

BRITISH STANDARD

Painting of buildings – Code of practice

ICS 87.020, 91.180



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Contents

Foreword *iv*

1	Scope	1
2	Normative references	2
3	Terms and definitions	3
4	Design considerations	4
4.1	General	4
4.2	Accessibility	4
4.3	Control of moisture	5
4.4	Profiles	5
4.5	Selection of materials	5
4.6	Selection of coating system	6
5	Organization of work	37
5.1	General	37
5.2	Health and safety	37
5.3	Order of working	38
5.4	Scaffolding and equipment	38
5.5	Supply of materials	38
5.6	Storage of materials	38
5.7	Protection of components on site	39
5.8	Off-site work	40
5.9	Workforce and supervision	40
5.10	Inspection procedures	41
5.11	Materials sampling and testing	41
6	Exchange of information	41
6.1	General	41
6.2	Specification	41
6.3	Bills of quantities	42
6.4	Schedules	43
6.5	Drawing	43
6.6	Records	43
7	Materials	43
7.1	Functions of coatings	43
7.2	General properties of coatings	44
7.3	Components of coating systems	46
7.4	Ancillary materials	48
8	Substrates and coating systems	50
8.1	Wood	50
8.2	Wood-based panels products	59
8.3	Iron and steel	62
8.4	Non-ferrous metals and metallic coatings	68
8.5	Plaster, external rendering, concrete (including lightweight and autoclaved aerated blocks), brick and stone – General considerations	75
8.6	Plaster	80
8.7	External renderings	82
8.8	Concrete	83
8.9	Brick and stone	85
8.10	Precast concrete blocks	86
8.11	Cement-based sheets, boards and components	88
8.12	Paper and wallcoverings including plasterboard	89
8.13	Plastics	91
8.14	Glass and inorganic glazed surfaces	93

8.15	Bituminous surfaces and materials	95
9	Application and practice	96
9.1	Conditions of application	96
9.2	Craft procedures and practices	98
9.3	Application methods	103
10	Inspection, sampling and testing	111
10.1	General	111
10.2	Inspection	111
10.3	Sampling and testing	114
11	Maintenance	116
11.1	General	116
11.2	Factors affecting decisions on maintenance	117
11.3	Selection of coating systems for maintenance	119
11.4	Organization of maintenance work	121
11.5	Preparation of painted surfaces	121
11.6	Application	129

Annexes

Annex A (informative) Types of coatings		130
A.1	General	130
A.2	Conventional coatings	130
A.3	Specialist coatings	130
A.4	Factory-applied coatings	131
Annex B (normative) Health and safety		131
B.1	Hazards	131
B.2	Injury to eyes and skin	134
B.3	Fire and explosion	135
B.4	Noise	136
B.5	Spillages	136
B.6	Waste disposal	136
Annex C (informative) Wood		136
C.1	Design considerations	136
C.2	Characteristics	137
C.3	Wood-based panels products	142
Annex D (informative) Fire		144
D.1	General	144
D.2	Fire behaviour of coating and substrate	144
D.3	Fire testing and classification of construction products with coating films	145
Annex E (informative) Anti-graffiti treatments		146
E.1	General	146
E.2	Removal	147
E.3	Prevention and damage limitation – anti-graffiti coatings	147
Annex F (informative) Constituents of coatings		149
F.1	General	149
F.2	Binders	149
F.3	Solvents and thinners	152
F.4	Pigments	153
Annex G (informative) Paint colours		154
Annex H (informative) Iron and steel		155
H.1	Characteristics	155
H.2	Cast iron	155
H.3	Wrought iron	155

Annex I (informative) Plaster	156
I.1 General	156
I.2 Lightweight plasters	156
Annex J (informative) Paper and wallcoverings	157
J.1 General	157
J.2 Plasterboard	157
Annex K (informative) Bricks, stone and concrete blocks	158
K.1 Bricks and stone	158
K.2 Concrete blocks	159
K.3 Cement-based sheets, boards and components	159
Annex L (informative) Conditions of application (temperature and humidity)	161
Bibliography	162

List of Tables

Table 1 – Selection of coating systems	12
Table 2 – Exposure condition categories	13
Table 3 – Primers for wood	14
Table 4 – Primers for metal	15
Table 5 – Miscellaneous primers	16
Table 6 – Undercoats	16
Table 7 – General pigmented finishes	17
Table 8 – Transparent and semi-transparent finishes for interior wood	20
Table 9 – Transparent and semi-transparent finishes for exterior wood	20
Table 10 – Bituminous and tar-based coatings	21
Table 11 – Specialist coatings	22
Table 12 – Coating systems for interior wood	23
Table 13 – Coating systems for exterior wood	24
Table 14 – Paint systems for iron and steel except heated surfaces	26
Table 15 – Site pre-treatment and priming of non-ferrous metals and stainless steel (not factory pre-treated)	27
Table 16 – Coating systems for internal plaster, concrete, brick, block and stone	28
Table 17 – Coating systems for external renderings, concrete, brick, block and stone	30
Table 18 – Site priming of fibre building board, wood chipboard and plasterboard (not factory-primed or sealed)	32
Table 19 – Paint film defects arising during, or shortly after application	33
Table 20 – Paint film defects arising after a period of exposure	34

Summary of pages

The document comprises a front cover, an inside front cover, pages i to vi, pages 1 to 166, an inside back cover and a back cover.

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

Information about this document

This new edition represents a full revision of the standard, and has been prepared to reflect changes in legislation and coating technology.

The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tags **[A1]** and **[A1]**.

Text introduced or altered by Corrigendum No.1 is indicated in the text by tags **[C1]** and **[C1]**. Minor editorial changes are not tagged.

Amendment No. 1 updates numerous references to other standards and clarifies some of the recommendations, primarily to reflect changes in legislation (e.g. The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations 2012 [5]). In addition, technical changes have been made to the following:

- **4.6** Selection of coating systems (including Table 3, Table 7 and Table 20);
- **8.1** Substrates and coating systems: Wood;
- **9.2.6** Craft procedures and practices: Differing colours;
- **9.3.3.2** Types of rollers;
- **10.3** Sampling and testing;
- **11.1** Maintenance: General;
- **A.1** Factory applied coatings
- **B.1.3** Fungicidal washes and coatings;
- **B.1.4** Vapours, fumes and dusts; and
- Annex G Paint colours.

Attention is drawn to the Construction (Design and Management) Regulations 2007 [35], which were introduced after publication of BS 6150:2006, but which set out the responsibilities of those involved in construction work, including clients, designers, contractors and workers (<http://www.legislation.gov.uk/uksi/2007/320/contents/made>). These Regulations are currently being revised.

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”.

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

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.

1 Scope

This code of practice gives recommendations for good practice in initial painting and maintenance painting of buildings internally and externally, e.g. dwellings, offices, light industrial buildings, schools, hospitals, hotels and public buildings generally, in which decoration is a significant and often the major factor. The code takes into account the need to protect many building materials against the weather or other forms of attack normally encountered.

NOTE 1 Further guidance on the protection of steel structures, is given in BS EN ISO 12944 [A1] (and BS 5493 for iron structures) [A1].

The coatings referred to in this code are principally of conventional type, as defined in A.2, but limited reference is made to specialist coatings (A.3) and factory-applied coatings (A.4). In respect of materials generally, the code does not cover in detail the wide and constantly increasing range available. 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.

NOTE 2 Product references are indicated in the text by figures in parentheses, e.g. (3/2), and refer to the products listed and described in Table 3 to Table 11.

The code does not cover:

- a) decorative processes and other work usually carried out by specialists;
- b) the particular requirements of listed or historic buildings (see BS 7913);

NOTE Buildings which are listed or which lie within a conservation area are protected by law. This does not mean that you can never alter or demolish one, but carrying out relevant work without the appropriate consent is a criminal offence. Attention is drawn to the Notice to the Department of the Environment of work on buildings scheduled under the Ancient Monuments scheduled under the Acts of 1913-1953 [1] and PPG15, Planning and the historic environment) [2].

- c) limewash and distemper coatings;

NOTE Limewash and distemper coatings are either made up from dry powders or are supplied as ready-mixed formulations. They are significant for reasons of traditional compatibility, especially in relation to some older buildings. Information and advice regarding these materials can be obtained from the Society for the Protection of Ancient Buildings and from the British Lime Association.

- d) preservative treatments for structural timber (see BS 5268-5);
- e) coatings for fire protection (see BS 8202);
- f) general safety hazards of access for painting (see BS 8210:1986, Appendix C).

The recommendations made in the code are intended to facilitate achievement of standards of finish likely to be acceptable in most cases in the 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 the code might be necessary and should be specified accordingly.

2 Normative references

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

BS 476 (all parts), *Fire tests on building materials and structures*

BS 1070, *Specification for black paint (tar-based)*

 Text deleted 

BS 1336, *Specification for knotting*

 Text deleted 

BS 2992, *Specification for painters' and decorators' brushes for local authorities and public institutions (excluding quality of fillings)*

BS 3416, *Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water*

BS 3761, *Specification for solvent-based paint remover*

BS 4072, *Copper/chromium/arsenic preparations for wood preservation*

BS 4652, *Specification for zinc-rich priming paint (organic media)*

BS 4756, *Specification for ready-mixed aluminium priming paints for woodwork*

BS 4764, *Specification for powder cement paints*

 BS 5493, *Code of practice for protective coating of iron and steel structures against corrosion* 

 Text deleted 

BS 5707, *Specification for preparations of wood preservatives in organic solvents*

BS 6949, *Specification for bitumen-based coatings for cold application excluding use in contact with potable water*

 Text deleted 

BS 7664, *Specification for undercoat and finishing paints*

BS 7956, *Specification for primers for woodwork*

BS 8000-12, *Workmanship on building sites – Part 12: Code of practice for decorative wallcoverings and painting*

BS 8221-1, *Code of practice for cleaning and surface repair of buildings – Part 1: Cleaning of natural stones, brick, terracotta and concrete*

BS 8417, *Preservation of timber* –  Code of practice 

BS EN 350-2, *Durability of wood and wood-based products – Natural durability of solid wood – Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe*

BS EN 927-1:1997, *Paints and varnishes – Coating materials and coating systems for exterior wood – Part 1: Classification and selection*

A1 Text deleted A1

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

A1 BS EN 13279-1, *Gypsum binders and gypsum plasters – Part 1: Definitions and requirements*

BS EN 13279-2, *Gypsum binders and gypsum plasters – Part 2: Test methods* A1

BS EN ISO 2409, *Paints and varnishes – Cross-cut test*

A1 BS EN ISO 2431, *Paints and varnishes – Determination of flow time by use of flow cups*

BS EN ISO 2808, *Paints and varnishes – Determination of film thickness*

BS EN ISO 4618, *Paints and varnishes – Terms and definitions* A1

BS EN ISO 4624, *Paints and varnishes – Pull-off test for adhesion*

A1 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, cut edges and other areas with surface imperfections* A1

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

A1 BS EN ISO 14713, *Zinc coatings – Guidelines and recommendations for the protection against corrosion of iron and steel in structures – General principles of design and corrosion resistance* A1

A1 BS A1 ENV 927-2, *Paints and varnishes – Coating materials and coating systems for exterior wood – Part 2: Performance specification*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in A1 BS EN ISO 4618 A1 and the following apply.

3.1 thixotropy

property of changing reversibly from a gel or semi-liquid state when at rest to a more liquid consistency when shearing forces are applied at a constant rate over a period of time

NOTE Shearing forces include for example brushing or stirring.

3.2 flow

extent to which a coating is able to flow out to a film of uniform thickness free from brush marks and similar irregularities produced by the method of application

3.3 undercoat

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

3.4 ancillary materials

materials other than coatings used in the painting of buildings

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

4 Design considerations

4.1 General

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 should be considered by the architect at the earliest possible stage. Specifiers need to consider design aspects from the perspective of coating 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 coating 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 be given to the factors described in Table 1. Of particular importance in relation to performances is the influence of design and detailing, proper organization and supervision and, in some circumstances, an effective inspection procedure. Exposure conditions are the consequence of construction and climatic factors (e.g. see BS EN 927-1:1997, Table 2). The guidance on typical life to maintenance will be system specific and apply to mild and moderate exposure conditions as described in Table 2. Service life will be 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 B. Reference is also made to applicable legislation (see also Annex B). These aspects should 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 needs to be ensured.

All parts of a building to which coatings are to be applied should 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.

4.2 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 external repainting 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 Control of moisture

Penetration of moisture is a common cause of the premature failure of coatings; it could 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 them 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 (see also C.2.6 and 8.3.3).

NOTE Condensation is likely to occur in most buildings both externally and internally. External condensation (i.e. dew) will 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. The latter includes surface moulds and in the case of interstitial condensation an increased risk of decay.

Measures to prevent or minimize condensation should be incorporated at the design stage but choice of coating can also make a contribution (see 4.6.4.2 and 4.6.4.3).

4.4 Profiles

Coatings have a tendency to recede from sharp edges during application and this could 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 usually being sufficient: sills and thresholds might need a 3 mm rounding. Sharp edges of metal, e.g. burrs and nibs, should be removed before painting, in accordance with [A1](#) BS EN ISO 8501-3, BS 7079-A3 [A1](#).

4.5 Selection of materials

4.5.1 General

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

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

Materials should be selected from Tables 3 to Table 11 in accordance with 7.1 to 7.3 for coatings and in accordance with 7.4 for ancillary materials.

4.5.2 Volatile organic compounds

When selecting coatings, the volatile organic compound (VOC) content of coatings and its effect on the environment should be taken into account.

NOTE Attention is drawn to Council Directive 1999/13/EC (the Solvent Emissions Directive) [3], European Directive 2004/42/EC (the VOCs in Paints Directive) [4] and SI 2005/2773 Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations 2012 [5] (which implements Directive 2004/42/EC), which limit the emission of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products.

4.6 Selection of coating systems

4.6.1 General

A number of factors should be considered when selecting coating systems. Selection is often made on a qualitative basis, judging the relative importance of the factors in relation to particular circumstances. If more than one type of system meets the specification, then selection might be made on the basis of relative cost, availability or individual preference.

NOTE 1 Care should be taken to ensure that factors are comparable; lower initial costs might well be more than outweighed by 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.

Factors, which should be considered when selecting coating systems, are listed in Table 1. There is a considerable degree of interaction between factors involved, and they should not be considered in isolation. The selection of coating systems and their suitability for substrates or groups of substrates should be determined using Tables 12 to 18.

NOTE 2 Information is given in the relevant tables on the expected life to first maintenance in mild or moderate exposure conditions, which have been categorized in Table 2.

Possible paintwork defects that might be encountered and the recommended remedial treatment for these should be determined using Table 19 and Table 20.

4.6.2 Exposure conditions

General and local exposure conditions and the conditions of service are major factors in the selection of coating systems. Reference should be made to **4.6.4** for information on special conditions that could influence selection.

NOTE 1 A broad distinction can be made between external and internal exposure conditions but, in either, there can be considerable variation in the severity of attack or rigours of service, 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.

NOTE 2 The requirement for resistant coatings does not override the requirements of Table 16. The choice of paint systems for substrates employing wet materials of construction **NOTE 1** ought to be **NOTE 1** determined by the moisture content at the time of painting (see 8.5.2.1). Resistant coatings ought not to be applied to surfaces which are not dry as defined in Table 16. **NOTE 1**

Table 2 indicates the broad categories of external and internal exposure conditions that might be encountered and illustrates factors that should be considered. It 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.

4.6.3 Substrates and coating systems

The properties of substrates and their influence on the selection of coating systems should be considered at the design stage (see Clause 8).

NOTE 1 For new build there are dominant economic and operational factors for the choice of substrates and methods of construction. Coatings may be required for aesthetic and/or protective reasons but cannot be expected to upgrade the performance of incorrectly specified building materials. The nature of the substrate will have a major impact on the suitability of specific coating systems.

Building materials to which coatings 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 coatings to upgrade the performance of inherently unsuitable materials, especially in circumstances where frequent maintenance is likely to be impracticable or uneconomic.

Alternative or supplementary treatments, e.g. galvanizing or sprayed metallic coatings (see 8.4.1.2), are available, as are ancillary treatments such as wood preservatives (see 8.1.5), to enhance the protection afforded by coatings.

NOTE 2 Where possible it is advantageous to undertake initial painting under controlled conditions, e.g. factory. This is often more satisfactory than site application and can offer a wider choice of systems.

4.6.4 Special conditions and requirements

4.6.4.1 General

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

4.6.4.2 High humidity

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

NOTE 1 This will include most solvent-borne paints and some water-borne paints (7/1, 7/2, 7/3 and 7/4).

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 where such conditions might prevail include swimming baths, laundries 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 coatings should be used.

Acrylated rubber paints (11/5), especially high-build types, have good moisture resistance and are available in a wide range of colours. Where colour is not important, bituminous coatings (see Table 10), including coal tar epoxies, can be used. Bituminous coatings can be used to provide semi-drying protective coatings with good moisture resistance which are suitable for use on surfaces not subject to handling or abrasion.

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

NOTE 2 Many moisture-resistant protective coatings need to be applied at a thickness of 100 μ m or more.

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

NOTE Most condensation in buildings is caused by warm, moist air coming in 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. They usually contain aggregates with insulating or absorptive properties. Some coatings 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 to be expected that condensation will be followed by conditions favourable to drying out of absorbed moisture.

Where the function of a building gives rise to conditions of constant or frequent high humidity and the measures to prevent or reduce condensation in the preceding paragraphs are impracticable or not fully effective, priority should be given to the protection of substrates vulnerable to moisture attack by using specifically moisture-resistant coatings, as described in 4.6.4.2.

4.6.4.4 Mould growth

NOTE 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 ($\times 10$ or higher) when the filaments or hyphae characteristic of most moulds might be seen.

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 **4.6.4.3**; or
- b) applying moisture-resistant protective coating (see **4.6.4.2**) 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 before painting, should be treated in accordance with **11.5.8**.

NOTE 1 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 2 Further information on mould growth and its treatment is given in BRE Digest 370 [6].

4.6.4.5 Chemical attack

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

In mildly acidic industrial exposure conditions, alkyd gloss and drying-oil/resin micaceous iron oxide paints can be used and should be applied to prepared and primed surfaces in systems of adequate thickness to achieve a defect-free film. Where there is a need for resistance to heavy fume attack or direct contact with chemicals, chemical-resistant coatings should be used.

NOTE Chemical-resistant coatings include acrylated rubber, two-pack epoxy and polyurethane, coal-tar epoxy and bituminous types (see Table 10 and Table 11).

The resistance of any of the coatings described in Table 11 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,

specialist advice should be sought unless there is previous experience of the satisfactory performance of a particular type of coating in similar circumstances.

4.6.4.6 Fire

NOTE For further information on fire, see Annex D.

4.6.4.6.1 Painted surfaces

A painted surface should be considered as a thin film of flammable material in close contact with a substrate. The potential for the release of flammable volatiles (and therefore for a fire to occur) is a function of the nature of the paint film itself and the nature of the substrate. Paints would not normally affect the flame-spread rating of the unpainted surfaces, but see **4.6.4.6.2**.

4.6.4.6.2 Resistance to surface spread of flame

*NOTE 1 Attention is drawn to the Building Regulations which require that, in certain types of buildings, the materials of which walls are ceilings are constructed conform to specified minimum requirements in relation to the spread of flame across the surfaces when tested as described in the relevant parts of BS 476, but see also Annex D. **[A1]** 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. **[A1]** Paint is not regarded as a material of construction and is not subject to the Regulations.*

[A1] Flame retardant paints should have a reaction to fire classification in accordance with BS EN 13501 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 and in conformity with ETAG 028 [21]. **[A1]** The flame spread rating of paint cannot be expressed in isolation but only in relation to its performance on a specified substrate. Reference should be made to the manufacturer's details of the ratings of their paints when applied to specified substrates.

[A1] Conventional paints should not be applied over flame-retardant surfaces, unless specifically recommended by the manufacturer of the flame retardant paint or treatment. To avoid such difficulties, details of systems applied, including dates of application and types or brands of paints used, should be recorded for future reference. **[A1]**

*NOTE 2 **[A1]** Attention is drawn to the Building Regulations which require that, in certain types of buildings, the materials of which walls and floors are constructed conform to specified minimum requirements in relation to the spread of flame across the surfaces when tested in accordance with BS EN 13501 or the applicable parts of BS 476. Flame-retardant paints are regarded as a material of construction and are subject to the Construction Products Regulation [41]. **[A1]***

4.6.4.7 Resistance to abrasion

NOTE 1 Coatings 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 coatings 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 (7/14) can be used for walls in many interior hard wear situations.

4.6.4.8 Anti-graffiti treatments

Paint graffiti is an increasing problem in buildings and any organization with buildings that are vulnerable to attack should have a policy on removal or protection. New or undamaged surfaces should be assessed for the likely risk and cost of countermeasures. Choices for the prevention include sacrificial, semi-permanent and permanent coatings (see **E.3.1**).

Where graffiti is already a problem, measures of removal or obliteration should be assessed taking into account any hazards to the public during removal operations. Physical and chemical methods are available but the choice of method will depend on the nature of the marker and the substrate. Specialist manufacturers should be consulted and preliminary testing carried out on small areas (see **E.1** and **E.2**).

NOTE For further information on anti-graffiti treatments, see Annex E.

Table 1 Selection of coating systems

Issue	Question	Action
Exposure conditions	What is the general atmospheric exposure conditions, external and internal?	Consider location and functions of buildings
	What localized or intermittent conditions (e.g. fumes, condensation, heat, vulnerability to abrasion or wear) exist or are to be expected?	Refer to 7.1 , Table 2 and 4.6.4 . Consider possible future developments or changes in usage, which might alter the local exposure conditions
Function	What are the functional requirements (e.g. of protection, decoration, hygiene or special function)?	Refer to 7.1 and 4.6.4 . Design remit and experience. Consider substrate. Consider exposure conditions (see 4.6.2)
	Are there any relevant statutory requirements (e.g. under the Building Regulations or Factories Act) affecting selection?	Relevant legislation (see also Annex B)
Substrate	What substrates are involved?	Design remit, specification or inspection
	Do their characteristics influence the selection of coating systems?	Refer to 8.1 to 8.15
Special constraints on selection	Are there constraints relating to the composition of the coatings in some situations (e.g. in food factories because of the risk of toxicity or tainting)?	Consult client, industry association or supplier
	Are the materials chosen to minimize solvent content and the systems of working specified compliant with legislation?	Refer to Clause 10 and Annex B
	Are any constraints imposed by the conditions under which the work has to be carried out (e.g. requiring the use of coatings which dry very quickly)?	Consult client, contractor or supplier. Refer to 9.1
	Are there constraints imposed on colour choice by reason of solar gain?	Refer to 8.1.4.2
	Does the condition of the substrate (e.g. its high moisture content) impose constraints on the selection?	Ascertain condition, expected or actual, at time of treatment. Refer to 8.1 to 8.15
Coatings	Which coating systems are available?	Consider answers to preceding questions. Refer to Tables 3 to 11 and 8.1 to 8.15 . Consult suppliers
	Are the coatings readily available from the usual sources or is special order or manufacture required?	Consult suppliers
	Are the coatings suitable for site or factory application?	Consult suppliers
	Are there any restrictions on methods of application on site?	Consult suppliers. Refer to Clause 9 for information on application methods
	Is application by specialist contractors required?	Consult supplier. Refer to Tables 3 to 11
	Has the environmental impact of the chosen system been considered?	Consult supplier. Refer to Tables 3 to 11
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. Consult contractors and suppliers
	What is the expected life of the system to first maintenance?	Experience of similar systems. Refer to Tables 12 to 17
	Does the system provide a satisfactory base for maintenance type perhaps with coatings of different type?	See 11.3

Table 2 Exposure condition categories

Severity of exposure	Corrosivity category (see BS EN ISO 12944-2)	Exterior	Other exterior factors	Interior	Other interior 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, laundries, breweries, dairies	Moderate soiling, abrasion and handling of surfaces
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-I (very high – industrial)	Industrial areas with high humidity and aggressive atmosphere	–	Buildings or areas with almost permanent condensation and with high pollution	Surfaces in contact with chemicals, chemical solutions, process liquors and other aggressive agents
	C5-M (very high – marine)	Coastal and offshore areas with high salinity			

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.

Table 3 Primers for wood

Ref.	Description	General composition	Characteristics and usage
3/1	Opaque primer	Pigmented primer, solvent-borne (typically alkyd) or water-borne (typically vinyl acetate or acrylic), for general use under paints	Primers of this type are suitable for general use on wood, fibreboards and chipboards
3/2	Opaque primers conforming to BS 7956, Type A ^{A)}	Solvent-borne (typically alkyd) or water-borne (typically acrylic) pigmented primers of 3/1, but formulated for improved exterior durability	General purpose
3/3	Semi-transparent primers conforming to BS 7956, Type B ^{A)}	Solvent- or water-borne as 3/2 using transparent pigments	Semi-transparent dual-purpose primers designed for overcoating with either stain finishes or paints. Often used as the factory-applied primer for joinery. They are generally of lower durability than 3/2 primers and should be overcoated with minimum delay
3/4	Opaque primers conforming to BS 7956, Type C ^{A)}	Solvent-borne or water-borne primers as 3/2 with stain-blocking properties	Primers that can be used directly over knots, resinous timbers and timbers pretreated with preservatives, such as metallic naphthenates, known to discolour subsequently applied paint films
3/5	Ready-mixed aluminium primers conforming to BS 4756	Solvent-borne drying-oil/resin type binder with aluminium pigment	An alternative to conventional solvent-borne wood primer more suitable for woods that are resinous or have been treated with ~~A1~~ Text deleted A1 creosote. Relatively impermeable to moisture. Application of an additional coat of undercoat/finish might be required to obliterate grey primer colour
3/6	Preservative primers	Unpigmented or lightly pigmented solution of resins and fungicides in water or organic solvent	First coat of some proprietary wood coating systems, intended to seal porous and weather exposed surfaces and inhibit fungal colonization. Beneficial for treating weathered wood surfaces after mechanical preparation

^{A)} Conforming primers should meet the specified standard of exterior durability.

Table 4 Primers for metal

Ref.	Description	General composition	Characteristics and usage
4/1	Pretreatment, wash or etching primer, two-pack	Typically, polyvinyl butyral resin solution with phosphoric acid (as separate component) and a pigment (chromate containing primers now largely superseded by chromate-free primers)	The main function of these primers is to improve adhesion of paint systems to non-ferrous metals. They can also be used to provide temporary protection to blast-cleaned steel and sprayed-metallic coatings. The two-pack types generally give superior performance but might be less convenient to use. Application of primers of this type does not usually obviate the need for the application of a normal type of primer subsequently. Most pre-treatment primers can be used in conjunction with conventional and specialist coating systems
4/2	Pretreatment, wash or etching primer, one-pack.	Typically, polyvinyl butyral/phenolic resin solution with tinting pigment	
4/3	Mordant solution	Water-borne pre-treatment for galvanized and non-ferrous metals	Contains an indicator which darkens the surface of galvanized steel indicating that it has reacted
4/4	Adhesion promoter	Water-borne pre-treatment for non-ferrous metals and stainless steel	Pretreatment with low VOC content designed to improve adhesion of subsequent coating system to non-ferrous metals and stainless steel
4/5	Zinc phosphate primer (see also 4/8 and 5/4)	Solvent-borne. Typically, drying-oil/resin type binder with zinc phosphate as the main inhibitive pigment. Other tinting pigments can be incorporated	Zinc phosphate offers advantages over other inhibitive pigments in being less toxic and neutral in colour. Zinc phosphate primers are fairly quick-drying and can afford protection without finishing coats for reasonable periods. Established usage is for priming steelwork, but some types might be suitable for non-ferrous metals; refer to manufacturer's recommendations
4/6	Chromate primer (limited availability) for specialist use	Solvent-borne. Typically, drying-oil/resin type binder with zinc chromate as the main inhibitive pigment. Red oxide or other pigments can be incorporated	Vary according to formulation, but chromate primers are usually fairly quick-drying and suitable for use on ferrous and non-ferrous metals
4/7	Zinc-rich primer ^{A)} conforming to BS 4652 (two-pack), solvent-borne	Solvent-borne. Based on epoxy resin and supplied in two-pack form (zinc paste and curing agent)	A quick-drying metallic-grey primer for iron and steel with rust-inhibiting properties. Apply to well-prepared (e.g. blast-cleaned) steel only. Often used for touching up damaged zinc coatings, e.g. zinc-sprayed or galvanized surfaces or as a prefabrication primer. Spray application is recommended, except on small areas
4/8	Zinc-rich primer (one-pack)	Solvent-borne. Based on a non-saponifiable medium, e.g. chlorinated rubber	A quick-drying metallic-grey primer for iron and steel with rust-inhibiting properties. Often used for touching up damaged zinc coatings, e.g. zinc-sprayed or galvanized surfaces
4/9	Zinc phosphate primer, water-borne	Water-borne. Based on an acrylic resin dispersion in water and typically containing a zinc phosphate anticorrosive pigment	A quick-drying primer for iron and steel as well as non-ferrous metals including galvanizing. Some versions described as universal primer (5/4) and can be used on timber surfaces
4/10	Two pack epoxy primer	Solvent-borne. Based on epoxy resin and usually polyamide and supplied in two-pack form	Surface tolerant primer, usually containing a leafing aluminium pigment, is suitable for application not only to manually prepared steel surfaces, but also over existing, sound paintwork

^{A)} Advice should be sought when drying-oil/resin type paints are to be used over zinc-rich primers.

Table 5 Miscellaneous primers

Ref.	Description	General composition	Characteristics and usage
5/1	Alkali-resisting primer	Traditionally solvent-borne. Typically, alkali-resistant drying-oil (e.g. tung)/resin type binder, lightly pigmented	Although described as alkali-resisting, primers of this type are intended for use on substantially dry, possibly alkali-containing, surfaces mainly beneath drying-oil resin finishes; they will not necessarily prevent attack by alkalis on subsequent coats if the structure is very damp
5/2	Primer or primer undercoat	Water-borne (typically based on an acrylic polymer). Might be identical in composition to 4/9 or 6/2	These primers are for use on dry plaster and similar surfaces. They might also be suitable for priming wood and building boards, metals (universal primer) and as undercoats (see 4/9 or 6/2)
5/3	Primer-sealer Other descriptions include stabilizing primer or solution, penetrating primer or masonry sealer	Traditionally solvent-borne and lightly pigmented, or semi-transparent with a marker pigment, to assist even application. May also be based on fine particle-sized water-borne acrylic	The essential function of a primer-sealer is to bind down powdery or friable residues of previous coatings which cannot be removed completely. Too much reliance should not be placed on the ability of this type of material to penetrate unsound coatings of substantial thickness, and as much as possible of the old material should be removed. Primer-sealers can also be used to reduce absorption on surfaces of high or uneven porosity. Masonry sealers are usually formulated specifically for use on exterior surfaces and might not be suitable for interior work: with other types, the reverse might apply. Reference should be made to the manufacturer's recommendations
5/4	Universal primer (see also 5/2) All purpose primer	Typically, drying-oil/resin type binder or water-borne acrylic with white or light-coloured pigments, usually including rust-inhibitive types, e.g. zinc phosphate	A universal primer is typically white or light grey and is convenient for small-scale maintenance work involving patch-priming of a variety of substrates, e.g. wood, metal and dry plaster. For new and large-scale work, primers formulated for specific substrates are generally to be preferred

Table 6 Undercoats

Ref.	Description	General composition	Characteristics and usage
6/1	Solvent-borne undercoat	Traditionally drying-oil/resin type binder, pigmented with titanium dioxide and/or coloured pigments	This type of undercoat provides a matt or low-sheen surface for subsequent application of solvent-borne finishes, especially gloss finishes. In normal conditions, overnight drying is usually required before application of further coats. Undercoats for external work should be specifically designed with adequate flexibility for the purpose
6/2	Water-borne undercoat or primer undercoat	Based on acrylic or other polymers pigmented as in 6/1. Might be identical in composition to 5/2	These undercoats are quicker drying than 6/1 and, in normal conditions permit same-day recoating. General usage as 6/1. As primers they might be suitable for priming dry plaster, building boards and wood. Only types conforming to BS 7956 should be used for priming exterior woodwork

Table 7 General pigmented finishes

Ref.	Description	General composition	Characteristics and usage
7/1	Solvent-borne gloss or mid-sheen finish Other descriptions include hard-gloss enamel and high-gloss for gloss finishes; and eggshell, satin, silk and semi-gloss for mid-sheen finishes	Based on drying-oil/alkyd resin binder which might contain small amounts of polyurethane or other resins to increase hardness, flexibility or durability. Pigmented with titanium dioxide and/or light-fast, coloured pigments	These are protective and decorative finishes suitable for interior and exterior use on most building surfaces. They have good durability and wearing properties in most conditions except those of direct chemical attack or very high humidity. Advice should be sought from the manufacture regarding the suitability of mid-sheen finishes for exterior use on different substrates. For solvent-borne gloss or mid-sheen finish, drying and recoating times are variable according to composition but, usually, overnight drying between coats is required for drying-oil/alkyd resin types
7/2	Water-borne gloss or mid-sheen finish Descriptive terms for sheen can be described as for 7/1	Typically based on acrylic dispersions. Might contain other modifying resins. Pigmented with titanium dioxide and/or light-fast, coloured pigments	For water-borne gloss or mid-sheen finish under normal conditions, drying and recoating times are considerably shorter than solvent-borne and same day recoating is a possibility (see manufacturer's instructions) [A1] Regulations governing VOC emissions from paints (Note to 4.5.2) effectively preclude the use of solvent-borne finishes for interior walls and ceilings. [A1]
7/3	Solvent-borne matt or flat finish	Generally as for 7/1 adjusted to provide a matt finish	Essentially, this is a decorative finish for interior use only. Drying and recoating characteristics are usually similar to those of 7/1. Special purpose types, both water- and solvent-borne designed for renovating surfaces which might be weak, liable to cause staining of subsequent coatings, or subject to further drying (see also 7/5) [A1] Regulations governing VOC emissions from paints (Note to 4.5.2) effectively preclude the use of solvent-borne finishes for interior walls and ceilings. [A1]
7/4	Water-borne matt or flat finish Other descriptions include emulsion paint, latex, vinyl or acrylic paint (see F.2.3)	Composition of binder typically based on vinyl or acrylic polymers or combinations of these, with titanium dioxide and/or coloured pigments	Water-borne are often less resistant than their solvent-borne counterparts, but the wear-resistance and washability of some might approach those of the 7/1 mid-sheen finishes. They have advantages over the latter in ease of application to large areas, speed of drying (same-day recoating is usually possible), absence of solvent odour and ease of clean-up. They are widely used for ceilings and walls, mainly internally although some might be suitable for use on exterior walls. Choice of sheen level depends largely on location and aesthetic considerations but, in general terms, washability and resistance to soiling increase proportionately to the degree of sheen. Water-borne paints are generally more permeable to moisture than drying-oil/resin finishes and only some are suitable for use in situations where humidity is high for long periods, e.g. in kitchens and bathrooms (see manufacturer's recommendations)
7/5	Contract and general purpose paint	Water-borne. Composition, typically, is similar to that of 7/4 but with higher pigment content and giving a matt finish	Higher pigment gives increased opacity, compared with 7/4 type, but at the expense of a reduction in washability and resistance to soiling. Paints of this type are frequently used for new interior walls and ceilings where, apart from economy in use, their high permeability allows drying-out of contained moisture

Table 7 General pigmented finishes (*continued*)

Ref.	Description	General composition	Characteristics and usage
7/6	Aluminium paint, general purpose	Traditionally, solvent-borne. Typically, drying-oil/alkyd resin binder pigmented with flake aluminium	The laminar nature of the pigment (see F.4.6) imparts moisture-resistance to aluminium paints, and their reflective and heat-resistant properties are useful in many situations. They are suitable for use on most building surfaces, but their widest application is on structural steelwork, storage vessels and heated metal surfaces
7/7	Micaceous iron oxide paint, general purpose	Solvent-borne. Typically, drying-oil or drying-oil/resin type binder pigmented with micaceous iron oxide. Small amounts of other pigments can be incorporated to modify the natural colour (dark grey) of the main pigment	Because of the laminar nature of the pigment (see F.4.6) and the substantial thickness of the film, micaceous iron oxide paints provide good protection and are widely used extensively on structural steel, bridges, harbour installations and electricity transmission towers. On weathering, the coating develops a metallic sparkle. The dark colour of the pigment restricts the range of colours available, but overcoating with alkyd gloss finish is often possible
7/8	Masonry paint, water-borne, smooth or fine-textured	Water-borne binder, typically based on acrylic, vinyl and other polymers formulated to have the degree of flexibility required for exterior use and pigmented with titanium dioxide and/or lime-resistant coloured pigments. Some types are smooth; others contain fibre, sand or other agent to give a fine texture. Most contain an additive to inhibit mould and algal growth	These are essentially decorative coatings but have the weather-resistance and durability required in coatings for exterior walls. Both the smooth and the fine-textured paints can provide protection of concrete, etc. in combination with sealers, if needed, in accordance with manufacturer's recommendations. These types of paint are not generally suitable for application to wood and metal. Formulations containing fibre, sand, etc. usually provide thicker films than the smooth types. The manufacturer should be consulted regarding the use on interior surfaces of masonry paints containing additives to inhibit mould and algal growth because of the possible toxic hazard
7/9	Masonry paint, water-borne heavy-textured	Compositions can vary considerably but consist generally of a heavy-bodied water-borne binder, reinforced with coarse extenders and in some cases, fibrous material and aggregates. Pigmentation is similar to that of 7/8 and mould/algal inhibitors might be incorporated	Coatings of this type provide thick (1 mm to 2 mm), weather-resistant coatings, and experience indicates that they are capable of durability in excess of 10 years. Their heavy texture is derived partly from their composition and partly from the method of application, typically by means of specially-designed rollers. In addition to their use externally, coatings of this type might be suitable for internal walls where a hard-wearing textured finish is required
7/10	Masonry paint, solvent-borne, smooth or fine-textured	Composition varies considerably. Older types can be based on a drying-oil/resin type binder, others on modified or synthetic rubber film-formers. Pigmentation is generally as for other masonry paints	The appearance of this type of coating is similar to that of the 7/8 types, and film thickness is of the same order. Permeability is usually lower, and the coating might therefore provide greater resistance to penetration by water and other agents, and scope for protective use, but it should be applied to dry substrates. Brush application will generally be slower than with 7/8 types. It is more tolerant of poor drying conditions than water-borne types
7/11	Masonry paints, solvent-borne, thick, textured	Composition variable but typically employs a drying-oil resin binder; can be described as polyester (i.e. alkyd). Usually contains coarse extender and/or fibrous material. Pigmentation as for other masonry paints	These provide coatings of substantial thickness (0.6 mm to 1.0 mm), of relatively low permeability, and therefore have good resistance to moisture penetration. Coatings of this type are usually applied by spray or roller, often by specialist contractors. Material and application costs are likely to be high

Table 7 General pigmented finishes (*continued*)

Ref.	Description	General composition	Characteristics and usage
7/12	Silicate-based masonry coatings	Water-borne. Based on water soluble silicates with possible addition of minor quantities of organic resins	The coatings are unusual in being based on an inorganic binder. They are suitable for external and internal surfaces. They provide inert non flammable films which are less affected than organic coatings by fungal and algal growth and are compatible with all mineral building materials. External surfaces to be painted should be free from dirt and all previous paint coatings. Application can be by brush, roller or spray. While drying, the coating can be very susceptible to rain damage. The liquid paints are highly alkaline (caustic) and hence precautions should be taken during application. Resistance to moisture penetration can be improved by use of a hydrophobic impregnation treatment (e.g. silane, siloxanes)
7/13	Cement paint to BS 4764	Based on white Portland cement with titanium dioxide or coloured pigments, and additives to assist application and increase water-repellence. Supplied in powder form and mixed with water immediately before application	Low-cost coatings giving a rough finish and used mainly for exterior wall surfaces, although they can be used inside except on gypsum plaster: not recommended for application over other types of paint. On lengthy outside exposure, pastel shades can tend to lighten and darker colours to become patchy. Can be used as a primer on uncoated exterior wall surfaces prior to finishes of type 7/9 or 7/10
7/14	Multi-colour finish	There are different types of multi-colour finish. In one type, droplets of pigmented resin solution are emulsified in an aqueous medium so that the coating is water-thinnable. The pigmented droplets remain discrete in the dry film, so providing the multi-colour effect. In another type, a pigmented emulsion-type basecoat is followed, when dry, by spray-applied spatter coats of similar material. Alternatively, multi-colour patterns can be produced. Finally, an emulsion-type clear glaze-coat can be applied. In a third type, a pigmented emulsion-type basecoat is followed, when dry, by a clear emulsion glaze in which are suspended multi-coloured flakes of solid material	These are quick-drying, hard-wearing finishes for interior wall surfaces, often used in circulating areas, cloakrooms and similar hard-wear locations. Application is usually by spray, but materials of the third type might be suitable for brush or roller application
7/15	Plastic texture paint	Typically, based on gypsum and supplied as dry powder for mixing with water before use, but ready-for-use water-borne dispersion types are available. These may be referred to as synthetic resin plaster and do not necessarily contain gypsum. The term plastic indicates that the material can be worked after application to provide relief texture effects	This is essentially a decorative coating for interior use only. It can be used as a substitute for plaster skimming on plasterboard ceilings or to disguise rough or cracked walls and ceilings. Texture is achieved either directly by spraying or by brush or trowel application and subsequent combing, stippling or other treatment. Some types are self-coloured and require no further treatment; others might require over-painting, e.g. with a water-borne paint

Table 8 Transparent and semi-transparent finishes for interior wood

Ref.	Description	General composition	Characteristics and usage
8/1	Solvent-borne clear varnish, general purpose	Typically drying-oil/alkyd, urethane or urethane/alkyd resin	Used as a sealer on both softwood and hardwood surfaces. Available in a range of gloss from matt to full gloss. Some types might be sufficiently abrasion resistant for use on hardwood and softwood floors, counters and similar hard wear locations
8/2	Water-borne clear varnish, general purpose	Water-borne acrylic copolymer	Fast drying, durable protective coating for most interior wood
8/3	Water-borne clear floor varnish	Water-borne acrylic with polyurethane dispersion	High durability interior clear wood lacquer. Ideal heavy wear interior wood surfaces especially traditional floors. Resistant to common chemicals and hot water
8/4	Semi-transparent interior wood stain/dye	Coloured pigments or dyes, with or without drying-oil, water or solvent-borne	Used essentially to modify or enhance the appearance of interior wood without obscuring its grain and is usually overcoated with a clear finish
8/5	Solvent-borne two pack varnish	Typically oil, alkyd or polyol cured with aliphatic isocyanate	Limited potlife, some additional safety precautions required. Used in hard wearing areas, such as flooring

Table 9 Transparent and semi-transparent finishes for exterior wood

Ref.	Description	General composition	Characteristics and usage
9/1	Clear varnish, solvent-borne	Typically drying-oil/phenolic or alkyd resin	This provides a tough water-resistant coating, used principally as a clear protective finish for exterior hardwood. Usual mode of eventual failure by cracking and flaking, and in exposed situations demands frequent maintenance
9/2	Solvent-borne two pack varnish	Typically oil, alkyd or polyol cured with aliphatic isocyanate with added UV absorber	Limited potlife. Used primarily on hardwoods. Similar to some yacht varnishes. Can give superior performance on hardwoods
9/3	Semi-transparent exterior wood stain, low-build, solvent-borne	Resins, pigments and fungicides in organic solvent	Relatively thin coating that normally imparts a noticeable sheen to the surface. Relatively high moisture vapour permeability and wood likely to be subject to dimensional movement and surface splitting. Not best suited to dimensioned components such as joinery
9/4	Semi-transparent exterior wood stain, low-build, water-borne	As for 9/3 minimizing the use of organic solvents	Relatively thin coating that normally imparts a noticeable sheen to the surface. Relatively high moisture vapour permeability and wood likely to be subject to dimensional movement and surface splitting. Not best suited to dimensioned components such as joinery
9/5	Semi-transparent exterior wood stain, medium-build, solvent-borne.	Generally as for 9/3 but higher resin content.	Often used as top coat for 9/3. Because of its higher resin content this type of stain will confer a higher build and offers better control of moisture and dimensional movement
9/6	Semi-transparent exterior wood stain, medium-build, water-borne	An alternative to 9/5 minimizing the use of organic solvents.	Often used as top coat for 9/4. Because of its higher resin content this type of stain will confer a higher build and offers better control of moisture and dimensional movement

Table 10 Bituminous and tar-based coatings

Ref.	Description	General composition	Characteristics and usage
10/1	Black paint (tar-based) conforming to BS 1070, types A and B	Coal-tar or water gas-tar solutions	Moisture-resistant protective coatings for general use on metal and other surfaces where decorative appearance is unimportant. Both types are suitable for cold application, e.g. by brush. Type A is required to dry in 8 h and type B in 4 h
10/2	Bitumen-based coatings conforming to BS 6949, types 1 and 2	Bitumen solutions, type 2 with fillers	Generally as for 10/1. Type 1 without fillers, type 2 with, permitting greater film thickness per coat. Not suitable for use in contact with drinking water (see 10/3 for suitable types)
10/3	Bitumen-based coatings conforming to BS 3416, types 1 and 2	Bitumen solutions, type 2 with fillers	Generally as for 10/2, but suitable for use in contact with drinking water. Has to be certified under the Water Regulations Advisory Scheme ^{A)} in order to comply with EEC Directive 80/778/EEC (as amended) [7]
10/4	Bituminous emulsion	Water-borne bitumen emulsion	Black, water-thinnable moisture-resistant coating. Typical use is as a waterproof membrane on exterior walls before application of water-borne masonry paints

^{A)} The Water Regulations Advisory Scheme is managed for the UK water industry by WRc-NSF Ltd.

Table 11 Specialist coatings

Ref.	Description	General composition	Characteristics and usage
11/1	Two-pack epoxy primers, undercoats and finishes	Epoxy resin binder with amine or amide curing agent. Pigmentation according to end use, e.g. metal primers usually contain corrosion-inhibitive pigments Primers are generally either zinc rich or zinc phosphate pigmented. Undercoats often contain MIO pigments. Both solvent-borne and water-borne epoxy coatings are available	Resistant to some acids and weak alkalis, oils, solvents and abrasion and used for protection of surfaces, especially steelwork, in severe conditions where coatings of conventional type are inadequate. Should be applied only to stable, well-prepared surfaces. Blast-cleaning of steelwork is essential. Might not be suitable for application to gypsum plaster; a cement plaster base is preferable. Application to substrates liable to significant dimensional change (e.g. external woodwork) can result in cracking of the film. Curing is temperature-dependent, and the manufacturer's recommendations in respect of ambient and surface temperatures should be observed. High humidity during application and curing can also affect the coatings
11/2	Two-pack coal-tar epoxy coatings Replaced by hydrocarbon epoxies	Binder blended with hydrocarbon resins and mineral extenders	General characteristics as 11/1 but lower resistance to solvents. Main use is for protection in conditions of very high humidity or immersion in fresh or seawater
11/3	Two-pack polyurethane pigmented coatings, principally finishes	Acrylic modified polyester resin binder with polyisocyanate curing agent and white or coloured pigments	General characteristics as 11/1, but low temperature curing is usually better and sensitivity to moisture curing greater than with epoxies. Principal usage is as non-yellowing chemical-resistant finishes over epoxy primers and undercoats. These products contain isocyanates and need to be handled in accordance with relevant HSE requirements
11/4	One-pack moisture-curing polyurethane primers, undercoats and finishes	Polyether isocyanate binder. Pigmentation according to end use	Resistant to some acids and weak alkalis, oils, solvents and abrasion; and used for the protection of steel and concrete surfaces in severe conditions where coatings of conventional type are inadequate. Apply only to stable, well prepared surfaces. Blast-cleaning of steelwork is essential. Might not be suitable for application on gypsum plaster; a cement plaster base is preferable. The film might crack if applied to substrates liable to significant dimensional change (e.g. external woodwork). Curing is humidity-dependent and to some extent temperature-dependent. Observe the manufacturer's recommendations in respect of humidity and temperature. Most formulations can tolerate traces of surface moisture
11/5	Acrylated rubber primers, undercoats and finishes	Acrylated rubber, pigmented according to end use, as 11/1. Some types can be modified with drying-oil/alkyd resin. Formulations yielding coatings of substantial thickness are available	Suitable for use on most substrates and, as one-pack products, are more convenient to use than two-pack epoxy and polyurethane coatings, although their chemical resistance might be lower. As for solution binders (see F.2.5), drying is essentially by evaporation and is less affected by low temperatures than is that of drying-oil/resin, epoxy and polyurethane coatings. Brush or roller application to large areas might be difficult, and spraying is recommended (see 9.3)
11/6	Cellulose coatings, clear or pigmented, other than cellulose multi-colour types (7/14)	Nitrocellulose/synthetic resin solutions clear or pigmented	Quick-drying coatings, having a limited application in the painting of buildings. As with other lacquers (see F.2.5) cellulose coatings are best applied by spray, although some types can be modified to allow brush applications to small areas. The most frequent usage is of clear and pigmented coatings, including "gold" and "bronze" lacquers for shop fronts, lift doors, ornamental metalwork and similar items, work usually carried out by specialists. NOTE This material has a high fire risk

Table 12 Coating systems for interior wood

Application (end-use)	Coating type (see Note 1)	Priming options for new and bare areas of wood (see also 8.1.6.3, 8.2.2.3, and Table 3)	Typical life to first maintenance (see Note 2)
Opaque systems			
Internal surfaces of door and window joinery, wood trim, plywood and wood-based boards	General purpose pigmented finishes as described in 7/1, 7/2, 7/3 and 7/4	Opaque primer 3/1 optionally overcoated with undercoats 6/1 or 6/2	Over 5 years
Transparent and semi-transparent systems			
Internal surfaces of door and window joinery, wood trim, plywood and wood-based boards	Varnish, clear or semi-transparent in wood tone of choice. Build and gloss level of choice. Abrasion resistant binder, e.g. polyurethane, for hard-wear situations (Table 8)	Often primed with a suitably diluted coating of the finishing coat. Wood stains may be used to enhance grain	Variable according to type and service conditions but typically up to 5 years in average wear conditions
	Interior wood stain in wood tone of choice, possibly overcoated with clear varnish	–	Variable according to type and service conditions but typically up to 5 years in average wear conditions. Might give lifetime service in some situations
Flooring	Varnishes with good abrasion resistance. See 8/1 and 8/3. Specialist application may be required	Often primed with a suitably diluted coating of the finishing coat. Wood stains may be used to enhance grain	Long life in domestic situations but will require maintenance in high traffic areas

NOTE 1 Wood coatings are described by many terms including colour, build and opacity; BS EN 927-1 gives an account of terminology. Systems that do not fully obliterate the colour or grain of wood are sometimes described as natural finishes. Coating systems can be based on different chemistries, e.g. alkyds and acrylics, and can be carried in either water or solvent. For interior use the latter are being phased out in response to environmental legislation.

NOTE 2 Interior coatings will not require frequent maintenance unless mechanically damaged. Transparent wood coatings could have some colour change.

Table 13 Coating systems for exterior wood

Application (end-use)	Coating type (see Note 1)	Priming options for new and bare areas of wood (see also 8.1.6.3, 8.2.2.3, and Table 3)	Typical life to first maintenance (see Note 2)
Opaque systems			
Exterior door and window joinery	1 or 2 coats general-purpose alkyd-based gloss paint over recommended undercoat	Opaque solvent-borne or water-borne (3/2 or 3/4), or preservative primer (3/6)	3 to 5 years
	1 or 2 coats flexible exterior alkyd-based paint over recommended primer. Gloss level and colour of choice	Opaque solvent-borne or water-borne (3/2 or 3/4), or preservative primer (3/6). Special primer/undercoats may be specified.	Over 5 years
	1 or 2 coats exterior water-borne paint (7/3). Gloss level and colour of choice	Opaque solvent-borne or water-borne (3/2 or 3/4), or preservative primer (3/6)	Over 5 years
Softwood and plywood for cladding, bargeboards, soffits and fascias	1 or 2 coats flexible exterior alkyd-based paint over recommended primer. Gloss level and colour of choice	Opaque solvent-borne or water-borne (3/2 or 3/4), or preservative primer (3/6)	Over 5 years
	1 or 2 coats exterior water-borne paint (7/3). Gloss level and colour of choice	Opaque solvent-borne or water-borne (3/2 or 3/4), or preservative primer (3/6)	Over 5 years

NOTE 1 Wood coatings are described by many terms including colour, build and opacity; BS EN 927-1 gives an account of terminology. Systems that do not fully obliterate the colour or grain of wood are sometimes described as natural finishes. Coating systems can be based on different chemistries, e.g. alkyds and acrylics, and can be carried in either water or solvent. For interior use the latter are being phased out in response to environmental legislation.

NOTE 2 Interior coatings will not require frequent maintenance unless mechanically damaged. Transparent wood coatings could have some colour change

Table 13 Coating systems for exterior wood (*continued*)

Application (end-use)	Coating type (see Note 1)	Priming options for new and bare areas of wood (see also 8.1.6.3, 8.2.2.3, and Table 3)	Typical life to first maintenance (see Note 2)
Transparent and semi-transparent systems (see Note 3)			
Exterior softwood door and window joinery	Exterior wood stain Medium-build (9/5 or 9/6)	3/6 or 3/3	Depends on product type, unlikely to exceed 2 to 3 years on full exposure
Exterior hardwood door and window joinery (see Note 4)	Exterior wood stain Medium-build (9/5 or 9/6)	3/6 or 3/3	Typically 3 to 5 years depending on exposure
Exterior grade plywood, e.g. door panels	Exterior wood stain Medium-build (9/5 or 9/6)	3/6 or 3/3	Depends on product type, unlikely to exceed 2 to 3 years on full exposure. Efflorescence is a risk factor
External softwood boarding, cladding, bargeboards, soffits, fascias	Exterior wood stain Low-build (9/3 or 9/4) Medium-build (9/5 or 9/6)	3/6 or 3/3	3 to 5 years depending on exposure
External hardwood boarding, cladding, bargeboards, soffits, fascias	Exterior wood stain Medium-build (9/5 or 9/6)	3/6 or 3/3	4 to 5 years depending on exposure
External grade plywood boarding, cladding, bargeboards, soffits, fascias	Exterior wood stain Medium-build (9/5 or 9/6)	3/6 or 3/3	Typically 3 to 5 years depending on exposure. Efflorescence is a risk factor
Gates, fences, handrails, decking and garden furniture (see Note 5)	Exterior wood stain Medium-build ((9/5 or 9/6) Low-build (9/3 or 9/4) (see Note 3)	3/6 or 3/3	3 to 5 years

NOTE 1 Wood coatings are described by many terms including colour, build and opacity; BS EN 927-1 gives an account of terminology. Systems, which do not fully obliterate the colour or grain of wood, are sometimes described as natural finishes or exterior wood stains. Coating systems can be based on different chemistries, e.g. alkyds and acrylics, and can be carried in either water or solvent.

NOTE 2 Life expectancies shown assume application to dry, sound timber which, if necessary, has received preservative treatment and are based on performance in moderate environments as defined in Table 2. Lifetime expectations are expressed as an average and a distribution (standard deviation) around the average can be expected in real situations. BS EN 927-3 provides a performance specification for exterior wood coatings.

NOTE 3 The final appearance of transparent and semi-transparent coatings will depend on the number of coats. Two is the usual minimum; an additional coat will increase service life but may darken the appearance. Penetrating low-build stains are primarily used on rough sawn timber where one or two coats are required.

NOTE 4 Commercial systems designed for hardwood might have a different composition to their softwood counterparts.

NOTE 5 Commercial variants might include different degrees of water repellence.

Table 14 Paint systems for iron and steel except heated surfaces

Surface condition, primer and reference in Table 4	Finishing system and references in Table 6 and Table 7	Total film thickness μm	Typical life to first maintenance in exposure conditions indicated (see Note 1)
Manually cleaned			
2 coat primer, e.g. 4/5	2 coats aluminium paint (7/6); or 1 coat solvent-borne undercoat (6/1) and 1 coat alkyd gloss finish (7/1) or 2 coats of gloss finish; or 2 coats micaceous iron oxide (MIO) paint (7/7 high-build type) (see Note 3)	125 to 150	Interior Up to 10 years
			Exterior Up to 5 years
1 coat primer, e.g. 4/5	2 coats aluminium paint (7/6); or 1 coat solvent-borne undercoat (6/1) and 1 coat alkyd gloss finish (7/1) or 2 coats of gloss finish; or 2 coats micaceous iron oxide paint (7/7 high-build type) (see Note 3)	85 to 115	Interior Up to 5 years
			Exterior Not recommended
Blast-cleaned			
2 coats oil-primer, e.g. 4/5	1 coat solvent-borne undercoat (6/1) and 2 coats alkyd gloss finish (7/1) or 2 undercoats and 1 coat of gloss finish (see Note 2); or 2 coats micaceous iron oxide paint (7/7 high-build type) (see Note 3)	170 to 205	Interior Over 10 years
			Exterior Up to 10 years
1 coat primer, e.g. 4/5	1 coat solvent-borne undercoat (6/1) and 2 coats alkyd gloss finish (7/1); or 2 undercoats and 1 coat of gloss finish (see Note 2); or 2 coats micaceous iron oxide paint (7/7 high-build type) (see Note 3)	115 to 145	Interior Up to 10 years
			Exterior Up to 5 years for film thicknesses exceeding 125 μm

NOTE 1 Life expectancies are based on performance in moderate exposure conditions as defined in Table 2.

NOTE 2 Mid-sheen alkyd finish (7/3) can be used in mild interior exposure conditions.

NOTE 3 MIO paint can be covered with alkyd gloss finish (if manufacturer approves) to provide specific colour.

NOTE 4 Zinc rich primers (e.g. 4/7) are also used but problems can arise with many or drying-oil/resin systems, advice needs to be sought regarding compatible top coats (see also 11.3.2).

Table 15 Site pre-treatment and priming of non-ferrous metals and stainless steel (not factory pre-treated)

Substrate	Surface preparation and pretreatment/priming
Aluminium, smooth surfaces, e.g. sheets, extrusions and aluminized steel	Degrease (see 8.4.2.2). Abrade (see 8.4.2.7) and/or apply treatment primer (4/4). Then prime using zinc phosphate (4/5)
Aluminium, rough surfaces, e.g. castings and sprayed metallic coatings	Abrade lightly (see 8.4.2.7) remove dust and dirt. Sprayed metallic coatings might require washing (see 8.4.2.3). With sprayed metallic coatings, pre-treatment primer (4/4) should be applied immediately following application of the coating (see 8.4.3.4). Then prime using zinc phosphate (4/5)
Zinc sheet, zinc (hot-dip galvanized, sherardized and electroplated) coated steel, zinc aluminium alloy (hot dip) coated steel	Degrease (see 8.4.2.2); abrade coated sheet metal components as necessary (see 8.4.3.3); apply pre-treatment primer (4/4) or treat with mordant solution (4/3). With sherardizing or if suitable primer is used on other coatings, weathering or application of pre-treatment primer is not needed. Some hot dip coatings might need de-nibbing ^{A)} and careful abrasion to remove surface deposits and sharp points
Zinc and zinc aluminium alloy, sprayed	Sprayed metallic coatings might require washing (see 8.4.2.3). Apply pre-treatment primer (4/4) or treat with mordant solution (4/3). With sprayed metallic coatings, this should immediately follow application of the coating (see 8.4.3.4). If painted at a later time first remove dust and dirt; wash surface if necessary
Copper, brass, bronze	Degrease (see 8.4.2.2). Abrade lightly (see 8.4.2.7) or apply pre-treatment primer (4/4)
Lead	Abrade WET (see 8.4.2.7 and for health and safety guidance, see B.1.2). Apply pre-treatment primer (4/4)
Cadmium coatings	Degrease (see 8.4.2.2). Abrade lightly (see 8.4.2.7). Apply pre-treatment primer (4/4)
Tin coatings	Degrease (see 8.4.2.2). Abrade lightly (see 8.4.2.7)
Chromium and nickel coatings (if corroded)	Abrade (see 8.4.2.7) to remove corrosion products. Apply pre-treatment primer (4/4)
Stainless steel (see 8.3.2.2)	Degrease (see 8.4.2.2). Abrade (see 8.4.2.7). Apply pre-treatment primer (4/4)

^{A)} De-nibbing should take place before delivery to site. If this does not happen, it is essential that de-nibbing takes place prior to painting.

NOTE 1 For specialist advice on substrates listed in this table, check with the coatings manufacturer.

NOTE 2 Abrasion of metals may detract from the aesthetic appearance of the overall finish.

Table 16 Coating systems for internal plaster, concrete, brick, block and stone

Substrate condition	Finish type and reference in Table 7	Primer and reference in Table 5	Coating system and references in Table 6 or Table 7
DRY r.h. below 75% (see Note 1)	Gloss, mid-sheen or matt (7/1, 7/2, 7/3)	Alkali-resisting primer (5/1) or, plaster only, water-borne primer (5/2)	Gloss finish: 1 coat solvent-borne (6/1) or water-borne (6/2) undercoat; 1 coat alkyd gloss finish (7/1) or 1 coat water-borne (7/2)
			Mid-sheen finish: 2 coats alkyd mid-sheen finish (7/1) or 2 coats water-borne (7/2)
			Matt-finish: 2 coats alkyd matt finish (7/3) or 2 coats water-borne (7/4)
	General purpose emulsion paint (7/4, 7/5)	Primer not usually required but see 8.5.1.4 and 8.5.1.5. A well-thinned first coat of water-borne paint might be required on surfaces of high or variable porosity (see 8.6.2.4)	Matt or mid-sheen finish: 2 or 3 coats general purpose water-borne paint, matt or mid-sheen (7/4)
			Matt, high-opacity finish: 2 coats contract water-borne paint (7/5) 1 coat, spray-applied, might suffice in some situations
	Multi-colour (7/14)	Primer or basecoat as recommended by manufacturer	Usually 1 coat multi-colour finish (7/14) spray-applied but refer to manufacturer's instructions
	Textured (7/15)	Primer not usually required but refer to manufacturer's instructions	Plastic texture paint (7/15): Normally 1 coat but might require over-painting
			Water-borne masonry paint, heavy-texture (7/9): Normally 1 coat but refer to manufacturer's instructions
Masonry paint, mineral type (7/12)		Check with manufacturer	Check with manufacturer
Cement paint (7/13) (not on gypsum plaster)		Primer not required	1 or 2 coats cement paint (7/13)

Table 16 Coating systems for internal plaster, concrete, brick, block and stone (*continued*)

Substrate condition	Finish type and reference in Table 7	Primer and reference in Table 5	Coating system and references in Table 6 or Table 7
DRYING Some damp patches might be evident, r.h. 75% to 90%	Water-borne paint (7/4, 7/5)	As for DRY substrates	Matt or mid-sheen finish: 2 or 3 coats general purpose water-borne paint, matt or mid-sheen (7/4)
			Matt, high-opacity finish: 2 coats contract water-borne paint (7/5) 1 coat, spray-applied, might suffice in some situations
	Multi-colour finishes (7/14) possible but consult manufacturer	As for DRY substrates	Usually 1 coat multi-colour finish (7/15) spray-applied but refer to manufacturer's instructions
	Textured paints (7/15) possible but consult manufacturer	As for DRY substrates	Plastic texture paint (7/15): Normally 1 coat but might require over-painting
			Water-borne masonry paint, heavy-texture (7/9): Normally 1 coat but refer to manufacturer's instructions
			If overcoating is necessary, water-borne paint should be used
DAMP Obvious damp patches, r.h. 90% to 100%	Masonry paint, mineral type (7/10)	Check with manufacturer	Check with manufacturer
	Cement paint (7/11) (not on gypsum plaster)	Primer not required	1 or 2 coats cement paint (7/13)
	Water-borne paint (7/4, 7/5) possible, but consult coating manufacturer	Primer not recommended	Matt or mid-sheen finish: 2 or 3 coats general purpose water-borne paint, matt or mid-sheen (7/4)
			Matt, high-opacity finish: 2 coats contract water-borne paint (7/5) 1 coat, spray-applied, might suffice in some situations
			Contract types (7/5) are usually more permeable than general purpose (7/4) types and less prone to failure on damp substrates
WET Moisture visible on surface, r.h. 100%	Masonry paint, mineral type (7/12)	Check with manufacturer	Check with manufacturer
	Cement paint (7/13) (not on gypsum plaster)	Primer not required	1 or 2 coats cement paint (7/13)
	Cement paint (7/13) (not on gypsum plaster)	Primer not required	1 or 2 coats cement paint (7/13)

NOTE 1 For information on the repair of concrete structures, see BS EN 1504-2 and BS EN 1504-10.

NOTE 2 For information on the selection of coating systems for exterior masonry and concrete, see BS EN 1062-1.

NOTE 3 r.h. refers to the relative humidity in equilibrium with the surface. See 8.5.1.1 for method of measuring moisture content.

Table 17 Coating systems for external renderings, concrete, brick, block and stone

Substrate condition	Coating type	Primer and reference in Table 5	Coating system and references in Table 6 or Table 7 and use	Typical life to first maintenance (see Note 2)
DRY r.h. below 75% (see Note 1)	Masonry paints, solvent-thinned (7/10 or 7/11)	Alkali-resisting primer (5/1) or as recommended by manufacturer	<i>Smooth or fine-textured</i> (7/10) <i>types, solvent-thinned</i> 2 coats	5 years or more
			<i>Thick, textured</i> (7/11) <i>types, solvent-thinned</i> Usually 1 or 2 coats applied by spray, often by specialist applicators	10 years or more
	Water-borne masonry paints (7/8, 7/9)	Primer not usually required with 7/8 types but see 8.5.1.4 and 8.5.1.5	<i>Smooth or fine-textured</i> (7/8) <i>water-borne types</i> 2 coats	5 years or more
		Primer not usually required with 7/9 types but refer to manufacturer's recommendations	<i>Heavy-textured</i> (7/9) <i>water-borne type</i> Usually 1 coat applied by roller	10 years or more
	Masonry paint, mineral type (7/12)	Check with manufacturer	Check with manufacturer	Over 15 years
	Cement paint (7/13)	Primer not required	2 coats cement paint (7/13)	3 to 5 years
DRYING Some damp patches might be visible, r.h. 75% to 90%	Alkyd gloss and modified alkyd gloss (7/1)	Alkali-resisting primer (5/1)	1 coat solvent-borne undercoat (6/1); 1 or 2 coats alkyd gloss finish (7/1)	3 to 5 years
	Water-borne masonry paints (7/8 or 7/9)	As for DRY substrates	<i>Smooth or fine-textured</i> (7/8) <i>water-borne type</i> 2 coats; or <i>Heavy-textured</i> (7/9) <i>water-borne types</i> Usually 1 coat applied by roller	Potentially as for DRY substrates but some risk of earlier failure at higher moisture levels
	Masonry paint, mineral type (7/12)	Check with manufacturer	Check with manufacturer	Over 15 years
	Refer to manufacturer's recommendations for use of solvent-borne masonry paints (7/10 or 7/11)	As for DRY substrates	<i>Smooth or fine-textured</i> (7/10) <i>types, solvent-borne</i> 2 coats; or <i>Thick, textured</i> (7/11) <i>types, solvent-borne</i> Usually 1 or 2 coats applied by spray, often by specialist applicators	Potentially as for DRY substrates but some risk of earlier failure at higher moisture levels

Table 17 Coating systems for external renderings, concrete, brick, block and stone (*continued*)

Substrate condition	Coating type	Primer and reference in Table 5	Coating system and references in Table 6 or Table 7 and use	Typical life to first maintenance (see Note 2)
DAMP Obvious damp patches, r.h. 90% to 100%	Masonry paint, mineral type (7/12)	Check with manufacturer	Check with manufacturer	Over 15 years
	Cement paint (7/13)	Primer not required	2 coats cement paint (7/13)	As for DRY substrates
	Refer to manufacturer's recommendations regarding use of water-borne masonry paints (7/8 or 7/9)	Primer not required	<i>Smooth or fine-textured (7/9) water-borne types</i> 2 coats; or <i>Heavy-textured (7/10) water-borne types</i> Usually 1 coat applied by roller	Potentially as for DRY substrates but high risk of earlier failure
WET Moisture visible on surface r.h. 100%	Cement paint (7/13)	Primer not required	2 coats cement paint (7/13)	As for DRY substrates but some risk of earlier failure

NOTE 1 *r.h. refers to the relative humidity in equilibrium with the surface. See 8.5.1.1 for method of measuring moisture content.*

NOTE 2 *Life expectancies shown assume application to dry, sound substrates, qualified as indicated for other substrate conditions, and are based on performance in moderate external conditions as defined in Table 2. Aesthetic considerations might influence the need for maintenance.*

NOTE 3 *For information on the repair of concrete structures, see BS EN 1504-2 and BS EN 1504-10.*

NOTE 4 *For information on the selection of coating systems for exterior masonry and concrete, see BS EN 1062-1.*

Table 18 Site priming of fibre building board, wood chipboard and plasterboard (not factory-primed or sealed)

Type of board or sheet	Primers and references in Table 3 and Table 5	
	With solvent-borne finishes	With water-borne finishes ^{A)}
Hardboard, medium board, medium density fibreboard (MDF) and softboard	Primer-sealer (5/3) Water-borne primer (5/2) Aluminium wood primer (3/2)	Not usually required, but, for absorbent board, first coats might need additional thinning
Flame retardant treated	Alkali-resisting primer (5/1)	Alkali-resisting primer (5/1)
Softboard, bitumen-impregnated	Aluminium wood primer (3/2)	Not usually required
Wood chipboard	Solvent-borne wood primer (3/1) Primer-sealer (5/3) Water-borne primer (5/2) Aluminium wood primer (3/2)	Not usually required except possibly that solvent-borne primer (3/1, 3/2 or 5/3) is recommended for single layer boards (see 8.2.1.3) to prevent swelling of chips
Plasterboard	Primer-sealer (5/3) Water-borne primer (5/2)	Not usually required (see Note)
Oriented Strand Board (OSB)	As wood chipboard	As with solvent-borne finishes if a high quality finish is required
Cement bonded particleboard	Water-borne primer (5/2) Alkali-resisting primer (5/1)	Water-borne primer (5/2) Alkali-resisting primer (5/1)

^{A)} Water-borne multi-colour finishes (7/14) are usually applied over a special base coat.

NOTE Refer to the plasterboard manufacturer's recommendations on priming for use with water-borne finishes.

Table 19 Paint film defects arising during, or shortly after application

	Defect name	Possible cause	Cure
1	Bleeding	Solvent or water reactive 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
2	Blooming, or milky appearance usually 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 re-coat
3	Ropiness (brush marks)	Poor flow of the paint, over brushing, rapid drying, etc.	Abrade and re-coat
4	Cissing (separation of paint film whilst wet)	Surface contamination, wax, grease, sometimes occurs when applying water-borne paint over poorly prepared oil-based paint	Remove as much contamination as possible, degrease, use a silicone digester, abrade and re-coat. Ensure application tool is also free from contamination
5	Sleepy gloss (low sheen)	Sinkage into substrate, due to incorrect or insufficient primer or undercoat, medium density fibre board paraffin wax contamination	For medium density fibre board, abrade and then apply acrylic primer conforming to BS 7956, then re-coat. Other surfaces may simply require re-coating
6	Flashing (halo effect where two edges of paint meet)	Losing the wet edge of the paint during application, trying to "touch up" areas, especially sheen paints, but can occur with all paints	Re-paint to the nearest whole elevation, ensuring the wet edge is maintained
7	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 re-coat
8	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 re-coat. Severe instances may require lining paper
9	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 may be required
10	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, abrade with wet and dry abrasive paper to smooth, and re-coat
11	Rainspotting (also known as pitting)	Rain/water attack during the drying phase	Wet abrade to smooth, re-coat
12	Bittiness	Contaminated paint, dusty atmosphere, substrate not clean, application tool not clean	Abrade, re-coat, ensure application tools are clean, strain the paint
13	Orange peel effect	Application by roller without laying the paint off with a brush (such as applying gloss to doors). Poor atomization when spraying	Wet abrade to smooth, re-coat using correct method and adjustment

Table 20 Paint film defects arising after a period of exposure

	Defect	Typical causes	Remedial treatment
1	Adhesion failure	a) Application to damp, dirty or weather-degraded substrates, substrates contaminated by biological growth; or subsequent entry of moisture, e.g. through open joints in woodwork	Flaking, peeling or poorly adhering coating should be removed (see 11.5.2) and any damaged substrate repaired (see 8.1.4.2). Biological growths should be removed (see 11.5.8). Where moisture is the cause, it should be ensured that the substrate is dry before repainting. See 8.1.3 in relation to sources of moisture in woodwork
		b) Failure to prepare or pre-treat non-ferrous metals	Defective material should be removed. See 8.4.2 for preparation of non-ferrous metals
		c) Omission of primer or use of unsuitable primer	Defective material should be removed. Refer to appropriate substrate in Clause 8 for information on priming
		d) Application to powdery or friable substrates	Defective material should be removed. Application of a penetrating primer or sealer might be necessary (see 11.5.5)
		e) Application to hard, dense substrates, e.g. glass or glazed surfaces	Defective material should be removed. See 8.14 for subsequent preparatory treatment
		f) Apparent loss of adhesion on iron and steel, might be due to detachment of millscale	Removal of millscale, e.g. by blast-cleaning or flame cleaning, might be impracticable as a maintenance operation and is costly, hence the desirability of effective initial preparation. There might be no alternative to manual cleaning to remove millscale as it loosens, but this might extend over several repaints
2	Blistering	Blistering is usually indicative of liquid or vapour beneath the coating. The presence of water is a frequent cause. On painted woodwork, migration of water vapour from the inside of a building through the wood can cause blistering if the internal and external coatings do not provide the recommended differential permeability system. Resinous knots might also cause localized blistering	Depending upon the extent and severity of blistering, preparation might be confined to removal of isolated blisters or complete stripping might be necessary. Where moisture is the cause, time should be allowed for drying out. (See also 8.1 in relation to sources of moisture in woodwork.) Blistering on resinous external woodwork might be influenced by choice of finishing colour

Table 20 Paint film defects arising after a period of exposure (*continued*)

	Defect	Typical causes	Remedial treatment
3	Chalking, powdering	Slow erosion and chalking on lengthy exposure, especially externally, is a characteristic of many paints and wood finishes. It is not usually regarded as a defect unless it occurs prematurely and profusely, when the causes might be as follows: a) conditions of exposure exceptionally severe; b) earlier coats in system have failed to satisfy porosity of substrate; c) incorrect or unsuitable formulation	In absence of other defects, lightly chalking surfaces might require only washing and light abrasion to provide a satisfactory base for further coats. Heavily chalked or powdery surfaces will require more vigorous cleaning or abrasion combined if necessary with application of a penetrating primer (see 11.5.5)
4	Colour defects, e.g. fading, staining, bleeding, or other forms of discoloration	a) Some loss of colour of paint might occur on lengthy exposure to bright sunlight but is not usually significant. Early loss of colour might be due to use in unsuitable conditions, e.g. external use of a colour intended only for interior use. Chemical attack might cause change or loss of colour	If necessary, consult manufacturer regarding selection of colours or types of finish for repainting
		b) Solvent-borne finishes tend to yellow in situations where direct daylight is excluded ^{A1} or when exposed to fumes from other building materials typically containing amines ^{A1} . This is more obvious with white and light-coloured finishes	^{A1} Text deleted ^{A1} If freedom from yellowing is important, consult manufacturer for guidance on selection of oil-free coatings
		c) Apparent colour change might be due to masking of colour by surface chalking (item 3 of this table) to efflorescence (see 8.5.1.2) especially on external rendering or, on external plywood treated with wood stain, to diffusion of water-soluble salts contained in adhesives	Normal cleaning usually removes surface deposits. Efflorescence and diffusion of salts on plywood might recur until source is exhausted
		d) Failure of clear finishes on external woodwork might result in discoloration of exposed wood	Clear finish should be removed completely. Sanding or scraping might remove discoloration or damaged timber, but application of coloured wood stain might be necessary to achieve uniform appearance
		e) Constituents of the substrate or previous coatings can cause discoloration (see 8.5.1.5 and 11.5.9)	See 8.5.1.5 and 11.5.9

Table 20 Paint film defects arising after a period of exposure (*continued*)

	Defect	Typical causes	Remedial treatment
5	Cracking, other than that due to structural movement	Cracking is usually indicative of stresses within the coating film, caused, for example, by applying hard-drying coatings over soft coatings. It might also be the initial stage in adhesion failure (item 1 of this table). Cracks might be confined to the finishing coat or extend through the thickness of the film	If cracking is slight and confined to the finishing coat, light abrading might provide a satisfactory base for recoating. If cracking is severe or extends through the thickness of the film, complete removal might be necessary
6	Damage to coating	a) Mechanical damage, e.g. by abrasion, impact or vigorous cleaning b) Graffiti	Where surfaces are subject to hard wear, specialist coatings might be required (see 4.6.4.6.2). Consideration should also be given to the use of wear-resistant materials, e.g. ceramic tiles or plastics, where practicable. In relation to graffiti, see 4.6.4.8
7	Gloss, loss of	Some loss of gloss is to be expected after lengthy exposure, especially externally, and might be the first stage in chalking (item 3 of this table). Where it occurs prematurely, possible causes are as described for premature chalking	Loss of gloss in the absence of other defects is not usually significant in relation to maintenance treatment
8	Biological growths, i.e. moulds, algae, lichen, moss, blue stain	See 4.6.4.4 and 11.5.8	See 4.6.4.4 and 11.5.8 . Consider modifications to design or environment which might eliminate or reduce causes of failure
9	Rust-spotting or rust-staining on painted iron and steel	This usually indicates that the thickness of the paint system is insufficient to provide protection on peaks and edges. It might result from application of an inadequate system initially or at the last repaint or from erosion of the film during exposure. A further possible cause is failure to use a rust-inhibitive primer (see F.4.5 and Table 4)	Depending upon the severity and extent of the defect, treatment might range from manual cleaning and priming of localized areas to overall removal of the coating and treatment as for new iron and steel (see 8.3). Consideration should be given to increasing the film thickness of the system or to reducing the intervals between repaints until an adequate thickness has been built up

5 Organization of work

5.1 General

Where applicable, painting work should be planned in relation to the work of other trades (see 5.3), to ensure that surfaces are in a fit condition to be painted and that completed work is not damaged by subsequent building operations; in particular, time should be allowed for drying out of plaster and similar surfaces 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. In such circumstances, it might be necessary to erect temporary partitioning to isolate the areas where painting is in progress.

5.2 Health and safety

NOTE Health and safety in respect of access and equipment is not covered in detail by this standard, see Scope (Clause 1).

The recommendations of Annex B should be followed, concerning the manner of dealing with typical hazards to health and safety that might be encountered in the painting of buildings.

NOTE Annex B also draws attention to current legislation in relation to health and safety and the relevant statutory requirements. Attention is drawn to the following regulations and publications:

- *Control of Lead at Work Regulations 2002 [8]*
- *Control of Substances Hazardous to Health Regulations 2002 [9]*
- **A1** *Control of Noise at Work Regulations 2005 A1 [10]*
- **A1** *Biocidal Products Regulation A1 [11]*.

Information on the properties or constituents of coatings or other materials that affect health and safety should be obtained from the manufacturer or supplier and the precautions set out in their safety data sheets and container labels should be followed. All preservatives should be handled with care in accordance with the manufacturer's specific instructions.

Potential health and safety hazards include but are not limited to the following:

- a) inhalation, absorption through the skin or ingestion of toxic substances, including fumes, vapours and dusts;
- b) injury to eyes and skin;
- c) fire and explosion;
- d) noise;
- e) lack of personal hygiene.

5.3 Order of working

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 external surfaces or when painting is carried out from the scaffolding as it is struck. However, the determining factor is often weather or the time of year at which work is done.

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

5.4 Scaffolding and equipment

Scaffolding should be adequate in quantity and type to permit safe working and avoid delays. Hazards can be created by the use of unsuitable or defective scaffolding and the guidance given in BS EN 12811-1 should be followed.

NOTE Attention is drawn to Construction (Health, Safety and Welfare) Regulations 1996 [12] for information on the condition, erection and use of scaffolding.

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

Allowance should be made for the provision of temporary heating or drying equipment where necessary.

5.5 Supply of materials

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. Manufacture of materials not normally held in stock can take several weeks, and orders should be placed well in advance to avoid delay.

Usually, placing of orders for materials is the responsibility of the contractor, but early issue of painting schedules by specifiers reduces the risk of delay in supply that could cause work to be delayed.

5.6 Storage of materials

On large projects, facilities should be provided for the storage of materials, having regard to security, avoidance of hazards and maintenance of materials in good condition.

Some coatings, other than water-borne types, are flammable in the liquid state; precautions to prevent accidental ignition should be taken and emergency fire-fighting equipment provided. If the total quantity of flammable paints, etc. in storage exceeds 50 l at any one time, special provisions in accordance with BS 8000-12 should be taken.

Containers of highly flammable liquids (flash points below 32 °C), which include certain solvents and specialist coatings, usually carry a warning label but, in case of doubt, reference should be made to the manufacturer.

NOTE Attention is drawn to statutory requirements regarding the storage of highly flammable liquids (see also Annex B). Further guidance fire safety is contained in the HSE Guidance Note HSG168 Fire safety in construction work [13].

To maintain coatings 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. Attention should be paid to the storage of coatings containing volatile solvents, as temperatures exceeding 30 °C can create excessive pressure within containers and increases the risk of fire. Water-borne coatings should be protected from frost.

On contracts of long duration, 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. If batch numbers are missing or illegible, the containers should be marked with the date of receipt.

5.7 Protection of components on site

5.7.1 General

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 be protected against damage and soiling.

5.7.2 Joinery

Where possible, joinery, primed or unprimed, should not be kept in external storage, especially when it is to be installed in a centrally heated building. If external storage cannot be avoided, the components should be protected against moisture and other adverse climatic conditions. Components, whether stored indoors or outdoors, should not be in direct contact with the ground. If stacking is necessary, spacers should be placed between the components to permit air circulation and, in the case of primed joinery, to prevent sticking at contact surfaces.

5.7.3 Metal components

Where possible, 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 external storage cannot be avoided they should be protected and stacked as described in **5.7.2**.

5.7.4 Structural steel members

Primed structural steel members, if stored externally, should be stacked in such a manner that they do not retain water even if no cover is provided. The bottom layer in the stack should be laid on timber packings to raise it above the ground and the rainwater splash zone. Spacers should be placed between subsequent layers to permit air circulation and prevent sticking.

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.

5.8 Off-site work

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 should have properties appropriate to the exposure conditions or conditions of service. The primer (or other treatment) and coatings 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.

5.9 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. On extensive ceiling and wall areas, there should be a sufficient number of operatives to ensure working wet edges are maintained (see **9.3.2.3**) and should take into account working conditions and the characteristics of the coatings to be applied.

Operatives should be skilled and experienced in the types of work involved and with the materials, methods and equipment to be used. With novel materials, methods or equipment, special training might be necessary.

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, or have ready access to, test equipment, e.g. moisture meters, film-thickness gauges and flow cups, when the nature of the work requires it.

5.10 Inspection procedures

Inspection procedures should be carried out in accordance with Clause 10, which may necessitate the sampling and testing of materials on a regular basis (see 5.11 and 10.3).

NOTE For large contracts, specific stages of the work might be subject to inspection and approval by a nominated person or specialist inspection organization to ensure compliance with the specification. Inspection does not remove or diminish the contractor's responsibility for proper supervision of the work.

5.11 Materials sampling and testing

The routine sampling and testing of materials should be carried out as described in Clause 10.

NOTE Sampling and testing procedures can be time-consuming and expensive and are effective only if they are properly implemented.

6 Exchange of information

6.1 General

Specifications and other documents needed in respect of initial or maintenance painting should be prepared in sufficient detail to afford proper guidance in the preparation of estimates and the execution of the work.

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.

A painting project can involve several parties, including 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.

6.2 Specification

6.2.1 General

A specification should be clear, concise and unambiguous. 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;
- d) to act as a reference if disputes arise or arbitration is necessary.

6.2.2 Surface preparation

For initial and factory painting, many substrates will benefit from specific surface treatments and preparation, which should be discussed with the coating 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 (see **11.5.2.1**). 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 wirebrushing” cannot be achieved (see **8.3.4.2.4**), the choice lies between selecting a more effective method or accepting a lower standard of preparation which will lead to a shorter life expectancy for the coating system.

6.2.3 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, a check should be made to ensure they are compatible (see **7.3.5**).

Materials should be used strictly in accordance with the manufacturer’s instructions, including guidance on whether thinning is permissible (see **F.3.1**).

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 (see also **6.4**).

6.2.4 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 (see **9.1** and **11.4**).

6.2.5 Inspection procedure

Where the work is to be subject to inspection, the intended inspection procedure should be described in the specification (see **5.10**).

6.3 Bills of quantities

Bills of quantities should be prepared in accordance with a document such as *Code of procedure for the measurement of building work SMM7 measurement code* [14]. It is essential that the relevant edition, or any other method of measurement adopted, is stated.