there a requirement for support equipment, e.g. scaffolding?	Identify any potential issues.
	Are there any other specific issues in the vicinity e.g. related to building layout?	Identify any potential issues.
Exposure conditions	What are the general atmospheric exposure conditions in the vicinity?	Research location, establish any key issues e.g. coastal environment with high salt content.
	What localized or intermittent conditions (e.g. fumes, condensation, heat, vulnerability to abrasion or wear) exist or are to be expected?	Refer to Table 3, Clause 7 .
	Are there possible future developments or changes in usage, which might alter the local exposure conditions?	Design for potential changes that could be foreseen.
Function	What are the functional requirements of the paint (e.g. protection, decoration, hygiene or special function)?	Different paints fulfil different functions. Refer to Clause 8 .
	Are there any relevant statutory requirements affecting selection?	Refer to relevant legislation (see also Annex A).
Application	What will be the climatic conditions during paint application e.g. cold/damp/humid, or hot/dry?	Paint flow, appearance and drying are susceptible to weather conditions. Refer to Clause 5 and Clause 7 .
	What is the preferred method of application?	Refer to Clause 5 .
	Is there a potential environmental impact if a certain application method is chosen?	
	Are there any restrictions on methods of application on site?	
	Is specialist equipment required (e.g. spray)?	
	Is application by specialist contractors required?	
Coating materials	Which coating systems are available?	Consult suppliers. Refer to Clause 8 .
	Are the coating materials readily available from the usual sources or is special order or manufacture required?	Consult suppliers.
	Are the coating materials suitable for site or factory application?	Consult suppliers.
Sustainability	What are the project's objectives in terms of sustainability? Is the project falling under the remit of one of the 'green construction' schemes?	See 8.1 .

Table 1 (continued)

Issue	Question	Comment and action
	Is there environmental footprint information available for the candidate paints?	Some environmental footprint information might be of interest, however there is no recognized international method at present to accurately compare the environmental impact of different paints. <i>NOTE There is a European Product Environment Footprint (PEF) project underway in 2018 to address this issue.</i>
	Has the durability and lifetime of the finished painted surface been taken into consideration, linking to future maintenance requirements?	More durable paints will require less maintenance and therefore generally have less impact on the environment.
Costs and maintenance	What is the likely first cost of the system, including preparation, materials and application?	Cost analysis of previous work of a similar nature is useful. Consult contractors and suppliers.
	What is the expected life of the system to first maintenance?	Experience of similar systems is useful.
	Does the system provide a satisfactory base for future maintenance, perhaps with different coating materials?	Refer to 8.2 .
Special constraints	Are there constraints relating to the composition of the coating materials in some situations (e.g. in food factories, hospitals)?	Consult client, industry association or supplier.
	Are any constraints imposed by the conditions under which the work has to be carried out (e.g. requiring the use of coating materials which dry very quickly due to access issues)?	Consult client, contractor or supplier. Refer to Clause 7 .
	Are there constraints imposed on colour choice due to a high degree of sunlight exposure?	Refer to 9.2.2.3 .

Building materials to which coating materials are to be applied should be chosen for their inherent properties of durability and resistance to decay or corrosion in the exposure conditions in which they are to be used. Over-reliance should not be placed on the ability of coating materials to upgrade the performance of inherently unsuitable materials, especially in circumstances where frequent maintenance is likely to be impracticable or uneconomic.

NOTE Alternative or supplementary treatments, e.g. galvanizing or sprayed metallic coating materials are available, as are ancillary treatments such as wood preservatives, to enhance the protection afforded by coating materials.

Where possible, it is advantageous to undertake initial painting under controlled conditions, e.g. factory conditions. This is often more satisfactory than site application and can offer a wider choice of systems.

4.2 Common elements to painting activity

4.2.1 General

The following elements relating to the actual painting activity are common to both new build and maintenance projects, and should be considered at the initial design stage.

- Health and safety ([Annex A](#))
- Knowledge of paints to be used ([Annex B](#))
- Inspection ([Clause 10](#))
- Materials, sampling and testing ([5.10](#), [Clause 8](#))
- Workforce and supervision
- Supply and storage of materials
- Scaffolding and equipment
- Order of working

4.2.2 Workforce and supervision

The number of operatives employed should be appropriate to the size of the contract, its planned duration and the nature and availability of the work involved. Preparation is generally more labour intensive than application, and the size and deployment of the workforce should allow for this. Operatives should be skilled and experienced in the types of work involved and with the materials, methods and equipment to be used.

NOTE With novel materials, methods or equipment, special training might be necessary, especially with regard to the safe use of mechanical equipment and employment of personal protective equipment (PPE).

On extensive ceiling and wall areas, there should be a sufficient number of operatives to ensure working wet edges are maintained (see [5.7.2.3](#)), and working conditions and the characteristics of the coating materials to be applied should be taken into account.

Adequate supervision should be provided, having regard to the nature of the work and the size and deployment of the workforce. Supervisors should be experienced in all aspects of the work for which they are responsible. They should be provided with copies of all working documents (e.g. specifications, painting schedules and product information) necessary for effective supervision and control of the work. They should also be provided with risk assessments and method statements as required and have ready access to test equipment, e.g. moisture meters, film-thickness gauges and flow cups, when the nature of the work requires it.

4.2.3 Supply and storage of materials

NOTE 1 Most conventional decorative materials are available on demand or at short notice from the manufacturer or distributor; but this might not apply to all quantities, colours and container sizes, or to specialist materials. Placing of orders for materials is normally the responsibility of the contractor – the prompt issuing of painting schedules by specifiers reduces the risk of delay in supply that could hold up work.

Consideration should be given at the tender or pre-project stage to the quantities of paint and coating materials needed; having a robust estimating process can eliminate future paint waste (see [5.11](#)).

On large projects, appropriate facilities should be provided for the storage of materials, having regard to security, avoidance of hazards and protecting the materials from the weather, in accordance with the manufacturers' instructions. In general, to maintain coating materials in good condition and to prevent rusting of containers and deterioration of dry materials, such as powder fillers, materials should be stored in dry conditions, preferably within a temperature range of 5 °C to 30 °C.

Water-borne paints should be protected from frost. Solvent-borne paints are flammable in the liquid state; precautions to prevent accidental ignition should be taken and emergency fire-fighting equipment should be made available. See [BS 8000-0](#) for more information on storage of materials. Attention should be paid to the storage of paints containing volatile solvents, as temperatures exceeding 30 °C can create excessive pressure within containers and increases the risk of auto-ignition and fire.

Containers of highly flammable liquids (flash points below 32 °C), which include certain solvents and specialist paints, usually carry a warning label but, in case of doubt, the manufacturer should be consulted for recommendations regarding safe storage.

NOTE 2 Attention is drawn to statutory requirements regarding the storage of highly flammable liquids (see also [Annex A](#)). Further guidance on fire safety is given in the HSE publication HSG168 Fire safety in construction [3].

Extended contracts, when successive batches are delivered at intervals, dates of receipt and batch numbers should be recorded and storage organized so that the materials can be issued in the same order as they were received. Containers should be marked with the date of receipt.

4.2.4 Scaffolding and equipment

The use of scaffolding should be designed to ensure secure and adequate coverage of the building, in quantity and type, to permit safe working and avoid delays. Hazards can be created by the use of unsuitable or defective scaffolding; the guidance given in BS EN 12811-1 should be followed with respect to temporary work equipment.

NOTE Attention is drawn to the Construction (Design and Management) Regulations 2015 [1] and the Construction (Design and Management) Regulations (Northern Ireland) 2016 [2] for information on the condition, erection and use of scaffolding.

Equipment should be suitable for the type of work being undertaken and should be in good condition and working correctly. Mechanical equipment, e.g. for spraying or dust removal (vacuums), should be of a capacity and rating appropriate to the work and should operate efficiently.

Allowance should be made for the provision of temporary heating or drying equipment where necessary. The use of other equipment, including paint test equipment (e.g. to determine whether lead is present) should be considered at the design stage, and the appropriate expertise consulted before purchase, rental or use.

4.2.5 Order of working

Work should be carried out from exterior surfaces to interior, from upper parts to lower.

When buildings are painted internally and externally, the exterior work should be completed first, especially when it is necessary to use rooms and windows to gain access to the exterior surfaces or when painting is carried out from assembled scaffolding.

NOTE Often, the determining factor for the order of working is the weather and/or the time of year.

Work should be carried out from the upper parts of a building or structure downwards. Application of paint following preparation should be carried out in the same order, but circumstances might require an alternative approach. If so, care should be taken to ensure that finished work is not spoiled by dust and debris arising from subsequent preparatory work.

4.3 New build projects

4.3.1 General

The following additional elements to [4.2](#) should be considered during the design stage of the project and/or the painting of newly constructed buildings:

- a) organization of work;
- b) components prepared off-site;
- c) protection of components;
- d) accessibility;
- e) moisture control; and
- f) profiles.

Future maintenance requirements for a painted surface should be taken into consideration at the design stage of new buildings. The function of a building or the type of occupancy should be established in order to determine the rate of deterioration of coatings, the type of systems used and the frequency of maintenance.

The initial treatment of new substrates should be considered in relation to subsequent maintenance requirements. The aim should be to use systems which provide a sound base for further coats with the minimum of preparation.

NOTE Initial preparatory treatment is especially important as it can affect the performance of coating systems throughout the life of the building. Some effective preparatory treatments, e.g. abrasive blasting of steelwork or preservative treatment of timber, can be difficult or impossible to carry out as maintenance operations.

4.3.2 Organization of work

Where applicable, painting work should be planned in relation to the work of other trades, to ensure that surfaces are in a fit condition to be painted and that completed work is not damaged by subsequent building operations; for example, time should be allowed for plaster and similar surfaces to dry out before they are painted.

In factories and commercial buildings, it might be necessary for work to proceed without interrupting the normal functions of the building; this should be planned carefully to avoid inconvenience to the occupants and minimize loss of productive time by the contractor.

NOTE In such circumstances, it might be necessary to erect temporary partitioning to isolate the areas where painting is in progress.

4.3.3 Building components prepared off-site

Many components, such as primed and finished joinery, blast-cleaned and primed steelwork, pre-treated non-ferrous metal components and primed or sealed building boards, are now factory coated off-site. Where components are supplied partially painted, e.g. primed, the treatment or coating material should have properties appropriate to the exposure conditions or conditions of service. The primer (or other treatment) and coating materials to be applied should be compatible.

Measures should be taken to prevent damage to primed and finished components during transit, as it might not be possible to effect repairs to a standard equal to that of the original. The painting specification for the site work should detail responsibility for repairing any damage. The manufacturer's or supplier's recommendations for repairing damage caused in transit or during installation and for subsequent maintenance treatment should be followed.

4.3.4 Protection of components

Measures should be taken to prevent damage or deterioration of components and factory-applied treatments on site, i.e. during off-loading, handling, storage and erection. If mechanical lifting equipment is used to handle large or heavy components, slings should be well padded at contact points. Wrapping or other means of protection provided by the manufacturer should not be removed before it is essential to do so. Factory-coated articles and components should be stored away from areas subject to pedestrian or vehicle traffic and should be protected against damage and soiling.

Where possible, joinery should not be kept in external storage, especially when it is to be installed in a centrally heated building. Wooden components, whether stored indoors or outdoors, should not be in direct contact with the ground. Metal components (prepared and painted with part or the whole of the coating system before delivery to site) should, size permitting, be stored indoors. If there is a delay between delivery to site and fixing or erecting of joinery, it should be protected against ingress of moisture. Primed joinery, if not fixed or erected immediately, should be properly stored.

If external storage cannot be avoided, the components should be protected against moisture (including rainwater puddles) and other adverse climatic conditions. If stacking is necessary, spacers should be placed between the components to permit air circulation and, in the case of primed surfaces, to prevent sticking. The bottom layer in the stack should be laid on timber packings to raise it above the ground and the rainwater splash zone.

Consideration should be given to applying additional coats, e.g. of primer, when there is a possibility of long delay between initial and final painting after erection.

4.3.5 Accessibility

Spaces between adjacent wood or metal members, e.g. in roof trusses, should be sufficiently wide to allow access for painting. Alternatively, hidden or contact surfaces should receive protective treatment before assembly or erection. Pipes and similar components should be fixed sufficiently clear of walls to allow them to be painted completely.

Access for exterior repainting and maintenance should be considered at the design stage. Where necessary, scaffolding should be provided in accordance with BS EN 12811-1.

NOTE The need for scaffolding for initial or maintenance painting will add considerably to the costs.

4.3.6 Moisture control

NOTE 1 Penetration of moisture is a common cause of the premature failure of coatings; it can also lead to biological decay or corrosion of structural materials.

Attention should be paid to the design and location of damp-proof courses and membranes, vapour barriers, flashings, weatherings, drip-mouldings and throatings. Measures should be taken to prevent the retention of water on horizontal surfaces, e.g. by bevelling or sloping the surfaces or, in the case of structural metalwork, by providing drainage holes. Rainwater run-off or dripping on to coated surfaces should be prevented by appropriate detailing.

NOTE 2 Condensation is likely to occur in most buildings both externally and internally. External condensation (i.e. dew) can, in combination with rainfall, contribute to the overall time of wetness with detrimental effects on durability. Internally persistent condensation can cause failure of coatings both physically and through biological attack, e.g. surface moulds.

Measures to prevent or minimize condensation should be incorporated at the design stage but choice of coating material can also make a contribution (see [7.3](#)).

4.3.7 Profiles

NOTE 1 Coating materials have a tendency to recede from sharp edges during application and this can result in the film having inadequate thickness at these points.

Timber arrises should be slightly rounded, a radius of 1 mm to 2 mm for timber other than sills and thresholds is usually sufficient; sills and thresholds might need a 3 mm rounding.

Sharp edges of metal, e.g. burrs and nibs, should be removed before painting, and steel edges should be rounded to 2 mm in accordance with BS EN ISO 8501-3, [BS 7079-A3](#).

NOTE 2 There is no benefit to rounding steel edges to 3 mm.

4.4 Maintenance projects

4.4.1 General

The following additional elements to [4.2](#) should be considered during the design stage of the project for maintaining existing buildings:

- a) organization of work;
- b) timing and frequency;
- c) heavy soiling and patch-painting; and
- d) structural features.

The general aim of the maintenance of coating systems should be to restore the painted surface to a satisfactory condition, preferably to its original standard, to enable it to continue to meet its function. A planned approach should be adopted in order to achieve this.

The function of a building or the type of occupancy should be established in order to determine the rate of deterioration of coatings, the type of systems used and the frequency of maintenance. Building function and occupancy is likely to change and consideration should be given to the effect on maintenance requirement since the last or initial treatment.

The recommendations given in BS EN ISO 12944 (all parts) and [BS 5493](#) should be followed for the maintenance painting of steel and iron structures respectively, and those in BS EN 1504-10 should be followed for concrete structures. The recommendations given in BS EN 927 (all parts) should be followed for the maintenance painting of wood.

4.4.2 Organization of maintenance work

Reference should be made to [4.3.2](#) for general guidance on organization of work. The following factors should also be taken into account for maintenance projects:

- a) Restricted access, e.g. a requirement that the work be done only at night or weekends. This might impose constraints on the nature or standard of preparatory work or the types of coating materials that can be used. It is also likely to increase costs.
- b) It might be necessary to isolate the working area, e.g. by the erection of temporary screens or partitions, to limit interference with the normal functions of the building. Similar precautions might be required to create a satisfactory working environment, e.g. to exclude process fumes or dust from the working area during application of coating materials.
- c) In some circumstances, e.g. in food factories, precautions might have to be taken to prevent contamination of products by solvent vapours or other constituents of coating materials. Isolation of the working area, as in b), might be sufficient, but there might also be constraints on the types of coating materials that can be used. Specific requirements should be established and the measures to be taken agreed between the client and contractor.

Specifications should refer to a) to c) and any other special requirements or conditions which might affect the organization of maintenance work.

4.4.3 Timing and frequency

In principle, maintenance should be carried out while the existing coating is in sound condition, when all that is necessary is little more than cleaning down and the application of the minimum number of coats needed to restore the original finish.

Maintenance should be planned and a maintenance schedule should be established for areas with regular treatment at intervals best suited to local conditions and specifications. The maintenance schedule should include provision for regular inspection and recording of the condition of coating systems so that their performance can be monitored and evaluated.

NOTE This allows future maintenance requirements to be assessed and adjustments to be made to the maintenance schedule where necessary.

4.4.4 Heavy soiling and patch-painting

Painted surfaces subjected to heavy soiling and/or pollution from road traffic or other emission sources should be cleaned regularly and might require more frequent painting. The choice of colour for such surfaces should be carefully considered in light of this heavy soiling.

NOTE 1 In practice, the condition after a given period of exposure is unlikely to be uniform over all parts of a building. Typically, some parts will still be in good condition when others require treatment; overall treatment at this stage might well be uneconomic. On the other hand, if deterioration is allowed to proceed too far, it is likely that extensive preparation and possibly complete renewal of the system over large areas will be necessary. The additional cost of the work might then exceed any apparent saving made by delaying maintenance. Hidden costs might also be incurred as a result of deterioration of structural materials, loss of production or revenue decline in amenity value and other factors.

Where there are marked differences in the condition of paintwork on different parts of a building, patch-painting should be considered for areas that are easily accessible.

NOTE 2 Patch-painting, as a form of interim treatment, is generally more applicable to situations where protection is the major factor, e.g. on steel structures, and might not be acceptable where appearance is important. If a significant amount of scaffolding is needed, thereby making the cost of access a high proportion of the overall treatment cost, it might be more economical to repaint the whole structure.

4.4.5 Structural features

Where it is evident that structural or design features have contributed to the deterioration of coatings, they should be modified if practicable and economically justifiable.

NOTE Such modifications may include the following:

- a) improving drainage or run-off to avoid retention of water on horizontal surfaces;*
- b) preventing discharge of steam, water or industrial fumes on to coated surfaces;*
- c) measures to prevent or reduce condensation on internal surfaces;*
- d) sealing gaps, e.g. between wood frames and adjacent masonry;*
- e) providing drip mouldings or canopies over external doors and windows if they are exposed to rainwater run-off;*
- f) providing guard rails to prevent damage to painted walls in heavy traffic areas, e.g. corridors in factories and hospitals; and*
- g) enclosing plant and equipment to prevent splashing or spillage.*

Where painted surfaces are subject to very heavy wear or other forms of attack, alternative materials should be considered, e.g. ceramic tiles.

4.5 Information exchange and record keeping

4.5.1 General

A painting project can involve several parties, including the client, main contractor and subcontractors, suppliers and inspectors; copies of all relevant documents should be available to all parties, including site personnel responsible for supervision.

Where relevant, there should be an exchange of information at an early stage between the painting contractor or subcontractor and those responsible for the constructional work, including other trades whose work might affect or be affected by painting. This should be in the form of a specification along with other documents, both for new build and for maintenance painting. These documents should be prepared in sufficient detail to provide an adequate basis for the preparation of estimates from contractors for the execution of the work.

Records should be kept of the details, including costs, of all maintenance treatments carried out. Where experience or records are lacking, as they can be with newer buildings, maintenance inspections should be carried out at relatively short intervals in the early stages.

4.5.2 Specification

4.5.2.1 General

The specification should be clear, concise and unambiguous.

NOTE The prime functions of a specification for initial or maintenance painting are:

- a) to describe the substrates to be treated and the means by which the required finish is to be achieved, including surface preparation, materials, systems, application methods (where relevant) and the conditions under which the work is to be done;*
- b) to provide a basis for accurate pricing and tendering;*
- c) to serve as a comprehensive reference document for all parties; and*
- d) to act as a reference if disputes arise or arbitration is necessary.*

4.5.2.2 Surface preparation

For initial and factory painting, many substrates benefit from specific surface treatments and preparation, which should be discussed with the coating material manufacturer.

The nature and extent of preparatory work should be specified as clearly as possible because of its influence on costs, appearance and subsequent performance. Imprecise terms such as "thoroughly prepare" or "burn off where necessary", without further qualification, should be avoided. In circumstances where it is difficult to describe the standard of preparation to be achieved, for tendering purposes, a sample area should be prepared as an indication of the standard required.

Where a particular method of preparation is specified, it should be appropriate and relevant to the result required. For example, if a requirement to "remove all rust and scale by chipping, scraping and wire-brushing" cannot be achieved, the choice lies between selecting a more effective method or accepting a lower standard of preparation which leads to a shorter life expectancy for the coating system.

4.5.2.3 Coating system materials

All the materials in a coating system should, if possible, be obtained from the same manufacturer. Where differing makes or brands are specified, they should be compatible.

Materials should be used strictly in accordance with the manufacturer's instructions, including guidance on whether thinning is permissible.

For work of modest size or where relatively few finishes or colours are to be used, information identifying different coating systems with particular areas should be incorporated in the specification. Where necessary, the use of special undercoats or additional finishing coats should be covered.

When there is doubt about the extent to which coatings should be removed, the specification should include a contingency allowance for the removal of coatings from a stated percentage of the areas affected and for the subsequent measurement of the area of the coatings actually removed.

4.5.2.4 Application

The specification should clearly state if circumstances require or preclude the use of particular methods of application and should indicate any requirements or constraints in respect of the conditions under which work is to be carried out or, if necessary, suspended, e.g. temperature, humidity, climatic conditions or other factors.

4.5.2.5 Inspection procedure

Where the work is to be subject to inspection, the intended inspection procedure should be described in the specification in accordance with [Clause 10](#).

4.5.3 Bill of quantities

The bill of quantities should be prepared in accordance with a document such as *NRM2: Detailed measurement for building works* [4]. The relevant edition, or any other method of measurement adopted, should be stated.

4.5.4 Schedules

NOTE For large or more complex projects, the preparation of a painting schedule detailing location, nature of substrate, coating system and (where relevant) colour, is recommended.

A painting schedule should not be regarded as a substitute for the painting specification; site personnel responsible for supervision should have copies of both documents.

4.5.5 Drawings

Drawings should be used for large projects either for tendering purposes or as an aid to the organization and control of work.

4.5.6 Record keeping

NOTE 1 Painting and decorating work is usually carried out at regular intervals as part of an overall maintenance schedule and therefore a planned approach is essential.

Planning is dependent on the availability of information, and therefore, where expenditure on maintenance painting is significant, accurate records should be maintained. The essential information that should be recorded includes dimensions, details of initial and maintenance coating systems (including preparation) and costs.

NOTE 2 Other relevant information might include the conditions (e.g. weather, atmosphere or exposure conditions), methods of application employed, size of labour force and any special difficulties or problems encountered.

When work is subject to independent inspection during application, the inspection reports should be retained as a permanent record. Similarly, where a system of regular inspection of paintwork is in operation, any observations should be recorded.

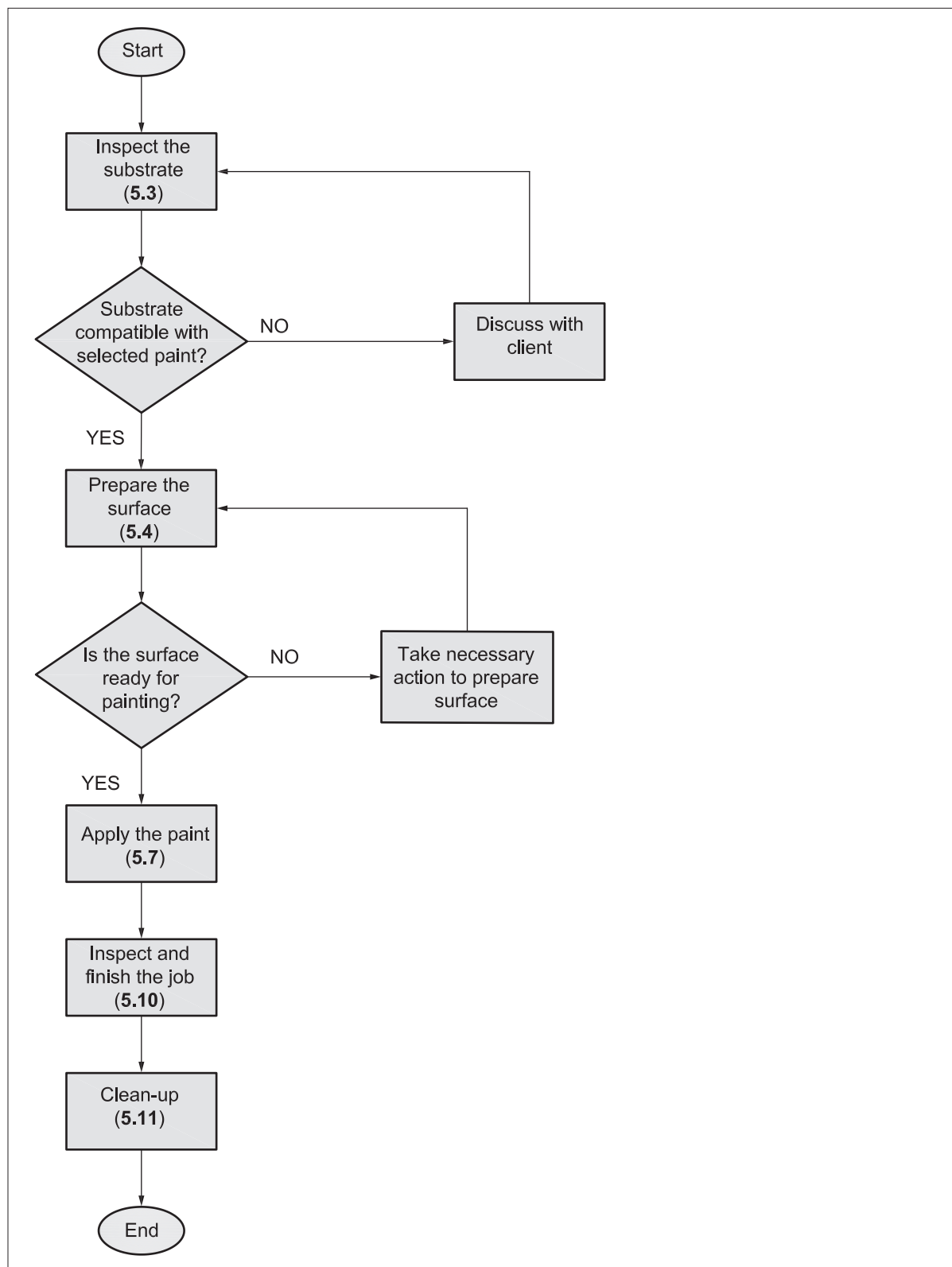
NOTE 3 Apart from its contribution to ease and economy of maintenance, a system of recording can assist in the investigation of failures and the settlement of disputes.

5 Paint application

5.1 General

The procedure in [Figure 1](#) should be followed when painting is to be undertaken.

Figure 1 — Procedure for painting buildings for new build and maintenance projects



Material selection should be made with the following in mind:

- a) nature of the substrate;
- b) condition of the substrate;
- c) location of the surface (inside or outside);
- d) environmental exposure resistance requirements;
- e) function of the paint;
- f) conditions for application;
- g) sustainability aspects; and
- h) future maintenance of the surface.

5.2 Health and safety

Health and safety practices should be in accordance with [Annex A](#).

5.3 Inspecting the surface

The surface should be inspected in accordance with [Clause 6](#).

5.4 Preparing the surface

The surface should be prepared in accordance with [9.1](#).

5.5 Application conditions

5.5.1 General

NOTE The application and performance of coating materials are affected by the conditions under which they are applied, e.g. temperature, humidity and general exposure conditions.

Paint application should not be started unless conditions are suitable. In particular, seasonal factors should be taken into consideration e.g. rain, overnight frost or condensation.

5.5.2 Lighting

Good lighting is essential to efficient working; where natural daylight is lacking, an adequate level and type of artificial lighting should be provided before work begins and during inspection. The lighting whilst painting should simulate, as far as practicable, the final lighting scheme in intensity and direction of lighting. These lighting conditions should also be used for final inspection (see [Clause 10](#)).

NOTE Information concerning suitable illumination for differing purposes is given in the CIBSE Code for Lighting [5].

5.5.3 Temperature and humidity

NOTE 1 Temperature and humidity affect the performance of coating materials.

The manufacturer's recommendations in respect of temperature and humidity should be followed at all times; specifically, paint application should not be started or should stop if the ambient temperature is below that recommended or the relative humidity is above that recommended.

In addition to the ambient temperature, the temperature of the surface to be painted should be taken into account. The temperature of heavy metal sections or plates, as well as plaster, rendering and masonry, for example, can be several degrees lower than the ambient temperature, especially early in the day.

NOTE 2 See [Annex C](#) for information on the impact of temperature and humidity on different paint types.

In assessing conditions of application, account should be taken of changes in temperature and relative humidity that are likely to occur within a few hours of application, and especially the effects of overnight frost or high humidity on recently applied coatings.

For some speciality coating materials, such as two-pack epoxy and polyurethane, the manufacturer's recommendations in respect of temperature and its relation to curing time and pot life should be observed.

5.5.4 Surface moisture

NOTE 1 Adhesion, drying and other properties are likely to be adversely affected if paint and coating materials are applied to wet surfaces.

Application should not proceed if, as a result of adverse weather, high humidity or other cause, there is a visible film of moisture on the surface.

When conditions improve, wet surfaces should be dried off, and time should then be allowed for contained or trapped moisture to evaporate; moisture testing might be necessary.

NOTE 2 Condensation is often a problem in unheated buildings during the winter months. In some circumstances, e.g. when painting metal surfaces, it might be necessary to delay application when the temperature of the surface is below the dew point of the air because of the risk of condensation, even though condensation has not yet occurred.

NOTE 3 See [Clause 9](#) on absorbency and moisture for specific substrates.

The choice of paint systems for substrates employing wet materials of construction should be determined by the moisture content at the time of painting. Resistant coating materials should not be applied to surfaces which are not dry.

5.5.5 Air movement and wind

Painting should be avoided under windy conditions unless precautions are taken, because the wind can carry dust and grit onto wet paint and mar its appearance.

Adequate movement of air assists drying and prevents build-up of vapours; painting should therefore generally be done under well-ventilated conditions.

5.6 Preparing the paint

5.6.1 Stirring

Unless the manufacturer's instructions state otherwise, painting materials should be stirred before use and at intervals during use.

NOTE 1 The solid constituents in liquid paints can settle during storage and their re-incorporation is essential to avoid defects such as poor opacity and retarded drying. Manual stirring is the method generally used for small quantities.

A clean broad-faced stirrer, long enough to reach the bottom of the container, should be used, and stirring should continue until no settlement remains.

NOTE 2 Mechanical equipment for stirring or shaking paint is available, and its use is advantageous when large quantities are involved.

There are some speciality coating materials that should not normally be stirred before use. These are indicated on the product label and the technical data sheet. For example, thixotropic coating materials should not normally be stirred before use as stirring or shaking temporarily impairs the thixotropic properties, and two-pack clear coating materials should be stirred slowly to avoid aeration. The manufacturer's instructions in this respect should be followed.

5.6.2 Thinning

NOTE Paints and coating materials for buildings are generally supplied ready to use. Thinning of primers might be necessary to improve penetration or facilitate application, e.g. on surfaces of high or variable porosity. Thinning might also be necessary for spray application of coating materials.

If thinning is necessary, it should be carried out with the types of thinners and in the proportions recommended by the manufacturer.

5.6.3 Two-pack materials

Two-pack materials are supplied as two components, e.g. base and activator; hardener or curing agent; these should be combined before use in a clean suitable container. The base and activator can be held in separate containers or in a dual-pack container; in either case, the components are present in the correct proportions in relation to the total quantity of material supplied. If a smaller quantity than a standard pack size is required, it should be measured to ensure that the correct proportion of each component is used. Care should be taken to ensure both components are thoroughly mixed.

The manufacturer's instructions in relation to induction period (standing time) and pot life (i.e. length of time during which the material is usable) should be observed.

NOTE Some two-pack materials require an induction period after mixing and before they are ready to use. Most have a limited pot life, and this is temperature-dependent.

5.6.4 Intermixing

Batch to batch colour variations might occur and therefore paint from different containers which is to be used on the same wall should be intermixed unless there is confidence that the different containers contain paint from the same ready-mixed batch. If there is doubt over correctly identifying the batch number, the manufacturer should be contacted and batches should be intermixed.

Different brands or types of paints should not be intermixed.

5.7 Application methods

5.7.1 General

The principal methods of applying paint and coating materials to buildings are by brush, roller and spray. The choice of method should be determined by the nature of the work or the type of material to be applied. The manufacturer's recommendations regarding the suitability of paint and coating materials for application by particular methods should be followed.

Whichever method is employed, operatives should be skilled and experienced in the techniques of application, as well as in the care and maintenance of tools and equipment, use of PPE related to the method and, where relevant, in the setting up and adjustment of equipment to obtain optimum results.

5.7.2 Brush application

5.7.2.1 Characteristics

NOTE 1 Most paints and coating materials may be applied by brush. Brushes are particularly suitable for applying paint to small areas or where there is much cutting-in or frequent changes of colour.

A brush should be used to coat internal angles and corners, e.g. between ceilings and walls. Brush application should also generally be used for the application of conventional types of primers to building surfaces, on the principle that the shearing action of brushing forces the paint into intimate contact with the surface, increasing the adhesion properties of the paint, although suitable types of rollers can be equally effective in this respect.

Unless recommended by the manufacturer, multi-colour finishes should not be applied by brush and should be sprayed.

NOTE 2 Brush application to large, unbroken areas is slower than roller or spray application and it is more difficult to obtain a uniform coating, especially with quick-drying paint.

5.7.2.2 Types of brushes

Brushes should be of good quality and robust construction. Synthetic filament brushes are suitable for all paints and varnishes. Bristle-based brushes are available but should not be used for water-borne trim.

NOTE Synthetic filament brushes do not absorb water to the same extent as natural bristle brushes, and therefore deliver a smooth, consistent application, improve the flow and wet-edge time of the coating material and reduce brush marks. Synthetic filament brushes are generally easier to clean.

In selecting appropriate sizes of brushes, the general principle should be to use the largest sizes consistent with application of a uniform coating without undue effort and appropriate to the surface.

5.7.2.3 Basic techniques

In general terms, the basic technique of brush application involves three phases. First, the material should be applied in a reasonably full coat and evenly spread, working most of it out of the brush and recharging as necessary. Then, without reloading the brush, it should be drawn in one direction (crossed) and then at right angles to this in order to distribute the coating evenly and uniformly. Finally, the coating should be laid off, i.e. the brush is drawn lightly in the direction of the greatest length of the work, in order to eliminate brush marks as far as possible.

Many undercoats and most finishes have good flow properties and for final laying off, lighter pressure should be used. Repeated crossing and laying off is not usually practicable with quick-drying paints which should be applied as quickly as possible with the minimum of brushwork; roller or spray application of this type of paint is usually preferred, especially for large areas. When applying matt and mid-sheen paint to ceilings and walls, the material should be applied and laid off using criss-cross strokes (switching) rather than in one direction.

Over-heavy application of paint should be avoided as this can cause runs and sags, particularly with free-flowing materials such as gloss finishes and varnishes. With some types of paint, a surface skin can form which retards thorough drying. The opposite extreme of brushing out too far should also be avoided as this produces excessively thin films with poor appearance or lacking in protective properties.

Heavy accumulations of paint (fat edges) along edges and arrises should be avoided by brushing towards the edge or arris rather than in the reverse direction.

Application, especially to large areas, should be organized so that wet edges are maintained, i.e. each section of the work is joined up to the preceding section before its edge has set, thus preventing unsightly finish. On large areas, the number of painters deployed should be sufficient to permit wet edges to be picked up with minimum delay. Where scaffolding is necessary, its arrangement should facilitate quick transfer from one section of the work to the next.

5.7.3 Roller application

5.7.3.1 Characteristics

NOTE 1 Most paints and coating materials may be applied by roller. This method is quicker than brushing on large, unbroken areas, such as ceilings, walls, flush doors, floors and plate work but is not recommended for small areas or where much cutting-in is required.

Rollers with appropriate sleeves should be used for the application of paint to rough or uneven surfaces, such as rough-cast external walls; for this purpose, they are usually quicker and more effective than brushes.

NOTE 2 A degree of stipple or surface texture is a characteristic of paint applied by roller but, if the appropriate type of sleeve is used, this can hardly be discernible.

Under critical lighting conditions, spray application should be considered in preference to roller application to avoid visible differences arising from variations in roller stipple due to the direction of travel of the roller. This can appear as roller marking however it is a characteristic of this type of application method, in combination with lighting conditions.

5.7.3.2 Types of rollers

Rollers should be of good quality and robust construction. Preferably, they should have interchangeable roller sleeves which can be selected depending on the surface or paint.

NOTE 1 Materials for roller sleeves include various natural and synthetic fabrics and fibres. Sleeves employing synthetic fibres are widely used; they are generally described in relation to the length of the fibres, i.e. as short, medium, or long pile types.

Short and medium pile types should generally be used for application to smooth surfaces when it is necessary to avoid excessive stippling of the coating. Long pile types should be used for application to brickwork, rough-cast and similar surfaces or when it is necessary to impart a texture to the coating. The roller or paint manufacturer's recommendations regarding the most suitable types of roller sleeve should be followed.

NOTE 2 For general use, rollers about 200 mm wide are suitable, but larger and smaller sizes can be obtained. Special rollers are available for paint application to corrugated sheeting, pipes and curved surfaces. Many rollers, including the special types, can be mounted on an extension pole to extend the painter's reach.

Rollers should be charged by dipping the head of the roller into the material and then rolling it over a corrugated or coarse mesh surface to distribute the material evenly around the sleeve. Roller trays and paint roller buckets are available, which are designed for this purpose.

NOTE 3 Rollers are also available in which material is supplied from a separate container under pressure, known as pressure rollers. See the manufacturer's instructions for use.

5.7.3.3 Basic techniques

Although it is generally easier to obtain a film of uniform thickness by roller than by brush, the weight of the paint applied and the nature of the surface should be taken into consideration. In particular, excessive rolling-out with a dry roller should be avoided. As with brush application, work should proceed systematically in sections, and the same attention should be paid to the maintenance of wet edges (see [5.7.2.3](#)) although, in this respect, the greater speed of roller application is an advantage.

Brushes should be used for cutting-in and for internal angles and this should be done just before rolling, with the roller then being promptly taken as close to the angle as possible.

When it is required to eliminate the slight stipple that can be produced with roller application, as might be the case with undercoats for gloss finishes, a brush should be used for laying off immediately after rolling.

5.7.4 Spray application

5.7.4.1 General

WARNING Use of spray equipment creates a fine mist that is hazardous to health. See [Annex A](#) for appropriate precautions to be taken.

Because of the very high pressures involved, caution should be exercised in the handling of spray equipment; in particular, the spray gun should never be pointed towards any part of the body while the equipment is in operation. The correct PPE should be used. Due to the hazards involved, spray equipment should be used by trained personnel only.

NOTE 1 There are several types of spray equipment, differing in method of operation and in the paints and coating materials and types of work for which they are suitable. In general, however, it can be assumed that there is spray equipment available for the application of virtually every type of paint likely to be used for buildings and structures.

The spray equipment manufacturer's guidance should be followed with regard to setting up the spray equipment. Many paints require thinning for use with different types of spray equipment and guidance should be sought from the paint manufacturer in relation to this.

NOTE 2 Spraying can be used on large, unbroken areas where the nature of the work permits continuous working for lengthy periods, enabling a speed of application which is faster than brushing or rolling.

Spraying should not be used on small-scale work unless the paint is of a type for which spray application is essential or preferred; brush or roller application can be more economic and have better transfer efficiency.

Spray application should be used for most multi-colour finishes and is preferred for paints and coating materials based on solution binders, especially for application to large areas. Zinc-rich epoxy primers may be applied by spray or brush. The manufacturer's recommendations regarding the preferred method of application should be followed.

The following possible limitations to spray application should be taken into account.

- a) Possible hazards to health or safety (see [Annex A](#)). Ideally spray equipment should not be used in occupied buildings in circumstances where spray mist would create a nuisance.
- b) The need for extensive masking or protection of surfaces that are not to be coated, although this is influenced by the type of equipment used.
- c) Spray application on exterior work in windy weather can cause difficulties as spray mist can be carried considerable distances and can cause damage or nuisance. As in relation to b), the type of equipment used is a relevant factor.
- d) Generally, conventional primers for masonry and wood building surfaces should not be applied by spray. Exceptions to this include zinc-rich epoxy primers for metal surfaces and some specialist types which might be unsuitable for brush or roller application.
- e) Legislation requires volatile organic compound (VOC) levels to be calculated for solvent-borne paints when ready for application [6], and the majority of solvent-borne paints are supplied ready to use. Where solvent-borne paint requires thinning for spray application, the manufacturer should be consulted regarding thinning ratios and the maximum permissible VOC level.

5.7.4.2 Types of spray equipment

NOTE The following types of spray equipment are in general use for the site application of coating materials:

- a) *airless spray;*
- b) *air-assisted airless spray; and*
- c) *high volume low pressure (HVLV) spray.*

Modified forms of spray equipment include hot spray and electrostatic spray equipment, but these are not used to a significant extent for site work.

Thorough cleaning after use is especially important with spraying equipment as residues of previously used materials can affect later applications or impair the efficiency of the equipment.

5.7.4.2.1 Airless spray

NOTE In airless spray equipment, a fluid pump forces the material at very high pressure through a restricted orifice in the spray gun so that on release to the atmosphere the material immediately atomizes. Airless spray equipment is available in a wide range of sizes and capacities.

High rates of application can be achieved with airless spray equipment, and the absence of atomizing air means that there is almost no spray mist and consequently little waste of material or necessity for extensive masking.

Most types of coatings can be applied by airless spray, with the possible exception of those containing coarse aggregates or fibres, e.g. some masonry paints. Airless spray should be used for the application of high-build specialist coating materials as thicker films can be obtained compared with other spray techniques.

With some types of airless spray equipment, a separate source of compressed air is required to operate the fluid pump. When this is supplied by a compressor powered by a petrol or diesel engine, precautions should be taken in respect of exhaust fumes.

Because of the very high pressures involved, caution should be exercised when handling airless spray equipment; in particular, the spray gun should never be pointed towards any part of the body while the equipment is in operation.

5.7.4.2.2 Air-assisted airless spray

Air-assisted airless spray equipment should be used where fine control is required to deliver a superior finish.

NOTE Air-assisted airless spray combines some of the characteristics of high-pressure air and airless spray methods. A pump unit of similar type to that used for airless spray is employed, but it operates at a lower pressure. In addition, the spray gun is supplied with a small volume of air at low pressure. The benefits of air-assisted airless spray over traditional spray techniques include better application control, reduced spray mist and more economical use of the coating material.

5.7.4.2.3 HVLP spray

HVLP spray equipment should be used for detailed and controlled fine finish applications; it produces a fine finish with little material preparation and less thinning, and can dramatically reduce overspray.

NOTE HVLP spray is specially developed for on-site application and is ideal for use with stains, epoxies, lacquers and varnishes. The atomization of paint in the paint gun is managed automatically; the gun chooses the most appropriate air:fluid ratio based on the fan width needed.

5.7.4.3 Basic techniques

All masking and protection of adjacent surfaces should be completed before spraying starts.

NOTE Elaborate masking might be unnecessary when airless spray equipment is used; because of the virtual absence of spray mist or overspray, it is often possible to cut in by using a hand-held shield.

If masking tape is used in spraying, it should be removed as soon as possible after completion of the work. A sharp knife should be used to cut along the edges of the tape to prevent the coating film being pulled away with the tape.

Equipment should be checked to ensure that it is in good condition and working efficiently. The flow rate for the tip should not be greater than the maximum flow for the sprayer. Filters should be checked at regular intervals and if blocked, should be replaced. The spray gun should be compatible with the spray feed equipment being used; serious injury can result from the use of an inferior gun. Spray guns should be set up in relation to the coating material to be applied; reference should be made to the equipment or paint manufacturer's guidance in this respect. All hoses should be checked regularly for damage and replaced where necessary.

Paints and coating materials should be prepared for use as described in 5.6. It should not be assumed that paints for spray application necessarily need to be thinned. Unless the manufacturer's recommendations are to the contrary, or experience suggests otherwise, a trial application of unthinned paint should first be made. If thinning is necessary it should not exceed the manufacturer's recommendations; if excessive amounts of thinner are required to facilitate application, it is likely that the equipment is unsuitable or is not operating correctly.

When spraying, the gun should be held at right angles to the surface, horizontally and vertically. In air spraying, the distance between the front of the gun and the surface should be between 150 mm to 200 mm; in airless spraying, the distance should be between 300 mm to 375 mm. These distances should be maintained as the gun is moved across the surface, i.e. it should not be swung or moved in an arc. Each stroke should be made at a constant rate to maintain a uniform thickness of coating. The trigger of the spray gun should be pressed just before the start of each stroke and released just before it is completed. With air spray guns, the trigger movement should be gentle and progressive, but with airless spray guns it should be firm and abrupt. Each stroke should overlap the previous one to ensure uniform coverage; overlap by 50% is recommended.

5.8 Application of multi-coat systems

5.8.1 Intervals between application of successive coats

NOTE 1 Manufacturer's recommendations can include minimum and maximum intervals for overcoating.

Generally, each coat in the system should be dry throughout its thickness before the next coat is applied.

Except with coating materials formulated for lengthy exposure without further coats, such as some primers for metal and wood, intervals between coats should not normally exceed a few days, otherwise adhesion might be impaired.

NOTE 2 Atmospheric conditions can affect the rate of drying and, in consequence, the interval between coats. Some coating materials might be suitable for wet-on-wet application, i.e. a second coat can follow immediately.

5.8.2 Intercoat preparation

It should be ensured that the surface is clean and dry before application of each coat in the system.

NOTE 1 This is important if there has been a lengthy interval between coats especially in situations where contamination of the surface is likely, e.g. in marine or industrial environments.

In general, light abrasion with fine-grade, preferably part-worn, abrasive paper is sufficient to remove nibs and adherent dust particles but care should be taken not to scratch or tear the coating material.

NOTE 2 Plastic abrasive pads (typically nylon) are also well suited for denibbing.

If abrasion tears the coating or the abrasive paper rapidly clogs, the coating should be left to cure for longer before abrading.

NOTE 3 Vigorous abrasion between coats is rarely necessary to assist intercoat adhesion except when the previous coating has exceeded the time limit stated by the manufacturer.

If extensive flattening of a previous coat is necessary to assist adhesion or provide a smooth level surface, wet abrasion with waterproof abrasive paper and water is usually the most effective method, but the coating should be hard before it is attempted.

5.8.3 Differing colours

The manufacturer's recommendations with respect to the colours of undercoats and first-coat colours should be followed.

5.9 Defects troubleshooting

5.9.1 Defective materials

If, during the course of the work, it appears that the coating material might be defective, no more should be applied until the matter has been investigated by the manufacturer or supplier.

NOTE To continue to apply coating material which might be defective can involve additional costs for which compensation could not justifiably be claimed from the manufacturer or supplier even if the material proves to be defective.

5.9.2 Coating film defects arising during, or shortly after, application

NOTE The more commonly encountered defects, typical causes and considerations in respect of remedial treatment can be found in Table 2 for those arising during or shortly after application. See Table 5 for those arising after a period of exposure.

The information in Table 2 should be used to assign a treatment for paint film defects arising during or shortly after application.

Table 2 — Coating film defects arising during, or shortly after application

Defect	Typical causes	Remedial treatment
Bleeding	Solvent or water reactive or extractable stain, timber extractives, nicotine, tar or bitumen	Remove as much contamination as possible, seal with stain block primer, alkali-resisting primer or aluminium wood primer.
Blooming, or milky appearance usually on gloss paint, also slight matting of the gloss	Cold temperatures, high humidity and/or moisture during the drying process of the paint. Usually associated with winter months	Abrade and recoat.
Ropiness (brush marks)	Poor flow of the paint, over brushing, rapid drying, etc.	Abrade and recoat.
Cissing or fish eyes (appearance of voids in paint film whilst wet)	Surface contamination, wax, grease, can also occur when applying incompatible paint over poorly prepared surface, e.g. water-borne paint over oil-based paint	Remove as much contamination as possible, degrease, abrade thoroughly and recoat. Ensure application tool is also free from contamination.
Sleepy gloss (low sheen)	Contamination, e.g. wax or sinkage into substrate due to incorrect or insufficient primer or undercoat	For medium density fibreboard, abrade and then apply a water-borne acrylic primer as described in B.3/2, then recoat. Other surfaces might simply require recoating.
Halo effect (flashing arising where paint has been touched up)	Trying to "touch up" areas, especially sheen paints, but can occur with all paints	Re-paint the whole area or to the nearest visible cut-off point.
Flashing	Losing the wet edge of the paint during application	Re-paint the whole area or to the nearest visible cut-off point, ensuring the wet edge is maintained. For water-borne paints only, reduce ventilation and airflow so that humidity is increased to assist with extending wet edge time.

Table 2 (continued)

Defect	Typical causes	Remedial treatment
Roller marking (visible mark between tracks of the roller)	Roller stipple folding over in a different way depending on whether application was an upstroke or a downstroke. Often only visible when viewed under oblique lighting conditions. More noticeable when the wet edge has started to dry	Re-paint the whole area or to the nearest visible cut-off point, ensuring the wet edge is maintained. Lay-off in one direction. Possibly thin water-borne paint so that roller stipple flows out more readily.
Curtains, runs, sagging, floatation of pigment	Over application, i.e. too much paint applied unevenly	Allow excessively thick areas to harden, sometimes scraping off excess thickness will be required. Abrade and recoat.
Cracking/crazing	Usually associated with applying a fairly brittle paint over a highly flexible layer, i.e. matt over silk	Abrade, correctly prime, i.e. alkali-resisting primer, and recoat. Severe instances might require lining paper.
Pickling (looks like wrinkling)	Solvent attack, i.e. applying chlorinated rubber paint over a conventional paint. Solvents act as a stripper	Complete removal of all affected coatings might be required.
Wrinkling, rivelling, shrivelling	Application too thick, usually gloss paints. The paint layer skins over but remains wet underneath. Can also be caused by overcoating before previous layer is dry	Allow affected areas to harden, then abrade with wet and dry abrasive paper to smooth, and recoat.
Rainspotting (also known as pitting)	Rain/water attack during the drying phase	Wet abrade to smooth, and recoat.
Bittiness	Contaminated paint, dusty atmosphere, substrate not clean, application tool not clean	Abrade, recoat, ensure application tools are clean, strain the paint.
Orange peel effect	Application by roller without laying off the paint with a brush (such as applying gloss to doors). Poor atomization when spraying	Wet abrade to smooth, and recoat using correct method and adjustment.

5.10 Inspection, sampling and testing

Finished paintwork should be inspected in accordance with [Clause 10](#).

In cases of dispute, sampling and testing of materials should be carried out if required for either of the following reasons:

- a) to ensure compliance to specification and the use of correct materials; or
- b) as a safeguard against over-thinning, adulteration or similar practices during application.

In either case, samples should be taken or set aside for examination by the specifying authority.

For the reason indicated in a), samples should be in the original unopened containers. In respect of b), samples should be taken during application, e.g. from painters' kettles or spray equipment containers. At least two samples should be taken, one for testing and one for the contractor; it might be advisable to take additional samples for submission to the manufacturer if this subsequently proves to be necessary.

NOTE Arranging testing is generally the responsibility of the specifying authority who might contact the manufacturer for assistance.

Samples should be compared against a reference manufacturer's specification and/or wet standard and any discrepancies should be identified and recorded.

5.11 Clean up and waste disposal

NOTE 1 See also [Annex A](#) on health and safety.

The Technical Data Sheets and Health and Safety Sheets from paint manufacturers will include recommendations for cleaning and the safe disposal of paint. Recommendations will differ from a decorative paint to more specialist industrial coating materials and therefore if in doubt, further information should be sought from the manufacturer.

When cleaning the tools used, effort should be made to remove as much paint or coating material as possible.

Equipment should be cleaned promptly with warm water or cleaning agents. To avoid emptying waste into a drain, the waste water should be stored in sealable containers and disposed of in accordance with local authority requirements.

NOTE 2 Some local authorities provide paint waste disposal facilities. There are a number of initiatives and outlets that accommodate waste paint for reuse or recycle which aims to reduce the impact of waste through can and container disposal. The BCF PaintCare website, for example, has further information on the reuse of decorative paints, www.paintcare.org.uk².

To avoid generation of additional waste, equipment and tools should be stored in a resealable, airtight container if the intention is to use them again the next day.

6 Surface inspection

Surfaces should be in a fit condition to allow work to proceed without detriment to the paint and coating materials to be applied, especially with regard to the moisture content of the surface. Work by other trades that might affect painting should have been completed. If some time has elapsed since preparation of the specification, any change in the nature or condition of the surfaces that might necessitate modification of the specification should be drawn to the attention of the specifier.

Factory-primed components should be inspected to ensure that the condition of the primer is satisfactory; if it is not, remedial action should be taken (see [Clause 9](#)).

For maintenance projects, the form and extent of any deterioration that has occurred influences the nature of the preparatory work necessary and, in many instances, the selection of coating types and systems. Its significance should be assessed in relation to the functional requirements.

Causes of deterioration should be investigated, unless they are obvious, so that corrective action can be taken. Where there are differences in deterioration, patch-painting should be considered.

Where unusual or rapid deterioration is apparent, expert investigation and advice should be sought in order to upgrade the specification if necessary.

² Last accessed 20 March 2019.

7 Environmental conditions

7.1 Exposure conditions

General and local exposure conditions and the conditions of service should be taken into consideration when selecting coating systems as they can have a significant influence on the suitability of materials.

NOTE A broad distinction can be made between external and internal exposure conditions but, in either, there can be considerable variation in the severity of local environmental conditions or micro-climates, even within a single building.

Externally, the main variables are location, proximity to the coast and level and nature of atmospheric pollution but elevation, aspect and the direction of prevailing winds can also have a significant effect. Internally, high humidity and the presence of process chemicals and dust can create severe conditions.

The factors in [Table 3](#) indicating the broad categories of external and internal exposure conditions should be considered. [Table 3](#) is intended to provide general guidance; it is not possible to take into account the many local variables that can influence the nature of the exposure conditions and the selection of coating systems in specific circumstances.

Table 3 — Exposure condition categories (as defined in BS EN ISO 12944-2:2017)

Severity of exposure	Corrosivity category	External	Other external factors	Internal	Other internal factors
Mild	C1 (very low)	–	–	Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels and domestic situations	Light soiling, abrasion or handling of surfaces
	C2 (low)	Inland areas (more than 10 km from the coast), non-industrial with low levels of pollution and average rainfall	–	Unheated buildings where condensation might occur, e.g. depots, sports halls	–
Moderate	C3 (medium)	Urban and industrial atmospheres, moderate sulfur dioxide pollution. Coastal areas with low salinity	–	More frequent moderate condensation, e.g. in kitchens, bathrooms, washrooms etc. Production rooms with high humidity and some air pollution, e.g. food-processing plants, laundry services, breweries, dairies	Moderate soiling, abrasion and handling of surfaces

Table 3 (continued)

Severity of exposure	Corrosivity category	External	Other external factors	Internal	Other internal factors
Severe	C4 (high)	Industrial areas and coastal areas with moderate salinity. Coastal ship- and boatyards	Areas with a driving rain index of 7 or more (see BS 8104 for further information)	Exposure conditions subject to frequent high humidity or heavy condensation, especially if pollutants, e.g. sulfur dioxide or ammonia, are present. Chemical plants, swimming pools	Exposure conditions in which heavy soiling or hygiene requirements necessitate frequent cleaning of surfaces. Surfaces subject to heavy abrasion or impact
Very severe	C5 (very high industrial or coastal onshore)	Industrial areas with high humidity and aggressive atmosphere, or coastal with high salinity	–	Buildings or areas with almost permanent condensation and with high pollution and/or high salinity	Surfaces in contact with chemicals, chemical solutions, process liquors and other aggressive agents
	CX (offshore)	Offshore areas with high salinity	Classification used only for offshore areas	–	–

NOTE For wood, the exposure conditions are better classified in accordance with BS EN 927-1, which takes into account the construction and the climate.

7.2 High humidity

Most paints are resistant to the levels of humidity normally encountered internally in the majority of domestic and non-industrial situations. Where conditions of moderate or high humidity prevail intermittently, as in kitchens and bathrooms, only resistant paints and coating materials should be used.

NOTE This will include most solvent-borne paints and some water-borne paints (see [Table B.1](#)).

The processes or activities carried out in some buildings can give rise to conditions of constant or frequent high humidity or cause surfaces to be splashed with water. Examples of where such conditions might prevail include kitchens, bathrooms, swimming baths, laundry services and factories engaged in the manufacture of food and drink, paper and synthetic and natural fibres. In these conditions, and especially for the protection of steel, wood and other substrates vulnerable to attack by moisture, specifically moisture-resistant paints and coating materials should be used.

Moisture-resistant protective paints and coating materials should be applied in accordance with the manufacturer's recommendations with regard to thickness, preparation and priming.

7.3 Condensation

Condensation should be prevented or controlled by providing good ventilation to remove moisture-laden air from buildings, preferably from a point near the source of moisture. Adequate levels of heating increases the capacity of the air to hold moisture but should be combined with good ventilation, otherwise the problem is aggravated.

NOTE 1 Thermal insulation also helps to reduce condensation by keeping surfaces warmer and reducing the cost of heating.

NOTE 2 Most condensation in buildings is caused by warm, moist air coming into contact with cooler surfaces. In domestic and non-industrial buildings, condensation is usually light and intermittent although, in some situations, it can be sufficient to cause water runs and drips, disfigure paintwork or promote mould growth. In dwellings, condensation is most likely to occur in kitchens and bathrooms, but water vapour can be carried by air currents through the house from these rooms and condense on cold surfaces in unheated areas. Guidance on designing to avoid condensation in new buildings and remedial measures in existing buildings is given in [BS 5250](#).

Paint treatment alone should not be used as an alternative to heating, ventilation and thermal insulation measures but, where condensation is moderate and occurs only intermittently, anti-condensation paints can be used.

Anti-condensation paints usually contain aggregates with insulating or absorptive properties. Some coating materials have a textured surface that helps to reduce water runs and drips, but these tend to hold dirt and are not easily cleaned. Absorptive types should be used only in situations where it is expected that condensation will be followed by conditions favourable to drying out absorbed moisture.

As in [7.2](#), where the function of a building gives rise to conditions of constant or frequent high humidity and measures to prevent or reduce condensation are impracticable or not fully effective, priority should be given to the protection of substrates vulnerable to moisture attack by using specifically moisture-resistant protective paints and coating materials, as recommended by their manufacturers.

7.4 Atmospheric pollution

In industrial situations, fumes can retard the drying or cause discoloration of conventional coatings; in severe cases, it might be necessary to use modified or specialist coating materials, and the manufacturer should be consulted.

The adhesion and drying of coating materials is impaired by the deposition of contaminants, including salt in marine situations. Where this occurs, surfaces should be suitably prepared according to the manufacturer's recommendations and cleaned thoroughly before application of each coat. Intervals between coats should be as short as possible (see also [5.8.1](#)).

NOTE The effects of fumes and the deposition of contaminants are likely to be most severe in foggy weather and in conditions of high humidity.

Painted surfaces subjected to heavy soiling and/or pollution from external sources, such as road traffic, sea salt, local industry, guano, etc., should be cleaned regularly and might require more frequent painting.

7.5 Mould growth

NOTE 1 Typically, mould has a black, sooty appearance and might be mistaken for dirt although some moulds are coloured. It is often possible to distinguish mould from dirt and chemical stains by examination with a magnifying glass (x 10 or higher) when the filaments of most moulds might be seen.

NOTE 2 Moulds germinate and grow when the relative humidity at a surface rises above 80% and where there is a supply of nutrients.

Mould growth should be avoided by:

- a) ensuring the relative humidity does not exceed 70%. Because of its dependence upon a supply of moisture, the growth of mould is most effectively inhibited by reducing humidity and preventing condensation by good ventilation, adequate heating and thermal insulation, as indicated in [7.3](#); or
- b) applying a suitable moisture-resistant protective coating material as recommended by the coating material manufacturer and sterilizing the surface by application of a fungicidal wash

at regular intervals. Proprietary washes containing fungicides are available, and some leave an inhibitive residue on the surface; a solution of household bleach also kills mould but does not have any residual inhibitive properties; or

- c) applying mould-resistant paints in domestic and non-industrial situations. When mould-resistant paints or washes are to be used where foodstuffs are prepared or stored, it should be ensured that there is no risk of food products being contaminated with toxic substances or their flavours affected. Mould-infected previously decorated internal surfaces should be treated in accordance with [9.1.3](#) before painting.

NOTE 3 Mould-resistant paints usually contain mould-inhibitive additives. Some more toxic mould-inhibitive additives might not be suitable for use in situations where foodstuffs are processed.

NOTE 4 Further information on mould growth and its treatment is given in BRE Digest 370 [7].

7.6 Chemical attack

NOTE Coating materials are likely to be chemically attacked by high concentrations of acids and alkalis, acidic and alkaline substances, alcohols, oils, fats and greases, solvents and fresh and salt water.

Where there is a need for resistance to heavy fume attack or direct contact with chemicals, chemical-resistant coating materials should be used.

The resistance of any of the coatings described in [Table B.1](#) is dependent on the specific agent and the form and severity of attack. When there appears to be a need for a chemical-resistant coating material, specialist advice should be sought unless there is previous experience of the satisfactory performance of a particular type of coating material in similar circumstances.

7.7 Fire

NOTE For further information on fire, see [Annex D](#).

7.7.1 General

NOTE A conventionally painted surface is considered as a thin film of flammable material in close contact with a substrate. However, a first application of paint would not normally affect the flammability of the unpainted surfaces. The potential for the release of flammable volatiles (and therefore for a fire to spread) is a function of the nature of the substrate, the nature of the paint film itself and the thickness and number of coats.

In addition to conventional decorative paints, flame-retardant and reactive fire coating materials are also available. Flame-retardant coating materials are specially formulated to reduce the spread of flame. Reactive fire coating materials are formulated to swell under high temperature to maintain the structure of the building.

If a specific fire classification is sought, the paint system and application techniques for this should be professionally specified. Manufacturers should be consulted regarding specialist products and application to be used.

7.7.2 Resistance to surface spread of flame

NOTE 1 Attention is drawn to the Building Regulations 2010 [8], the Building (Scotland) Regulations 2004 [9], and the Building Regulations (Northern Ireland) 2012 [10] regarding construction materials conforming to minimum requirements in relation to the spread of flame across surfaces when tested as described in the relevant parts of BS 476. See also [Annex D](#). Surfaces of wood and wood-based construction materials can have an enhanced reaction to fire classification conferred by factory-applied impregnation treatment or by application of flame-retardant paint. Paint is not regarded as a material of construction and is not subject to the Building Regulations. However, flame-retardant paints are regarded as a material of construction and are subject to the Construction Products Regulation [11].

Flame-retardant paints should have a reaction to fire classification in accordance with BS EN 13501-1 (or the relevant parts of BS 476). Flame-retardant paints should be applied so as to achieve the film

thickness or surface loading recommended by the manufacturer. Reference should be made to the manufacturer's details of the ratings of their paints when applied to specified substrates.

NOTE 2 The flame spread rating of paint cannot be expressed in isolation but only in relation to its performance on a specified substrate.

NOTE 3 Attention is also drawn to the ETAG 028 Guideline for European Technical Approval of Fire retardant products [12].

Conventional paints should not be applied over flame-retardant surfaces, unless specifically recommended by the manufacturer of the flame-retardant paint or treatment. In such instances, details of systems applied, including dates of application and types or brands of paints used, should be recorded for future reference.

7.8 Resistance to abrasion

NOTE 1 Paints and coating materials resistant to abrasion might be required for floors, machine surfaces, storage racks and bins, handrails and similar items, especially in factories and commercial buildings. There might also be a need for wall and ceiling finishes to be resistant to frequent vigorous cleaning in such places as dairies, abattoirs and food preparation areas.

Pigmented and clear two-pack epoxy and polyurethane coating materials should be used where resistance to abrasion is a major consideration, but their use might be limited by the nature of the substrate or the conditions of application.

NOTE 2 The modified one-pack types, although lower in abrasion resistance, can also be used, as they are subject to fewer restrictions in use and perform reasonably well in many situations; one-pack epoxy ester types, for example, can be used as floor and deck paints, often with a non-slip additive. Some modified alkyd paints are reasonably resistant to abrasion and can be used for painting machinery and similar applications. Multi-colour finishes (see B.4/9) can be used for walls in many interior hard wear situations.

8 Material selection

8.1 General

Materials used in the painting of buildings can be divided into two main categories:

- a) coating materials, e.g. primers, undercoats, paints, varnishes and wood stains; and
- b) ancillary materials, e.g. cleaning agents, fillers, stoppers and materials similarly used in the preparation of surfaces or in coating systems.

NOTE 1 Materials can be selected from the tables given in [Annex E](#) to [Annex G](#).

Material selection should also take into account the environmental impacts of paints, including the emission of VOCs and waste disposal (see [Annex A](#)).

NOTE 2 There are a number of ways to assess the overall environmental impact of a paint covering composition, production and supply to the painter. These include Environmental Product Declarations (EPDs) and the forthcoming European approach termed Product Environmental Footprint (PEF).

NOTE 3 Material selection in the construction industry plays a prominent role in reducing environmental impacts of built assets; sustainability rating schemes such as BREEAM (BRE Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design) promote and reward sustainability approaches such as the specification and installation of products in a way that minimizes the impact on the health and wellbeing of occupants.

8.2 Selection of coating systems

8.2.1 General

A number of parameters should be considered when selecting coating systems. These are listed in [Table 1](#). Selection should be made by judging the relative importance of the factors in relation to particular circumstances. There is a considerable degree of interaction between factors involved, and they should not be considered in isolation. The selection of coating systems for the target substrate should be determined by consulting the coating material manufacturers and referring to the relevant information in [Clause 9](#).

Care should be taken to ensure that parameters are comparable; lower initial costs might well be more than outweighed by reduced durability (shorter life) and consequent higher maintenance expenditure. In other circumstances, a single factor might exert so strong an influence that selection is limited to a single type of system.

For new build, there are dominant economic and operational factors for the choice of substrates and methods of construction. Specific coating materials might be required for aesthetic and/or protective reasons but should not be expected to upgrade the performance of incorrectly specified building materials.

For maintenance projects, where the coating materials used previously have performed satisfactorily, materials of similar type should be considered as a preference.

Where previous performance has not been satisfactory, the reasons for this failure should be established before material selection.

NOTE Possible reasons for coating materials failing include:

- a) application to new wet substrates, e.g. plaster, concrete, brickwork and similar materials;*
- b) inadequate or incorrect preparation of surfaces;*
- c) low film thickness in protective coating systems;*
- d) adverse conditions, e.g. of temperature or humidity during application;*
- e) poor application;*
- f) use of poor quality materials;*
- g) use of unsuitable materials.*

The type of coating material used might have proved unsuitable either because the original requirements were not correctly appraised or because of subsequent changes in the exposure conditions, conditions of service or function.

Where the failure is linked to new wet substrate, this does not necessarily imply a need to use a different type of material, provided drying out is complete and the surface is correctly prepared. However, where a permeable type of coating material was used for initial treatment, functional requirements might indicate a change to a material more resistant to washing or wear.

Where faulty performance is attributable to poor workmanship or material quality, corrective action should be taken in respect of procedures or quality of material rather than a change in the type of coating material.

Because of the diversity of conditions, substrates and coating materials, especially in relation to chemical resistance, it is possible to provide only a general indication of the types of paints and coating materials that might be suitable. For detailed recommendations in specific circumstances, specialist advice should be sought.

8.2.2 Volatile organic compounds (VOCs)

Paint VOC content is stated on labelling and manufacturers' data sheets, including maximum permitted level by category. Precautions should be taken when using paints that contain high levels of VOCs (for example, solvent-borne paints, see [Annex A](#) for further details), as breathing in these vapours can be harmful, depending on the quantities inhaled.

NOTE 1 VOCs are chemical substances that contain carbon and have a vapour pressure above 0.01 kPa at room temperature (20 °C), and/or can become gases when heated to temperatures up to 250 °C. All liquid paints contain VOCs – solvent-borne paints contain relatively high levels, whereas the current water-borne decorative paints used for painting buildings generally have minimal VOC content.

NOTE 2 Maximum VOC content limit values apply for paints and varnishes according to UK SI 2012-1715 [6].

NOTE 3 The VOC testing standard for decorative paints is BS EN ISO 11890-2, or BS EN ISO 11890-1 for paints with >15% VOC content.

8.2.3 Compatibility of coating materials

The compatibility of the coating materials selected should be confirmed prior to application.

NOTE 1 It is essential that the individual coats in the system are mutually compatible. Compatibility is influenced mainly by the composition and physical properties of each of the coating materials in the system and, to some degree, by their juxtaposition and age. Incompatibility can be a cause of poor adhesion between coats in a system.

Compatibility problems are less likely to arise with systems comprising coating materials of similar composition and properties but, even with these, slight variations in the same types of coating materials from different manufacturers can adversely affect the performance of the system.

All the coating materials in a system should be from the same manufacturer and should be used in accordance with the manufacturer's recommendations regarding the sequence and number of coats.

The manufacturer's advice should be sought if there are doubts as to compatibility of old and new coating materials, and small-scale trials might be appropriate prior to commencing the project.

It can be difficult to identify existing coatings by type, especially in older buildings. Where identification is necessary, either simple site tests, e.g. the reaction of the coating material to solvents of various types, or in other cases, laboratory examination should be undertaken to provide the information.

NOTE 2 The following are typical of circumstances that might require consideration.

- a) Application of water-borne coatings over solvent-borne coatings. Adhesion might be poor, especially in conditions of high humidity and when applied to glossy surfaces (this can be improved by abrading the surface).*
- b) Application of solvent-borne coatings over water-borne coatings. This does not usually present a problem if the existing coating is sound and firmly adhering, but a primer-sealer might be required on highly pigmented or absorbent coatings.*
- c) Application of specialist coating materials, e.g. two-pack epoxy or polyurethane types, over drying-oil/resin coatings. This might be possible if the existing coating is sound, hard and aged, but there is a risk that softening, cracking or lifting will occur.*
- d) Application of drying-oil/resin coating materials over metallic zinc-rich primers. It is recommended that advice is sought when drying-oil/resin coating materials are to be used over metallic zinc-rich primers.*
- e) Application of all types of coating materials over bituminous coatings.*

8.2.4 Components of coating systems

8.2.4.1 General

NOTE 1 A coating system comprises at least two coats of either the same material or a sequence of coats of differing type, typically primer, undercoat and a finish (or topcoat).

If the existing coating is generally in sound condition and materials of similar type and colour are to be used for repainting, either one undercoat and one coat of finish, or two coats of finish, as appropriate, usually provides a satisfactory result. Allowance should be made for bringing forward localized areas from which the old paint has been removed.

Additional coats might be required if a pronounced colour change is to be made, especially if the change is from a dark colour to a lighter colour. Additional coats might also be necessary with some bright or strong colours; manufacturer's advice should be sought if in doubt.

NOTE 2 For some types of finish one coat might suffice e.g. on internal work in good condition and where the same or a similar colour is to be used.

Surfaces from which the old coating has been removed completely should receive a full coating system as prescribed by the coating material manufacturer.

8.2.4.2 Primers and sealers

Primers should be used to secure good adhesion to the surface to which a coating system is to be applied, and thus provide a base to which the succeeding coats will adhere.

NOTE 1 Primers may also be used to:

- a) prevent undue absorption of binder from the subsequent coats, leaving them underbound or lacking in gloss on absorbent surfaces, such as wood, lightweight blocks, plaster and many building boards;*
- b) penetrate porous substrates such as wood and masonry to improve adhesion and other performance factors;*
- c) inhibit metal corrosion, especially iron and steel;*
- d) reduce the risk of attack on subsequent coats on surfaces of an alkaline nature, such as concrete, cement rendering, asbestos-cement and some types of plaster;*
- e) protect surfaces in the interval between erection or fixing and application of the complete coating system on new wood, metal and other materials exposed to attack by moisture or other adverse elements.*

Examples of primers include:

- 1) aluminium-pigmented primers that can be used as wood primers and also as sealers for bituminous surfaces other than wood and smoke affected surfaces;*
- 2) primer-sealers for powdery or friable surfaces or for plaster and similar surfaces of high or variable porosity;*
- 3) protective coating materials, usually unpigmented, e.g. clear sealers for metal-sprayed steel and some multi-coloured finishes.*

NOTE 2 Sealer is a term often loosely applied to coating materials which might combine some of the functions of primers described in a) to d) with other functions, or which might be used for purposes other than priming.

NOTE 3 Well-thinned first coats of water-borne paint might be needed on plaster of high or variable porosity. These are sometimes referred to as sealing or mist coats.

Care should be taken when paints are intended to be used over metallic zinc-rich primers that are not compatible, e.g. drying-oil/resin coatings and intumescent coatings. Advice should be sought from the manufacturer when such coating materials are intended to be used over metallic zinc-rich primers.

8.2.4.3 Undercoats

Undercoats should be used to provide a uniformly opaque base of a colour appropriate to that of the finish.

NOTE 1 They also contribute to the thickness, filling properties and cohesion of the paint system.

The manufacturer's recommendations regarding the use of undercoats should be observed.

NOTE 2 In some circumstances, undercoats might not be needed, or can be replaced in part by additional coats of finish. Many solvent-borne matt or mid-sheen finishes, for example, can be applied direct without undercoats to primed or previously painted surfaces.

Solvent-borne gloss finishes are usually applied over undercoats, but in three-coat systems on primed or previously painted surfaces, with the manufacturer's approval, a system of one undercoat and two coats of gloss finish should be used in preference to two undercoats and one coat of finish for greater durability externally or in severe internal exposure conditions.

Where necessary, the use of special undercoats should be covered in the painting specification.

8.2.4.4 Finishes and topcoats

The finish (or topcoat) is the final coat in the system and should be selected to provide the final required colour, degree of gloss, texture or other surface attributes, including resistance to weather, chemical attack and mechanical damage. The finish should not be used to compensate for deficiencies in preceding coats in the system, whether these relate to quality, suitability, compatibility or application.

Where necessary, the use of additional finishing coats should be covered in the painting specification.

8.3 Ancillary materials

8.3.1 General

Ancillary materials should be used in order to prepare the surface to an adequate standard for subsequent painting.

NOTE Possible paintwork defects that might be encountered during and after application and the recommended remedial treatment for these can be found in [Table 2](#) and [Table 5](#).

8.3.2 Cleaning agents

NOTE Surface cleanliness is essential to the performance of coating systems. Detergent solutions are usually adequate for normally soiled surfaces.

All residues should be completely removed prior to applying the coating system. For removal of oil or grease, appropriate specialist cleaning solutions should be used.

8.3.3 Sterilizing washes

Surfaces contaminated with mould or algal growths should be treated before coating materials are applied. Household bleach solutions are often effective in killing the growths but, in severe cases, proprietary mould-inhibitive washes should be used to prevent their reappearance. All residues, including chemicals and dead mould/algal spores should be completely removed prior to applying the coating system.

8.3.4 Knotting

Specialist knot sealers should be used to hold back resin, tannin and other stains, which could discolour wood coatings on some wood species (see [9.2](#)).

NOTE The most common problems are associated with knots in the wood. The problem is most acute with white water-borne finishes.

Where knotting is used to retard discoloration of light-coloured opaque finishes, a quick-drying solution in accordance with [BS 1336](#) (e.g. of shellac in industrial methylated spirit) should be applied to knots or resinous areas in wood before priming. Two coats are more effective than one, however knotting is not likely to be completely effective in cases of resin exudation.

8.3.5 Stoppers and fillers

Stoppers and fillers should be used to fill cracks and holes in wood or masonry surfaces. The manufacturer's recommendations should be followed when selecting an appropriate stopper/filler.

NOTE General purpose stoppers/fillers are usually water-mixed and comprise the following.

- a) *Water-borne fillers. These are usually based on vinyl or acrylic resin dispersions and are supplied in paste form, ready for use.*
- b) *Powder fillers. These are supplied in powder form for mixing with water and are usually based on water-soluble cellulose and gypsum or white Portland cement. Those containing gypsum are suitable for general use as stoppers and fillers in dry interior situations.*

Powder fillers are not usually suitable for use for external work, especially on wood, but the manufacturer's recommendations in this respect should be observed. Portland cement (CEM 1) types are suitable for external use on masonry surfaces and should not be used on woodwork.

Where water-borne fillers are used, the manufacturer's recommendations, especially regarding suitability for exterior use, should be observed. It should be noted that some exterior grades contain coarse particles, making the attainment of a fine finish difficult.

Linseed oil putty should not be used as a stopper.

For stopping deep holes in woodwork, proprietary materials based on two-pack polyester or epoxy resins can give good performance but only a grade supplied specifically for use on wood should be used.

Surface fillers formulated specifically for use on timber should be used when a high standard of finish is required, especially with solvent-borne paint systems. They are supplied ready for use as smooth, finely ground, creamy pastes, and should be applied with a wide filling knife or spatula.

8.3.6 Mastics and sealants

Mastics and sealants are mainly used for the repair or replacement of external pointing between window or door frames and adjacent masonry. They do not need to be over-painted, except for one-pack, non-elastic types, which should be over-painted. Silicone mastics and sealants should not be over-painted.

8.3.7 Water repellents

Water repellent solutions, for example, water-borne silane/siloxane water repellents, should be used when rain penetration of walls has caused internal dampness.

NOTE This type of product allows moisture to escape through the wall as vapour, so minimizing internal dampness due to possible condensation.

9 Substrates

NOTE The coatings referred to in this clause are generally those of conventional type and described in the tables in [Annex E](#) to [Annex G](#), but [Clause 7](#) describes some functions and situations for which specialist coatings or modified conventional coatings might be necessary.