

Australian/New Zealand Standard™

Guide to the painting of buildings



AS/NZS 2311:2017

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Australian Paint Manufacturers' Federation
Australian Wall and Ceiling Association
CSIRO
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Master Painters Australia
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Australian/New Zealand Standard™

Guide to the painting of buildings

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CH-003, Paints and Related Materials, to supersede AS/NZS 2311:2009, *Guide to the painting of buildings*.

The objective of this Standard is to provide guidance and recommended good practice for the design, application and maintenance of decorative paint systems for use by the paint industry in the development of painting specifications.

This Standard cannot be nominated as a painting specification, but it can be used as a basis for the preparation of appropriate paint specifications to suit individual contracts. Guidance on the preparation of painting specifications is given in Section 9.

This Standard was revised to introduce the following changes:

- (a) Update referenced documents.
- (b) Include paint type B16A water-borne sealer binder in Table 4.2, Paint types.

The term 'informative' has been used in this Standard to define the application of the appendix to which they apply. An 'informative' appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
FOREWORD.....	6
 SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	7
1.2 OBJECTIVE	7
1.3 REFERENCED DOCUMENTS.....	7
1.4 DEFINITIONS.....	9
1.5 HAZARDOUS MATERIALS.....	10
1.6 INFLUENCE OF CLIMATE ON EXTERNALLY EXPOSED PAINT	11
1.7 INTERNAL ENVIRONMENTS OF BUILDINGS	13
1.8 SPREADING RATE, PAINT COVERAGE AND PAINT USAGE.....	13
1.9 SELECTION OF COLOUR.....	14
1.10 GLOSS LEVEL AND FINISH	17
1.11 ENVIRONMENTAL ISSUES	17
 SECTION 2 DESIGN FOR PAINTING	
2.1 GENERAL.....	19
2.2 TIMBER	20
2.3 METAL INSTALLATIONS.....	22
2.4 BUILDING BOARDS	23
2.5 BRICKS.....	25
2.6 CONCRETE	25
2.7 GLASS-REINFORCED CONCRETE (GRC).....	26
2.8 SET PLASTER AND CEMENT RENDER	26
2.9 PLASTICS.....	26
 SECTION 3 PREPARATION OF UNPAINTED SURFACES	
3.1 GENERAL.....	27
3.2 TIMBER PRODUCTS.....	27
3.3 ORGANIC FIBRE-BASED BUILDING BOARDS.....	30
3.4 IRON AND STEEL	31
3.5 ZINC-COATED AND ZINC/ALUMINIUM ALLOY-COATED STEEL	31
3.6 ALUMINIUM.....	33
3.7 COPPER AND BRASS	33
3.8 LEAD	33
3.9 MASONRY	33
3.10 SET PLASTER	39
3.11 FIBROUS PLASTER AND PLASTER GLASS	44
3.12 GYPSUM PLASTERBOARD	44
3.13 PLASTICS.....	45
3.14 ASBESTOS ENCAPSULATION OR SEALING	45
 SECTION 4 GENERAL DESCRIPTION OF PAINTS, RELATED MATERIALS AND TREATMENTS	
4.1 GENERAL.....	46
4.2 SEALERS	47
4.3 PRIMERS	47
4.4 UNDERCOATS.....	47
4.5 SEALER/UNDERCOATS	48

4.6	SOLVENT-BORNE PAINTS	48
4.7	LATEX (WATER-BORNE) PAINTS.....	48
4.8	CLEAR (UNPIGMENTED) FINISHES	49
4.9	TIMBER STAINS	49
4.10	PAVING PAINTS	51
4.11	ROOFING PAINTS.....	51
4.12	BITUMINOUS PAINTS.....	52
4.13	SPECIAL PURPOSE PAINTS	52
4.14	MEMBRANE AND TEXTURED COATINGS	52
4.15	PAINT REMOVERS	54
4.16	WATER-REPELLENT TREATMENTS FOR TIMBER	54
4.17	WATER REPELLENTS FOR CONCRETE AND MASONRY	55
4.18	ANTI-GRAFFITI PAINTS.....	55
4.19	NON-CONVENTIONAL PAINTS.....	56
4.20	HERITAGE PAINT SYSTEMS	57
4.21	PUTTIES, GROUTS AND SEALANTS.....	58
4.22	LOW VOLATILE ORGANIC COMPOUND PAINTS	59
4.23	ECOLOGICAL PAINTS	60
 SECTION 5 SYSTEMS FOR THE PAINTING OF BUILDINGS		
5.1	CONVENTIONAL PAINTING SYSTEMS	68
5.2	SPECIALIZED PAINTING SYSTEMS	73
5.3	SPECIALIZED APPLICATIONS.....	74
 SECTION 6 PAINT APPLICATION		
6.1	GENERAL.....	77
6.2	PAINT PREPARATION.....	77
6.3	CLIMATIC CONDITIONS	78
6.4	CONDITION OF THE SUBSTRATE.....	79
6.5	STOPPING AND FILLING.....	79
6.6	SEQUENCE OF OPERATIONS	79
6.7	METHODS OF APPLICATION.....	80
6.8	TOUCH UP	86
 SECTION 7 MAINTENANCE OF PAINTED SURFACES		
7.1	GENERAL.....	87
7.2	CRITERIA FOR ASSESSING WHEN TO REPAINT	87
7.3	PRETREATMENT BEFORE REPAINTING	88
7.4	PAINTED SURFACES IN GOOD CONDITION (ALL SUBSTRATES)	90
7.5	SURFACES IN POOR CONDITION	91
7.6	DISCOLOURATION AND STAINING OF PAINT FILMS	95
 SECTION 8 MAINTENANCE PAINTING SYSTEMS		
8.1	GENERAL.....	98
8.2	RETAIN EXISTING PAINT SYSTEM AND GLOSS AND COLOUR.....	98
8.3	RETAIN EXISTING PAINT SYSTEM BUT CHANGE GLOSS AND COLOUR....	98
8.4	CHANGE OF PAINT SYSTEM.....	99
8.5	TEST FOR EXISTING PAINT SYSTEM	99

Page

SECTION 9 PREPARATION OF PAINTING SPECIFICATIONS

9.1	GENERAL.....	103
9.2	CONTENT.....	104
9.3	PROVISION OF DOCUMENTS	106
9.4	DEFECTS LIABILITY PERIOD.....	106

APPENDICES

A	CHECKLIST FOR THE PREPARATION OF A PAINTING SYSTEM SPECIFICATION FOR NEW SURFACES	107
B	CHECKLIST FOR THE PREPARATION OF A MAINTENANCE PAINTING SYSTEM SPECIFICATION FOR PREVIOUSLY PAINTED SURFACES	108
C	INSPECTION AND TESTING.....	109

INDEX	113
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FOREWORD

Painting is an accepted method of protecting materials to extend their service life, to enhance their appearance, or for reasons of hygiene.

Alternative materials and systems can also provide satisfactory service; however, the materials and systems included in this Standard are known to perform satisfactorily when correct application methods have been followed.

Because of health, safety and environmental considerations, emphasis has been given to the use of latex paint systems; however, in specific circumstances, alternative solvent-borne systems have been included to ensure that all performance requirements are met. It is recommended that specifiers contact manufacturers to obtain material safety data sheets (MSDSs) when considering matters dealing with health and the safe handling of paints.

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Australian/New Zealand Standard
Guide to the painting of buildings

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard provides a guide to products and procedures for the painting of buildings for general domestic, commercial and industrial use. Where no specific application standards apply the minimum standard to follow is the recommended specification from the relevant manufacturer specific to the product or type or substrate.

This Standard does not apply to the long-term protection of iron or steel exposed directly to the atmosphere or to internal climates likely to have aggressive environments. These subjects are dealt with in AS/NZS 2312 (series).

1.2 OBJECTIVE

This Standard is intended to assist those with interest in building design and maintenance such as trades people, architects, builders or building owners in the preparation of painting specifications for inclusion in contracts. It should not be called up in contracts without also specifying the detail to be derived from it.

In providing guidance on the preparation of painting and repainting specifications for surfaces forming parts of buildings, this Standard necessarily gives choices of paint types for use in different areas. For each contract, the architect, or owners, should draw up a complementary painting schedule to detail the options that are to be used together with a colour schedule. This Standard can then be referred to when specifying the necessary preparation, the coating system and the methods and conditions of application.

NOTE: Information on the preparation of painting specifications is given in Section 9 and Appendices A and B. Information on inspection and testing is given in Appendix C.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1318	Use of colour for the marking of physical hazards and the identification of certain equipment in industry
1345	Identification of the contents of piping, conduits and ducts
1580	Paints and related materials—Methods of test
1580.401.5	Method 401.5: Hard dry condition—Sanding test
1580.408.2	Method 408.2: Adhesion—Knife test
1580.408.4	Method 408.4: Adhesion (crosscut)
1604	Specification for preservative treatment (series)
1627	Metal finishing—Preparation and pretreatment of surfaces
1627.4	Part 4: Abrasive blast cleaning of steel
1789	Electroplated zinc (electrogalvanized) coatings on ferrous articles (batch process)
1897	Electroplated coatings on threaded components (metric coarse series)

AS	
2700	Colour standards for general purposes
3730	Guide to the properties of paints for buildings
3730.0	Part 0: General information on the specification, purchasing and testing of paints
3730.1	Part 1: Latex—Interior—Flat
3730.2	Part 2: Latex—Interior—Semi-gloss
3730.3	Part 3: Latex—Interior—Low-gloss
3730.5	Part 5: Solvent-borne—Interior—Semi-gloss
3730.6	Part 6: Solvent-borne—Interior/exterior—Full-gloss enamel
3730.7	Part 7: Latex—Exterior—Flat
3730.8	Part 8: Latex—Exterior—Low-gloss
3730.9	Part 9: Latex—Exterior—Semi-gloss
3730.10	Part 10: Latex—Exterior—Gloss
3730.12	Part 12: Latex—Interior—Gloss
3730.13	Part 13: Primer—Wood—Solvent-borne—Interior/exterior
3730.14	Part 14: Undercoat—Solvent-borne—Interior/exterior
3730.15	Part 15: Primer—Latex—For metallic zinc surfaces
3730.16	Part 16: Latex—Self priming timber finish—Exterior
3730.17	Part 17: Primer—Wood—Latex—Interior/exterior
3730.18	Part 18: Undercoat/sealer—Latex—Interior/exterior
3730.21	Part 21: Primer—Solvent-borne—For ferrous metallic surfaces
3730.22	Part 22: Concrete and masonry sealer—Solvent-borne—Interior/exterior
3730.25	Part 25: Clear finish—Solvent-borne—Interior
3730.27	Part 27: Floor varnish—Two-pack—Isocyanate cured
3730.28	Part 28: Wood stain—Solvent-borne—Exterior
3730.29	Part 29: Solvent-borne—Exterior/Interior—Paving paint
4361	Guide to lead paint management
4361.2	Part 2: Residential and commercial buildings
4506	Metal finishing—Thermoset powder coatings
HB 84	Guide to concrete repair and protection
AS/NZS	
1530	Methods for fire tests on building materials, components and structures
1530.3	Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release
1580	Paints and related materials—Methods of test
1580.408.5	Method 408.5: Adhesion—Pull-off test
1580.457.1	Method 457.1: Resistance to natural weathering
1580.601.1	Method 601.1: Colour—Visual comparison
1580.602.2	Method 602.2: Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85°
1680	Interior and workplace lighting
1680.1	Part 1: General principles and recommendations
1716	Respiratory protective devices
2310	Glossary of paint and painting terms
2312	Guide to the protection of structure steel against atmospheric corrosion by the use of protective coatings
2312.1	Part 1: Paint coatings
2312.2	Part 2: Hot dip galvanizing

AS/NZS	
2589	Gypsum linings—Application and finishing
2633	Guide to the specification of colours
2728	Prefinished/prepainted sheet metal products for interior/exterior building application—Performance requirements
3750	Paints for steel structures
3750.5	Part 5: Acrylic full gloss (two-pack)
3750.6	Part 6: Full gloss polyurethane (two-pack)
3750.10	Part 10: Full gloss epoxy (two-pack)
3750.17	Part 17: Etch primers (single pack and two-pack)
4548	Guide to long-life coatings for concrete and masonry
4548.1	Part 1: Wall coatings—Latex extensible
4548.2	Part 2: Latex finish coatings—High-build, low profile
4548.3	Part 3: Latex—Textured coatings—Non-aggregate
4548.4	Part 4: Latex—Textured coatings—Aggregate filled
4680	Hot dip galvanized (zinc) coatings on fabricated ferrous articles
4791	Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
60079	Explosive atmospheres
60079.10.1	Part 10.1: Classification of areas—Explosive gas atmospheres
60079.10.2	Part 10.2: Classification of areas—Combustible dust atmospheres
NZS	
3610	Specification for profiles of mouldings and joinery
3617	Specification for profiles of weatherboards, fascia boards and flooring
5807	Code of practice for industrial identification by colour, wording or other coding
6703	Code of practice for interior lighting design
BS	
381C	Specification for colours for identification, coding and special purposes
4800	Schedule of paint colours for building purposes
Safe Work Australia	
NOHSC: 2002	Code of practice for the management and control of asbestos in work places, (2005)
	How to safely remove asbestos—Code of Practice (2011)

1.4 DEFINITIONS

For the purpose of this Standard the definitions given in AS/NZS 2310 apply, in addition to the following:

1.4.1 Latex

Manufactured with water-borne polymers of acrylic, vinyl acrylic or blends of both. Latex products include paints, stains and coatings (sealers and binders).

1.5 HAZARDOUS MATERIALS

1.5.1 General

All paints and related products should be regarded as hazardous and should be assessed for their risk. Statutory regulations for the control of hazardous materials may be obtained from the relevant government authorities. These regulations may include requirements for storage methods, licensing, safe use (including provision of information and control of exposure) and disposal. Advice on some of these matters may be found in AS/NZS 60079, Parts 10.1 and 10.2. The manufacturer should be contacted for information on the company's products and material safety data sheets (MSDSs).

1.5.2 Precautions

1.5.2.1 *Poisoning*

Paint materials should not be left within the reach of infants and small children.

1.5.2.2 *Vapours*

Vapours from most solvent-borne paints are flammable, so contact with sparks, flames or hot surfaces should be avoided (pilot lights can be a hidden danger). Exposure to vapours can lead to adverse health effects. Adequate ventilation should always be provided. Suitable supplied-air respiratory protection devices complying with AS/NZS 1716 should be worn when painting is conducted within a confined space. A risk assessment, identifying hazards associated with any painting task, should be carried out before commencement of work.

1.5.2.3 *Storage and disposal*

Surplus paint should be stored or disposed of in accordance with the local regulatory requirements.

1.5.2.4 *Toxic materials*

Many older paints contain toxic materials, notably lead and chromate-based pigments. Removal of these paints by some methods could produce dusts that represent a health hazard and need to be avoided. The existence of lead paint on old buildings (typically pre-1970) can cause public health and environmental hazards and management procedures should be in accordance with AS 4361.2 in Australia (also refer to the appropriate WHS regulations).

1.5.2.5 *Asbestos*

Some older textured coatings contain asbestos fibres or are covered by a sandwich layer of asbestos. Care should be taken when working on these coatings and the appropriate regulations should be followed. Also the substrate of asbestos cement sheeting may be exposed during preparation work for painting and suitable precautions should be taken to prevent dust generation.

The regulations concerning working on or with products containing asbestos are continually changing. Refer to the workplace regulator for guidance.

Dry sanding and water blasting processes should not be used; they are, in fact, prohibited under most regulations.

1.5.2.6 *VOCs*

The quantity of volatile organic compounds (VOCs) in paints has been of increasing concern to specifier and legislators over recent years. The ingredients incorporated in paints as solvents for the binder, or as higher boiling point aids to film forming, present various occupational health and safety hazards and may contribute to the formation of photochemical air pollution. Conventional solvent-borne paints typically contain some 400 g/L VOCs while latex paints contain about one quarter of this amount. For water-borne paint the issue is essentially environmental. Recent technology can produce latex paint with lower VOC concentrations. Ultra-low VOC products, which produce less than 5 g/L are

available. These paints are particularly applicable where sensitivity to VOCs or odours are of particular concern. In some circumstances, products chosen for low VOC content may have compromises on performance parameters.

1.5.2.7 Substrates containing hazardous materials

There are a number of substrates that contain a percentage of materials that can be harmful if ingested or lead to sensitization. Care needs to be taken particularly when sanding to ensure that the dust generated is not absorbed by either breathing or swallowing. As an example, timber products such as medium density fibreboard (MDF) may contain formaldehyde in the glue. Treated timber particularly for termite protection has become common. Whilst copper-chrome arsenate (CCA) treated timber is a characteristic green most of the light organic solvent preservative (LOSP) treated timber is difficult to detect once it has been exposed to the atmosphere for a few days. It usually comes treated with a coloured dye that fades in a short period of time. If the timber is cut a slight smell of the solvent (kerosene or similar) can usually be detected. While the level of toxicity is low a contractor continually working on this product may be affected. Reference to the MSDS should be made in regards to the substrate.

1.6 INFLUENCE OF CLIMATE ON EXTERNALLY EXPOSED PAINT

1.6.1 General

In predicting the influence of climate on the weathering of paints and related surface coatings it is essential to consider a number of parameters including the following:

- (a) The mechanisms of weathering are complex and vary with the paint type and substrate.
- (b) The physical, chemical and weathering characteristics of the substrate influence paint durability. Performance of paint on one substrate does not necessarily reflect performance on another.
- (c) Weathering conditions are infinitely variable; attempts to identify and quantify the various parameters that are significant to the weathering processes are often unproductive.
- (d) The microclimate, which is influenced by such factors as the distance from industrial pollution or coastal salts and surface orientation, also influences durability performance.

A number of climatic factors are particularly significant in the durability performance of paints: atmospheric moisture, wind, coastal influence, temperature and solar radiation.

1.6.2 Specific influences

1.6.2.1 Atmospheric moisture

Moisture is a most significant factor in the degradation of paints and all organic materials, including plastics, sealants and timber, and in the corrosion of metals.

The chalking and erosion of organic paint binders is an oxidation process caused by ultraviolet (UV) radiation and water. The time that the surface is wet and the amount of moisture present in the coating influences the rate of development of this defect. Further, the presence of deliquescent coastal salts on the surface accelerates the chalking process close to the seashore and facilitates water absorption into the paint film. Diurnal and seasonal moisture changes are also significant, causing moisture-sensitive materials, notably timber, particleboard, hardboard and glass reinforced cement to swell and shrink, stressing the paint film in the process. Moisture changes may also cause timber to crack and timber composites, resins, glues and adhesives to hydrolyse or otherwise degrade. Higher atmospheric moisture levels also promote the corrosion of steel and other metals. It is generally accepted that the corrosion rate for steel is minimal at humidity levels below 70%.

Where high atmospheric humidity levels prevail, fungal growth and the chalking of paints are likely to be significantly greater than in drier or cooler areas. The effects are even more pronounced where the substrate expands and contracts with changes in atmospheric moisture.

Many regions in New Zealand have high relative humidity levels with mean annual values in the range of 70–85% common. Most of Australia is much less humid with the exceptions of tropical and subtropical areas during summer and in southerly latitudes.

1.6.2.2 Coastal influence

The coastal influence is a most significant factor in the deterioration of paint work on surfaces that corrode, notably steel and cast iron (refer to AS/NZS 2312.1).

The distance that the coastal fringe extends from the shoreline depends upon the prevailing wind, ambient humidity, and the sea conditions. In quiescent waters with prevailing offshore winds, the coastal zone may extend no more than a few hundred metres; however on ocean beaches, the coastal influence may extend some kilometres inland.

1.6.2.3 Solar radiation

Solar radiation, particularly the influence of the UV end of the spectrum, is an important parameter for paints that degrade by photo-oxidation processes. Incident solar radiation throughout Australia and in parts of New Zealand is high, relative to other parts of the world. Paints developed and manufactured in other parts of the world may degrade more rapidly under Australasian weather conditions. In the Southern Hemisphere, the rate of weathering on northern and western facing surfaces is far greater than on eastern and southern surfaces, particularly in the southern latitudes of Australasia. (Refer to AS/NZS 1580.457.1 for quantification of solar radiation.)

1.6.2.4 Miscellaneous influences

There is a range of other climatic influences that can impair the decorative and durability performance of paints.

Deposition of airborne pollutants, notably oxides of sulfur and nitrogen, hydrocarbons, dust and particulates from soil erosion, industrial sources and heavily urbanized locations, are significant influences.

Geothermal areas of New Zealand, such as those in the Bay of Plenty, have elevated levels of sulphurous gases, which can exacerbate corrosion and cause surface discolouration if strongly coloured sulfides are formed (e.g. black sulfides of mercury and lead).

Although the rate of deterioration of painted surfaces can vary throughout the land, depending upon the general climate and microclimate, the full range of contemporary commercial paints finds application over the whole of Australasia. The performance of paint systems may vary and the following climatic factors need to be taken into account:

- (a) Surfaces vulnerable to corrosion in the coastal fringe require particular attention; AS/NZS 2312.1 provides specific recommendations.
- (b) Areas of high moisture (e.g. tropical or mountainous areas) are particularly vulnerable to mould or fungal growth, and the use of anti-fungal additives or anti-fungal paints should be considered as retardant to such defacement.

NOTE: Inorganic anti-fungal components may provide a longer service life than organic components due to the volatility of the inhibitors used.

- (c) Degradation of paint is particularly rapid in tropical areas making the exterior grade latex paints, which have greater flexibility and slower chalking rates, particularly suitable.
- (a) Air and surface temperatures below 10°C are detrimental to most paints during application and drying. Although the loss of gloss is a common defect with solvent

borne paints, latex paints are particularly vulnerable as they can fail to form a cohesive film at low temperature. In addition, at lower temperatures the drying time of the paint may be extended to beyond that indicated in the manufacturer's literature and this should be considered before commencing application.

- (b) Surfaces subject to windborne abrasives (e.g. sand or soil) can suffer erosion.

1.7 INTERNAL ENVIRONMENTS OF BUILDINGS

Internal surfaces of all buildings are generally required to remain attractive for long periods. Therefore, surfaces constantly exposed to dirt and grime should be readily cleanable.

Kitchens, bathrooms, laundries and some industrial processes can generate steam which vaporizes small quantities of oils and fats which can condense on the walls and ceilings. Such surfaces should not be painted with a flat finish that cannot be readily and repeatedly cleaned without deterioration.

Mould will grow on any surface if there is nutrient and adequate moisture. This is best countered by removing the moisture quickly by means of extraction fans. If mould does become established, it is more readily and completely removed from a glossy finish.

Any surface to which dust adheres and on which water condenses is susceptible to attack by mould growth. High gloss paints are, therefore, generally less vulnerable to mould growth than flat paints.

1.8 SPREADING RATE, PAINT COVERAGE AND PAINT USAGE

The spreading rate of paint per coat is the area, in square metres, covered by 1 L of paint.

In general terms, this means that paint when correctly applied, i.e. not unnecessarily thinned, brushed out too thinly, or applied too heavily, will cover the area stated on the paint container provided that the surface is essentially non-absorbent. Where surfaces are absorbent more paint will be used and it is difficult to assess paint usage requirements with a high degree of accuracy. The complete obliteration of the colour of a substrate will not necessarily occur with a single coat applied at the stated spreading rating.

Factors that affect the spreading rate of paint include the following:

- (a) Type of paint.
- (b) Method of application.
- (c) Porosity of the substrate.
- (d) Surface texture of the substrate.
- (e) Ambient temperature and humidity.
- (f) Degree of thinning.

Under normal brushing application on a non-absorbent surface, the theoretical quantity of paint required to cover an area may be determined from the spreading rate specified by the manufacturer. The paint required may also be determined by the following equation:

$$\text{Quantity of paint (litres)} = \frac{A \times F}{10 \times N} \quad \dots 1.8$$

where

A = area to be covered, in square metres

F = dry film thickness, in micrometres

N = non-volatile content by volume, percent (volume solids)

NOTE: F and N values are obtainable from the paint manufacturers.

In making an assessment of the quantity of paint for any given painting job, it is necessary that the ability of the paint to obliterate the colour difference of a substrate be considered. This property is known as the opacity or hiding power of the paint. Consideration, therefore, needs to be given to the number of coats required to adequately cover the substrate.

Domestic paints are generally formulated to be applied at a dry film thickness ranging from 20 to 45 μm . Overthinning the paint, to spread it over a larger area or to increase the ease of application, will give an apparent increase in spreading rate but will also be accompanied by a loss of hiding power (opacity) and durability because the dry film thickness will be reduced.

NOTE: In dispute situations, refer to paint manufacturers' technical information.

Where paint is applied too thickly, the spreading rate will be reduced because the dry film thickness will be increased. There is also a chance of the paint sagging, running, bubbling and blistering.

The non-volatile content by volume, often termed 'volume solids', relates to the solid material in the paint which remains on the substrate after the evaporation of paint volatiles. At a specified dry film thickness, the higher the volume solids content, the greater will be the spreading rate; the higher the volume solids content for the same spreading rate, the higher will be the dry film thickness.

The majority of ready-mixed domestic paints are suitable for application by brush, roller and spray. In terms of control of the spreading rate, brush application usually gives less wastage of paint. Application of the paint by roller is generally faster than by brush and results in a thicker film. Application by spray is fastest but may require a greater quantity of paint. As distinct from contact application methods, such as by brush or roller where the final paint film thickness is controlled by the viscosity of the paint, the spreading rate for non-contact application methods, such as by airless or conventional spraying, is entirely under the control of the applicator (e.g. gun pressure, number of passes).

1.9 SELECTION OF COLOUR

1.9.1 General

The choice of colour is very much a matter of personal choice except where specific colours are required by a particular regulatory authority. For general colour selection, reference should be made to appropriate colour standards AS 2700, AS/NZS 2633 and AS 3730 or to a paint manufacturer's colour cards.

From time to time, there may be technical or economic factors that can influence colour selection. Some of these factors are as follows:

- (a) Most light coloured paints do not have the ability to hide highly contrasting colours in one coat. Bright yellows, oranges, reds and paints of related colours are particularly problematical. These paints have limited opacity and require two or more coats of paint to achieve hiding. In such cases, it will be expedient to use a neutralizing or tinted undercoat before finishing to ensure a uniform appearance or apply multiple coats.
- (b) Not all paints have the same level of durability and colour-fastness in exterior applications.
- (c) Some pigments may react adversely with some specific substrates or environments. For example alkalis may leach from concrete to affect aluminium pigments.

1.9.2 Product differences

The observed colour of a paint film depends mainly upon the combination and types of pigments used in the manufacture of the paint. Other factors that influence colour include the perceived differences in colour due to the gloss level and the type of paint, e.g. alkyd or latex. It should be noted that there can be perceived differences in the colour quality of paints of the same colour but of different gloss levels, i.e. paints of higher gloss levels may appear to be a deeper shade.

Colour matching of paints having different gloss levels is difficult.

Tints and bases used at retail outlets are chosen to minimize variation in colour although some variation in colour matching should be expected. The advantage of a tinting system is that a wide range of colours is possible.

1.9.3 Colour matching

Most manufacturers' colour cards are printed with lacquers to produce a 'colour chip' which should be a close match (refer AS/NZS 1580.601.1) with the paint to be supplied. A number of factors influence the apparent colour when paint is applied to, say, a wall. These factors include the following:

- (a) The gloss level and paint type.
- (b) The colour and opacity of the paint.
- (c) The lighting conditions.
- (d) The texture of the surface.
- (e) The quality of the paint surface.
- (f) The colour of the surface covered by paint.
- (g) The colour of surrounding areas, drapes and other furnishings.

Tints and bases supplied by retail outlets should be expected to produce satisfactory colour matches across a manufacturer's product range; however, some variations may occur between products for the same designated colour. To overcome this, where several containers of paint are required to complete a painted surface, the material should be mixed (boxed) and a quantity retained for touching up the finished coat.

1.9.4 Exterior colours

Colours should be chosen to suit the application. In particular, durable colours should be used in exterior situations. The paint manufacturers' colour cards are the main source of this information and should indicate colours that are not suitable for exterior use. Where there is doubt about durability under some conditions, such as exposure to heat, chemicals, or industrial fumes, the paint manufacturer should be consulted.

Light colours are generally used for exterior surfaces because of their reflectance qualities, although the insulating characteristics of the building envelope are primarily dictated by the thickness and the thermal properties of the cladding rather than the colour of the applied paint. For example, the colour of paint on concrete blockwork will have reduced influence on heat transfer through the blockwork because the building structure is itself insulating; however, the colour of the paint of an uninsulated galvanized roof will have a significant influence on heat transfer characteristics of the roof.

The application of very dark coloured paints may result in a more rapid deterioration due to the extra heat absorbed; for example, blistering of coating systems on timber or more rapid chalking. In addition, degradation of brightly coloured or dark paints is usually more apparent than that of pastel shades.

1.9.5 Interior colours

Although colour preference is often a matter of individual taste, it should be borne in mind that the selected colour will strongly influence the quality and intensity of reflected light within a room or space. Light-coloured surfaces are the best for maximizing light distribution to every part of a room, as they reflect between 80 and 90% of the light falling upon them. The darker the colour of a surface, the less light will be reflected.

As a general guide, ceilings should be painted white or near white. This is particularly important as natural or artificial illumination is diffusely reflected from overhead surfaces; a white or near-white ceiling greatly improves the quality of lighting in an interior by softening harsh shadows and reducing excessive brightness contrasts.

1.9.6 Highlighting or identification

Colours are used to highlight certain items or objects, such as doors, architraves or other architectural features, for aesthetic reasons or for the purposes of identification or for assisting the visually impaired. Colours for identification are important in building and plant services, to show reticulation of services or process streams. This is covered in detail in AS 1345. Similarly, hazards such as machinery or low overhangs, or safety equipment such as firefighting appliances or first aid facilities, have to be visible and recognizable. AS 1318 recommends colours to be used for this purpose.

1.9.7 Lighting

Lighting plays an important part in the colour sensation process and reference should be made to AS/NZS 2633, AS/NZS 1680.1 or NZS 6703, as applicable, which sets out recommendations designed to improve visual conditions in buildings by means of appropriate lighting and interior colour treatment for particular tasks and locations.

1.9.8 Heritage painting or restoration

1.9.8.1 General

With the emphasis on restoration rather than replacement, the use of colours once commonly used in earlier times (i.e. heritage colours) has become very popular since the mid 1980s. With the upsurge in restoration in older inner city suburbs has come an increasing demand for paints using these heritage colours (sometimes inaccurately referred to as heritage paints). Clause 4.20 provides some information on traditional heritage paint systems which may need to be used if true restoration is required.

1.9.8.2 Heritage colours

These are contemporary conventional topcoat finishes (i.e. alkyd enamels and acrylics) with only the colours differing from the more common commercial colours. AS 2700, BS 4800 and BS 381C provide a useful basis for comparing and identifying colours on old buildings. In many cases these Standards provide colours that are very close to the shades used between the years 1820 and 1930.

NOTE: BS 2660 (superseded) may also be of use, as only some of its colours were included in BS 4800 which superseded it.

The names of colours used in the nineteenth and early twentieth centuries are known, but it is often difficult to tell what shade was implied by a particular name. There was then no common standard for colour, and in many cases it is not known what a particular colour looked like.

The problem of accurately identifying heritage colours is further complicated by the fact that in the nineteenth century painters mixed their own paints. One painter's Brunswick Green might not have been quite the same as the Brunswick Green mixed by another painter; however, despite such variations, it should be remembered that the shade of colour is all important in restoration work. The wrong hue can place a building in a different period altogether.

When painting an old building in traditional fashion, the right colours should be used in the right way. Our forebears followed well-established practices in the placement of colour on their houses and other buildings.

When determining a traditional colour scheme, the following steps should be followed:

- (a) Look closely at the building to assess the architectural style and period.
- (b) Use a scalpel or some other sharp blade to scrape away layers of existing paint at various locations on the building.
- (c) Record the first finishing colours used and try to visually match them with colours either from established colour cards or from other samples of that colour (e.g. paint chips).
- (d) Refer to old photographs, even though they are black and white, to ascertain shades of colour and to assist in identifying the appropriate placement of the colours.

1.9.8.3 Health issues

The existence of lead paint on old buildings (typically pre-1970) can cause public health and environmental hazards, if not correctly managed and management procedures should be in accordance with AS 4361.2. In New Zealand, the occupational safety and health guidelines for the management of lead-based paint should be followed.

1.10 GLOSS LEVEL AND FINISH

The desired surface finish is another important factor to be considered prior to painting. Paints are available in a range of gloss levels from flat to full gloss (see Clause 4.1).

Interior broad areas are generally painted with a flat, low-gloss or semi-gloss finish to provide diffuse scattering of incidental light and minimize unwanted reflections and glare. Textured coatings are available for interior surfaces and are often used for filling and masking imperfections in the substrate. Areas requiring periodic cleaning, or those subject to frequent condensation of water vapour, such as kitchens, bathrooms and laundries, are best finished with a semi-gloss, gloss or full-gloss paint; however, low-gloss (low sheen) products are being increasingly used. This change is largely consumer driven because open plan living encourages a consistent gloss level throughout the building, the inability of gloss paint to mask minor surface imperfections and because mechanical ventilation is being increasingly used in these areas. This does however result in some sacrifice in wear and tear resistance.

Ceilings are normally finished in a flat finish (to help masking minor surface imperfections) except for those areas subject to frequent condensation of water vapour, such as kitchens, bathrooms and laundries.

1.11 ENVIRONMENTAL ISSUES

Environmental issues are important for manufacturers and end users of paint. The environmental concerns focus on the effect paint has on human health and ecosystems and on depletion of resources.

Buying more paint than is needed may cost money and create a disposal problem. Clause 1.8 provides guidance on calculating the amount of paint required. Only sufficient paint should be saved for later touch ups and the remainder can be used as an additional coat or for application to other areas. Paint should be stored in a suitable inert durable airtight container.

While improper disposal of many older paints, which may contain heavy metals, notably lead and chromates, or other hazardous constituents, is a particular concern, it is important to minimize all waste paint (see AS 4361.2).

The use of low VOC paints, notably latex-based products, and high solids paints also minimizes the initial environmental impact (see Clause 1.5). The life cycle of the paint or the necessary frequency of re-coating should be taken into account when considering the use of low VOC paints to ensure any environmental benefit is not negated by frequent re-coating.

Paints can be considered to have two service functions, namely primary service life, where the decorative appearance is the primary consideration and a secondary service life, where continued adhesion to the substrate is required to maintain the performance of any subsequent topcoats. Using paint with a lower environmental impact but shorter service life in the proposed application may result in a greater overall environmental impact than using a product with greater initial environmental impact but with better durability.

SECTION 2 DESIGN FOR PAINTING

2.1 GENERAL

2.1.1 Choice of building materials

Proper planning, sound design, good building construction and appropriate selection of building materials are essential if a paint system is to realize its potential. The choice of building materials can have a critical influence on the life of any given paint system, and selection of materials for construction that maximize paint durability, particularly under severe service conditions, should be considered. For example, paints on stable, inert substrates, such as concrete and fibrous cement sheets, are generally more durable than those on degradable surfaces or surfaces that expand and contract considerably with climatic variations, such as many timbers. Care should be taken in the use of new unproven building materials particularly in external and wet areas, as significant failures can result.

Clauses 2.2 to 2.9 set out important aspects that require attention in the design and building stages.

2.1.2 Waterproofing

Liquid applied paints should not be regarded as completely impervious to moisture irrespective of their composition. This is particularly true on porous substrates or those with a potential for cracking or joint movement. Therefore, exterior building surfaces should be designed with the assumption that moisture will breach the exterior coating but will allow it to escape without impairment of the building fabric. Moreover, in areas where the coating is vulnerable, notably horizontal surfaces and localities subject to cracking, alternative solutions need to be included in the design, such as metal cladding, flashing or impervious membranes.

Moisture has a deleterious effect on most paints (see Clause 1.6) and continuous direct contact of the painted substrate with soil, stone or concrete is to be avoided. Using such moisture barriers as polyethylene, chemical damp courses, metal flashing and bituminous felt may prevent ingress of moisture. Structures to be painted should be sealed or otherwise insulated from moisture by the inclusion of air gaps, tanking or similar.

Adequate drainage of water from surfaces and away from buildings should be provided for.

In selecting the optimum paint system for any given project, the specifier should be mindful of the potential for and implications of a paint failure and of the need for a risk assessment. The use of building designs or substrates outside the specifier's experience or where the service conditions are unusual or the condition of the substrate is questionable should sound a cautionary note and cause the specifier to appraise the situation with particular care. In addition, the risks associated with a failure and the cost of reinstatement may extend far beyond the cost of repainting to include the costs associated with disruption to building function, damage to image and WHS issues.

2.1.3 Durability

Horizontal and slightly inclined surfaces requiring painting in exterior applications should be kept to a minimum as the effect of weathering is much more severe on these surfaces than on vertical surfaces. In Australasia, deterioration is generally more severe on a surface with a westerly or northerly aspect.

Horizontal surfaces should not be orientated so dirt precipitated on them is washed onto facades which can cause unsightly staining.

Dark colours in exterior situations increase the absorption of heat and this may have a deleterious effect on the paint coatings and substrate materials.

2.1.4 Ventilation

Adequate ventilation should be provided in all areas of high humidity such as bathrooms, kitchens and laundries. Such areas and bathrooms in particular, should preferably be ventilated with exhaust fans to control humidity. Where practicable, clothes driers should be exhausted to the external atmosphere.

Subfloor areas and other enclosed areas also require movement of air to prevent damage from moisture. Therefore, an adequate number and appropriate positioning of ventilators is required to effect good ventilation. Where it is difficult to insert an adequate number of ventilators, the use of a vapour barrier (ground cover) laid on the ground is highly recommended.

2.1.5 Fastenings—Metal corrosion

Fastenings and fixing materials should be compatible with the substrate and the environment.

Uncoated steel fastenings may corrode or react with construction materials and produce unsightly stains. Such fastenings should be protected against corrosion, particularly where clear or natural stains are to be used in exposed locations. Thus the use of corrosion-resistant fastenings is recommended.

2.2 TIMBER

2.2.1 Nature of timber

Timber type can greatly influence the performance of paint applied to it. Some species are very dense and non-absorbent. Other species show a distinct seasonal variation in growth, indicated by prominent annual rings. The darker portion of those rings (the latewood) is denser, and in softwoods more resinous than the earlywood, and is less likely to provide a good bond with the coating.

Softwoods often provide a better base for coatings than hardwoods; however, there are many exceptions. Softwoods having high resin content are usually relatively poor substrates for paint. Softwoods, too, are more likely to contain knots, which present a difficult surface to coat satisfactorily for long-term external performance.

Some species contain extractives that are readily leached from the wood by water and thus have the potential to discolour painted surfaces. This may happen, for example, when external cladding that has not been primed on all surfaces is subjected to heavy rain, and water that has penetrated the joints emerges at a lower level with coloured extractives that discolour the paintwork. Therefore, a suitable primer coat should be applied to all surfaces of timber cladding and joinery prior to installation and painting.

Timbers containing preservatives including CCA and LOSP are popular building materials which require specific consideration prior to painting and are discussed in detail in Clause 1.5.2.7 and Table 5.2.

2.2.2 Moisture content

Timber is a hygroscopic material that will gain or lose water according to the prevailing atmospheric humidity. Moisture change will cause the timber to expand or contract resulting in stressing and destruction of the paint finish.

Timber reaches a state of equilibrium in keeping with the humidity of the surrounding atmosphere, and in most populated areas of Australia the equilibrium moisture content (EMC) is typically in the range 10% to 17%. In New Zealand, the EMC is typically in the range of 14% to 18%. These limits are extended in very dry inland areas or tropical areas, whereas air-conditioned buildings usually have a humidity level that produces an EMC of 8% to 12%.

Timber should be painted only when the surface is dry and not significantly above the EMC (see Clause 3.2.5).

2.2.3 Painting end-grain

During wetting or drying the rate of water movement along the grain of timber is extremely rapid compared with the rate of water movement across the grain. This explains why cracking often begins at the unsealed cut ends of butt and mitre joints and at the bottom edge of vertical boards.

Design should make provision for the protection of all end-grain of external timber. To retard the ingress of moisture, exposed timber cladding should be coated all round before being attached to the building framework.

2.2.4 Basic considerations

Attention to the following matters is essential if good performance and appearance is to be obtained with painting systems:

- (a) Sharp edges on profiles should be rounded before coating.
- (b) The use of unseasoned timbers should be avoided wherever possible. If this cannot be avoided, it is preferable to use exterior stain or latex finishes which are more accommodating to a slightly damp surface.
- (c) The use of poorly finished timber that has raised grain and planing burrs should be avoided.
- (d) The use of discoloured timber under clear finishes should be avoided. The discolouration in the timber will be visible through the clear finish and detract from the overall appearance of the finished surface.
- (e) Pine knots can give resin and colour bleeds which in practice cannot be eliminated by conventional paints, therefore timbers with excessive knots need to be avoided for both internal and external applications.

2.2.5 External applications

External paint applications will be assisted by design considerations such as the following:

- (a) Where cladding is used, wherever practicable, full lengths should be selected for exposed areas. The lower ends of the vertical boards should be undercut or bevelled to shed water. An air gap should be left between the bottoms of the boards and the plinths or flashings.

NOTE: Board profiles that allow the collection of moisture may reduce coating durability and adversely affect timber performance.

- (b) Eaves of adequate width should be provided for, to ensure that any wooden surfaces below them receive a minimum of wetting.
- (c) When using knotty timber in external applications, materials should be selected with care (see also Clause 3.2.6).
- (d) Adequate damp coursing between timbers and absorbent materials, e.g. brick or concrete, should be provided for.
- (e) The use of clear finishes on timber that is to be exposed to the weather should be given special consideration (see Clause 4.8).
- (f) The use of butt joints in exposed areas of timber cladding should be minimized; however, if butt joints are unavoidable they should be primed prior to installation and, where practicable, be placed in protected areas.
- (g) To retard the ingress of moisture, exposed timber should be coated on all faces, edges and ends before being attached to the building framework.

- (h) When installed, timber with high moisture content will shrink until it reaches the EMC. This will crack the paint and detract from the overall appearance of the finished surface.
- (i) Dark colours in exterior situations increase the absorption of heat and this may have a deleterious effect on the paint coatings and substrate materials.

2.2.6 Internal applications

Adequate space and access is required to permit internal painting, cleaning and ventilation of the area.

2.3 METAL INSTALLATIONS

2.3.1 Steel

Recommendations for the painting of steelwork included in this Standard are intended to apply to steelwork and fittings that are not exposed to external atmospheric conditions, i.e. steelwork installed within building structures. Corrosion of metals under these conditions is minimal, so no special design considerations for corrosion protection are needed.

Where steelwork is protected by an awning or other covering but is subject to attack by wind-blown contaminants such as sea spray or fog condensing on exposed surfaces, the steelwork is considered to be exposed to an aggressive environment and, therefore, reference should be made to AS/NZS 2312.1, which includes recommendations on design features and protecting systems for prolonging the longevity of steelwork. Similarly, where interior metalwork is subject to dampness or aggressive chemical service, special consideration should be given to corrosion protection.

The application of paint extends the durability of galvanized items in a synergistic fashion; however, painting galvanized roofs accelerates corrosion of the wetted surface of unpainted galvanized spouting, downpipes and associated flashings. The painting of roofs eliminates the neutralizing influence of such broad areas of galvanizing on slightly acidic rainwater, allowing the acidity to attack smaller and, hence, more vulnerable, rainwater goods. The problem is avoided by selecting superior corrosion-resistant rainwater goods, such as zinc-aluminium alloy, copper, stainless steel or unplasticized polyvinyl chloride (uPVC), or by minimizing attack by painting the wetted surfaces.

Where steel, galvanized or zinc-aluminium alloy-coated surfaces are in contact, and exposed to an accumulation of moisture, as may occur with some roof claddings, consideration may need to be given to painting the contact surfaces before assembly. In moist or otherwise corrosive conditions, direct contact with stainless steel, copper-based alloys and other more cathodic metals will accelerate corrosion unless contact areas are painted or insulated. Pre-painting is more common for profiled metal roof and wall cladding (see AS/NZS 2728); however, for uncoated cladding materials priming of all laps and unexposed surfaces should be carried out before installation. Preferably these materials should be delivered to the site in a primed condition.

2.3.2 Copper and brass

Protection of copper and brass fittings and fastenings with solvent-borne paint systems, chromium plating or polyester powder coating will inhibit tarnishing and discolouration of adjoining paintwork. Where these metals are exposed outdoors such that corrosion products may contaminate more anodic metals, notably zinc and aluminium alloys, steel and cast iron, the copper or brass should be painted to prevent corrosion. Indoors, they may be overcoated with clear finishes to maintain the lustre.

2.3.3 Aluminium

Protection of aluminium surfaces with solvent-borne paint systems, powder coatings (see AS/NZS 4506) or anodizing is favoured where maximum corrosion resistance and minimal deterioration in general appearance is essential.

The corrosion of aluminium in moist or otherwise corrosive situations is accelerated considerably by direct contact with more cathodic metals. In particular, in such circumstances, copper-based alloys should be insulated or protected (see Clause 2.3.2).

2.4 BUILDING BOARDS

2.4.1 General requirements

The surfaces of the various types of building board referred to below vary widely in durability, performance, texture, absorption properties and ability to hold paint coatings. Requirements also vary with application as follows:

- (a) *Internal applications* Some boards expand and contract with changes in moisture content, giving rise to movement which may lead to unsightly cracks in paintwork. To avoid the possibility of cracks opening between adjacent mineral-based building boards such as plaster and fibrous cement, the use of cover strips of paper, linen-backed paper or equivalent material to join the edges flush is necessary.

Joints between timber building boards used as facings should accommodate movement by means of vee-jointing or cover moulds of soft metal, plastic or timber.

- (b) *External applications* Where there is a possibility that moisture will be absorbed, it is preferable that, in addition to the face, the back and edges of timber-based boards be painted to reduce any differential movement resulting in buckling and lateral movement.

Where wallboards are fixed in direct contact with solid walls or ceilings, the whole structure has to be allowed to dry thoroughly before painting because moisture and water-soluble matter emanating from the backing material may damage the fresh paint.

Clauses 2.4.2 to 2.4.7 give details to be considered at the design stage for each type of building board. These details should be read in conjunction with Section 3 and Section 5.

2.4.2 Organic fibre insulating board

Organic fibre insulating boards have a soft absorbent open texture. Therefore, they should be painted with flat, low-gloss or semi-gloss paints. Gloss levels higher than low-gloss will accentuate the irregularity of the surface. Where semi-gloss, gloss and full-gloss paints are selected to satisfy service requirements, the fibreboard should first be sealed with a wallboard sealer. Alternatively, the fibreboard may be suitably primed (see Section 5).

Sealing of organic-fibre insulating board before installation is recommended rather than sealing it after installation. Materials should be delivered in a presealed condition.

2.4.3 Hardboard and tempered hardboard

Hardboard and tempered hardboard generally require sealing or priming before painting.

Sealing or priming before the installation of exterior grade hardboard is recommended rather than sealing or priming after installation. Ideally, materials should be delivered in a presealed or primed condition.

2.4.4 Particleboard and medium density fibreboard (MDF)

Particleboard and MDF are treated in the same manner as timber. All particleboard and MDF require sealing with a primer or undercoat before painting.

Factory-sealed material is recommended rather than board that requires sealing after installation. For a clear finish on MDF, matched plastic stopping compounds should be used after the application of a sealer coat.

NOTE: When water-borne products are applied direct to these materials, there may be a swelling of surface particles, which could result in undesirable or unacceptable finished appearance.

2.4.5 Gypsum plasterboard

Paper-faced gypsum plasterboard requires careful handling and storage prior to installation to avoid mechanical and atmospheric damage. It should be painted as soon as practicable, as the paper facing on these boards has a tendency to yellow on exposure to light, particularly to sunlight.

NOTE: Yellowing may be detected on unpainted surfaces within 3–4 weeks of installation.

In general, latex paints can be used directly on paper-faced plasterboard, unless there has been substantial yellowing of the paperface, which may cause bleeding problems. Where there is yellowing, a solvent-borne sealer should be used.

Where the joint is exposed to strong side lighting, particularly from natural light, e.g. floor to ceiling windows, careful fixing is required to reduce the effect of differential texture. A level of finish chosen from AS/NZS 2589 and appropriate to the decorative finish, lighting source and angles, should be specified at the project design stage to minimize the appearance of surface imperfections.

2.4.6 Fibrous plaster and plaster glass

Plaster should be stopped and plastered to a smooth finish and sealed with a solvent-borne sealer before painting, except that where plaster glass is used, the plaster should be dry and cured before painting. Because this material has a smooth glazed surface, the stopping should be equally smooth; otherwise the diffusion of light may give rise to apparent colour differences on the painted surface.

Low lime-based filling or jointing compounds should be used to avoid excess alkalinity and porosity.

2.4.7 Fibrous reinforced cement (FRC)

Conventional (autoclaved) fibrous cement boards do not require special surface treatment. Hand-moulded (non-autoclaved) FRC boards may have a higher alkalinity and should be given the same treatment as for concrete. Compressed FRC sheet may require surface sanding to improve adhesion properties because of its smooth dense nature. FRC materials using cellulose reinforcement should be painted as soon as practicable on the exposed face to minimize the possibility of mould growth occurring on the substrate. Where mould growth has occurred it should be treated prior to painting.

NOTE: This also applies to fibrous cement pipes and vents.

2.4.8 Polystyrene building cladding

In an effort to contain heating and cooling costs, many building owners, architects and facility managers are turning to polystyrene cladding systems. Typically, these cladding systems are used on upper storeys where impact damage is less of an issue and weight imposition on lower storeys needs to be minimized.

The cladding is supplied in large sheets, either factory or site rendered. Reinforcing mesh is usually included in the render. The render may then be painted as for other rendered surfaces.

2.5 BRICKS

2.5.1 General

Clay bricks and concrete block structures can usually be painted with acrylic latex paints without the need for primers or sealers. In general, painting of bricks with smooth dense surfaces or loose powdery surface should be avoided or will require additional preparation such as use of a penetrating sealer.

Where a smooth, uniform finish is required, attention should be paid during construction to the uniform laying of bricks and blocks, and to the uniform finishing of mortar joints. To obtain the smoothest possible surface it is generally necessary to apply a thin layer of cement rich render with subsequent treatment being the same as for concrete surfaces. Render mixtures used should be specified with adequate cement content to bind the render at the relatively thin coatings used. Use of a water resistant bonding agent in the render is also desirable to ensure a sound surface for painting.

2.5.2 Clay bricks

When selecting bricks for buildings that are to be painted, care should be taken to avoid brick colours that are susceptible to discolouration when painted. Many light-coloured bricks contain traces of vanadium salts, which can bleed through the paint and show a yellow, green or reddish brown colour after painting. Chemical treatment of these materials is discussed in Clause 7.6(i). The presence of iron contaminants in bricks or mortar may also lead to rust stains.

Where any suspicion exists regarding the presence of stain-prone bricks in the structure, it is prudent to apply one coat of latex flat (Type B6 paint), low-gloss (Type B7 paint), or semi-gloss (Type B8 paint), to a trial area of brickwork and to inspect for staining after four to six weeks. If stains become evident during this period, chemical treatment or use of a stain blocking sealer will be necessary prior to application of finishing coats.

2.5.3 Aerated autoclaved concrete (AAC) bricks

The permeability of AAC bricks requires the use of specialized sealers and coating systems to obtain satisfactory durability and performance. Designers should refer to block or paint manufacturers for current recommendations for treatment of AAC surfaces.

2.5.4 Concrete blocks

Concrete masonry products, having an open texture and greater porosity than clay bricks or in situ concrete may require a sealer coat in the painting specification depending on the appearance requirements of the project design.

2.6 CONCRETE

Concrete needs to be adequately cured before painting. Painting should not commence before curing is complete (see Table 3.1 for curing times). A range of curing compounds, bond breakers, form release oils, and the like, are variously needed to produce satisfactory concrete products. However, many can interfere with paint performance, particularly adhesion. It is therefore important that these concrete treatments are selected judiciously, so that surface preparation prior to painting can be kept to practicable levels, and a durable coating finish can be achieved. In general, concrete with a smooth dense surface should be avoided or will require additional preparation such as use of a penetrating sealer.

2.7 GLASS-REINFORCED CONCRETE (GRC)

Additional attention is required in the preparation of GRC for painting. Designers should allow for the use of specific sealers to seal exposed glass fibre edges to prevent the ingress of moisture where they are exposed to water or weather. Particular attention should be given to the possibility of expansion and contraction of this substrate due to changes in atmospheric moisture content.

2.8 SET PLASTER AND CEMENT RENDER

Both set plaster and cement render surfaces can vary considerably in composition, thickness and condition because it is a site prepared surface. Therefore, both need to be carefully scrutinized for any physical deficiencies, (notably adhesion, porosity, residual moisture and residual alkalinity) prior to painting. Particular care should be taken when it is suspected that cement render has been applied in hot windy conditions, on porous substrates or has been applied too thinly. These characteristics may cause the render to dry out too quickly and so result in a weak or poorly adherent base for painting. This may result in severe efflorescence, saponification or total delamination of the paint and render from the surface, refer Clause 3.9.2.3.

2.9 PLASTICS

The surface treatment of plastic materials depends upon the plastic type. For some plastics, particularly polyolefins (polyethylene, polypropylene and similar), field painting is often impractical. For the exterior application of paint on thermoplastic materials, lighter colours should be selected, as dark colours can result in temperature build-ups, which may cause distortion of the plastic components.

NOTE: Because some plastics may be stress corroded by paint solvents, compatibility of coating materials should be checked with the paint and plastic manufacturers.

SECTION 3 PREPARATION OF UNPAINTED SURFACES

3.1 GENERAL

Premature paint failure usually occurs if surfaces are not adequately prepared before painting, e.g. surfaces exposed to marine spray, dust or heavy industrial pollution should be cleaned thoroughly to remove contaminants before painting. Different types of surfaces require different preparations as discussed in this Section.

Surface assessment and preparation are particularly important as the painter may be held liable for any future failure because the very act of painting a surface may be interpreted as accepting that surface as being suitable for painting.

NOTE: Unacceptable surface imperfections may be undetectable until one or more coats of paint have been applied. Variability in on-site applied substrates, e.g. render/plaster may also not be evident until one or more coats of paint have been applied.

Preparation of previously painted surfaces is covered in Section 7.

3.2 TIMBER PRODUCTS

3.2.1 General

Most exposed timbers used in building construction are supplied in the dressed condition, e.g. cladding, panels, windows and mouldings. Such materials should not be delivered until just before they are to be incorporated in the building, unless on-site storage facilities are available, and should be in a clean, dry, freshly prepared condition. On-site storage should be such that it will allow that condition to be maintained. It is important that timber be allowed to equilibrate in a location protected from weather to near its final in-service conditions, to avoid shrinkage or swelling after installation and painting. On-site storage should be such that it will allow that equilibrium to be achieved. This may take several days for small relatively dry timber specimens to many weeks for large wet timber specimens that have been stored outdoors.

Some timber products are delivered pretreated with water repellents or preservatives. Such products may present difficulties when coated with latex systems. Where such treatments are known to have been used, the paint supplier's advice should be sought.

3.2.2 Standard of finish

All sharp corners should be rounded or eased by planing, scraping or sanding to ensure that they can be properly coated and that prime and intermediate coats are not rubbed through during sanding between coats of paint. For fully exposed exterior timber, a typical radius of curvature of 3 mm is recommended for best coating performance.

Dressed timber should be smooth, and free from raised or woolly grain, planing burrs, or other machining defects. The standard of finish should be appropriate to the end use (see NZS 3610 and NZS 3617).

Where dressed timber has been weathered for some time or has suffered handling or fixing damage, paint performance may be adversely affected. The amount of weathering allowable will depend on the timber species and may be as little as 7 days of exposure to weather for some timbers. Where post installation painting cannot be completed within this time period, some form of pre-installation priming should be considered. If the surface has yellowed or bleached, the surface should be sanded back to as-new condition before painting.

Rough-sawn timbers should be thoroughly brushed with the grain to remove dust and dirt before painting.

All sanding, especially where clear finishes are to be used, should be carried out with the grain.

NOTE: Garnet or aluminium oxide paper produces a better class of finish than glass paper.

3.2.3 Nail and screw fixings

All fixings for timber that is to be painted or stained should normally be taken below the surface, so that the surface may be sanded without abrasion of the fixing during sanding. Fixings for use in stained acidic timbers such as redwood and Western red cedar have to be made of a durable metal such as stainless steel or silicon bronze. Such fixings should be inserted so that the head is flush with the surface rather than below the surface.

3.2.4 Mechanical damage or natural defects

Holes or any other depressions formed in the surface of the timber as a result of mechanical damage, or natural defects such as resin or gum pockets, surface splits, checks or any areas of localized decay should be scraped clean of any loose or soft material. If a clear finish is to be used, then timber with visible defects should be replaced. Flexible synthetic wood fillers are preferred to linseed oil putty and all fillers used externally should be suitable for this use.

NOTES:

- 1 Linseed oil putty should never be applied to unprimed timber. Unprimed timber will absorb the oil and cause the putty to shrink and fall away.
- 2 Linseed oil putty should be allowed to harden, typically for one week, before overpainting otherwise drying oils may migrate into the finish coat to cause localized staining.

Sanding may be required on timbers with raised or uneven grain to provide a smooth substrate prior to painting.

3.2.5 Moisture content of timber

Ideally, the moisture content of timber at the time of priming should be near the equilibrium moisture content pertaining to the particular locality in which it is being used.

The priming of timber should not be carried out at a time when the moisture content of its surface has been temporarily raised. This may occur, without it being obvious, during fog or mist. Fitness for painting cannot be accurately assessed by visual appearance; however, a suitable moisture meter may be used to give an indication of the surface moisture. Up to 4 h of windy or sunny weather may be necessary to dry timber surfaces moistened by overnight fog or mist. A longer time may be needed to dry timber after more serious wetting.

3.2.6 Knotty timbers

Where knotty timber is used as external cladding, it is recommended that solid sheathing be used behind the cladding to prevent water leakage. In some cases loose knots may be cut out and replaced with another piece of timber of the same species, provided that the replacement timber is inserted with the same grain orientation.

3.2.7 Cleaning

Timber affected by superficial grease and oil may be successfully treated by wiping down with a solvent- or water-borne degreasing agent. The removal of grease and oil that has penetrated the timber is very difficult and may be impractical. In these instances replacement of the timber will be necessary. Resin may be removed by scraping in conjunction with a solvent or hot air gun treatment (see Clause 7.5.1); however, heating with a blowlamp before scraping is not suitable for timber that is to be finished with a clear coating. All sanding dust should be removed before application of the first coat and between subsequent coats.

NOTE: Resin exudation may be very difficult to remove and may persist or re-occur. Dark paint colours tend to increase the temperature of the timber and exacerbate this problem.

3.2.8 Pre-primed timber including light organic solvent preservative (LOSP)

Modern practice uses factory methods to machine (in-line) prime timber before sale, and it particularly applies where 'finger-jointed' *Pinus radiata* is used for exterior applications.

There is a range of different coloured pre-primed timber products available in the market place. Some are coated with a quality architectural primer and are ready for the final coat painting system. These can typically be identified by the presence of a manufacturer's brand and will have associated recommended finishing paint guidelines. In this situation the manufacturer's guidelines should be followed for application of finishing systems.

There are other pre-primed timber products where the pre-priming is only designed to temporarily protect the timber.

Where there is any uncertainty or the pre-primed timber does not have the manufacturer's finishing system recommended guidelines then testing the adhesion of the primer to the timber as per Clause 7.3.1 is recommended. If any of the existing coating comes off, it is unsound and needs to be removed by sanding. If in any doubt sand the entire surface bare before painting.

NOTE: LOSP treatments contain water-repellents which can cause waterborne coatings not to spread uniformly and wet the surface. This can occur even with acrylic topcoats applied over an oil-based primer, as the water-repellent can dissolve into an oil-based coat. If water-repellents are detected or suspected the boards should be appropriately cleaned to remove any surface contamination.

3.2.9 Preservatives

A range of preservative formulations are used for preserving timber. These preservatives are not restricted to a single hazard class (see AS 1604). It is important to determine whether the timber to be painted has been treated, and to obtain the appropriate specification prior to the design of a painting system, as some treatments and paint systems are incompatible.

Most dyes and water repellents used in LOSP formulations are solvent mobile and it is therefore important, when these preservatives are being overpainted, the paint system is not likely to immobilize the dye and bleed through can be visible.

3.2.10 Effect of timber species

Some timbers, notably heart totara, ironbark, matai, redwood and tallowwood present a special problem as the drying of linseed oil and alkyd resins applied over them is severely retarded. An appropriately formulated primer should be used when painting these timbers. Inhibition of paint drying also occurs with redwood when the timber is not properly dry.

Coloured water soluble extractives can leach out of western red cedar, redwood and eucalypt hardwoods and discolour paint. Before applying finishing coats over them, the timber should be well primed with a stain blocking coating.

Tannin bleed is a function of the type of timber substrate and the moisture content related to that substrate at the time of application. It should be noted that when applying tannin blocking paints, the longer the first coat is left beyond the normal recoat time and up to seven days, the more likely that the tannin will be chelated into the film and thus, will not transfer into the topcoat.

3.2.11 Oil-soluble preservative and creosote

Two types of oil-soluble preservatives have been used in the past, namely a 5% solution of pentachlorophenol in petroleum oil, and creosote. Timber treated by these processes was not intended to be painted.

These products have been superseded on Occupational, Health and Safety grounds. Recoating may be problematic with bleeding or drying inhibition. The application of selective solvent-borne wood stains may minimize recoating problems.

3.3 ORGANIC FIBRE-BASED BUILDING BOARDS

In addition to the recommendations of Clause 3.2, the following recommendations apply to organic fibre insulating board, particleboard (chipboard), MDF and hardboard. These boards are made by forming masses of small pieces of organic fibrous material, in most cases derived from wood, into flat sheets under varying degrees of pressure. At all but the highest pressures (hardboard), adhesives are incorporated to bond the fibrous material. Wax or other additives may also be included in the mixture, for example, to assist release from the pressure mould, particularly in the case of MDF.

Organic-fibre-based building boards are often supplied pre-primed or ready for sealing or priming, removing the need for general preparation. Nevertheless, dirt and grease should be removed, exposed edges stopped, filled or preferably fitted with an edge-strip, fasteners recessed, and holes filled and sanded back. If the board is not primed or sealed, contact with water should be avoided to prevent swelling of the fibres, and dirt or grease should be removed by wiping with a cloth moistened with a suitable solvent such as mineral turpentine, cleaning with a dry cloth and allowing the surface to dry thoroughly. A water-resistant board should be used in areas likely to be exposed to moisture in service. Non-water-resistant boards can absorb water rapidly and swell dramatically, particularly at the edges. Edges usually require at least two applications of primer or sealer.

If the board suffers some disturbance or intervention, such as absorbing water or being sanded, routed or scraped, the fibres in the affected surface may swell or debond irreversibly, changing the local surface texture and porosity and so affecting the performance of surface coatings. For example, a primer or sealer coat alone may not be sufficient to overcome the difference between the factory-supplied surface and the damaged areas, requiring at least a further coat such as a sandable undercoat for filling and levelling.

Clear finishes applied to surfaces composed of natural fibres such as timber or organic building boards can darken the surface in proportion to their depth of penetration or absorption; hence, surface-damaged areas may appear darker than undamaged areas when clear-coated, particularly with solvent-borne clears due to their greater penetration/absorption. As this effect occurs within the surface of the substrate, it cannot be rectified except by removing the surface of the substrate, or by overcoating with an opaque coating system. Such effects should be avoided, by applying one of the clear coats before fabrication and installation, while the surface is in factory condition. If an affected surface appears likely to show this effect when clear-coated, a waterborne clear finish should be selected to minimize penetration and consequent variation in appearance.

As these boards are subject to differences in composition between manufacturers, the selection of a coating system should take account of the likely variations, particularly in relation to MDF. Waterborne coatings can cause swelling of fibres at the surface, requiring light intercoat sanding. Tannins can bleed from bits of bark or hardwood within the board, requiring a solvent-borne coat or a tannin-resistant waterborne coat to block their migration. Wax or other water-repellent additives can have multiple effects, i.e.—

- (a) inhibiting the wetting or adhesion of waterborne coats, which may be overcome by sanding back the surface of the board;
- (b) inhibiting the curing of solvent-borne coats, requiring a greatly extended recoating time; and
- (c) dissolving into a solvent-borne coat during its application and then depositing on its surface as it dries, causing variable gloss development or inhibiting the wetting or adhesion of waterborne coats, requiring the surface to be sanded back before recoating.

These effects may apply equally to clear and pigmented coatings. Whether the coating system selected is waterborne, solvent-borne or mixed, it should be trialled on a sample area of the board, unless that manufacturer's production is already known not to affect the selected coating system.

Contemporary fibre reinforced cement (FRC) sheeting, in both standard and compressed grades, is cured by autoclaving to provide a homogeneous product without any free alkali. Therefore, it requires no special preparation other than as discussed in Clause 2.4.7, unlike the non-autoclaved sheeting of many decades ago, which presented problems for any alkali-sensitive paint applied to it.

3.4 IRON AND STEEL

3.4.1 General

Bright-rolled or drawn steel surfaces will quickly discolour with rust if not protected. The degree of subsequent rusting will vary with the degree of condensation of moisture and contamination from the atmosphere. Where the environment is more aggressive, or where unsightly discolouration is not acceptable for aesthetic reasons, such surfaces should be thoroughly prepared.

On exterior surfaces or in wet/damp areas or where superior protection is considered necessary, the recommendations given in AS/NZS 2312.1 should be followed.

Hot-rolled steels are covered with a tightly adherent layer of mill scale. During normal storage and handling operations, this layer of scale becomes damaged and the exposed steel starts to rust. On prolonged exposure, all of the scale eventually separates leaving a fully rusted surface. Consequently, when a steel surface is ready for painting, it may vary between an intact mill scale cover at one extreme and a mill scale-free rusty surface at the other. The usual condition is somewhere in between. Loose rust and mill scale may be removed by hand-tool or power-tool cleaning. More adherent rust and mill scale require abrasive blast cleaning or pickling.

Chemical pretreatments may be used after wire-brushing to remove the last traces of rust and to inhibit rust formation. In most instances, pretreatment solutions may require thorough washing with clean water to remove excess residues. In such cases, the recommendations of the manufacturer are to be followed.

Where optimal surface preparation is not possible, a minimum of two coats of clear penetrative oleoresinous binder may suffice prior to finish coats in low corrosivity environments.

3.4.2 Stainless steel

Stainless steel occasionally needs to be painted for aesthetic reasons, for colour identification purposes or, in rare cases, for protection from specific chemicals, notably chlorides. Because it is generally supplied in a smooth condition, roughening of the surface is usually necessary, variously with wet and dry papers or abrasive blasting, prior to painting. Chemical etching is usually impractical because of the need to use corrosive reagents. For maximized performance, an appropriate metal primer should be used (for example an epoxy primer).

3.5 ZINC-COATED AND ZINC/ALUMINIUM ALLOY-COATED STEEL

3.5.1 General

Four common forms of zinc-coated steel building products are marketed as—

- (a) hot-dipped galvanized product, such as preformed beams, lintels and handrails;
- (b) in-line galvanized products, such as light weight angles, channels and tubular products;

- (c) coil or strip for products such as roof and wall sheeting, rainwater goods and low capacity framing and lintels, which is commonly available as zinc and zinc/aluminium alloy-coated steel; and
- (d) electroplated products, such as small fittings and fasteners.

3.5.2 Hot-dip galvanized steel

Hot-dip galvanized steel products are covered with zinc; thickness typically in the range 40–100 µm largely dictated by steel thickness and are defined by AS/NZS 4680. Any post fabrication, such as cutting or drilling, which impairs the galvanized coating may need to be reinstated, such as by patching with a zinc rich paint or aluminium epoxy mastic. Cut ends or holes would need to be ground to a smooth radius prior to painting or the ends and holes sealed.

The optimum type of preparation needed for galvanized surfaces prior to painting will vary depending upon the type of paint being applied and the aggressivity of the service conditions. Given that most structural galvanized steel has been chemically quenched, light abrasion of the surface is usually necessary as a minimum prior to painting.

In arduous service, notably in coastal service or for surfaces subjected to wear and tear where good adhesion of the paint is critical, the surface needs to be degreased and thoroughly roughened with wet and dry abrasive paper or lightly (whip) abrasively blasted before painting. In mild climates and for most interior service conditions the surface usually only requires cleaning and degreasing prior to painting with appropriate conventional single pack paints, unless the surface is particularly smooth or enhanced wear and tear resistance required. In such cases, and with most two pack products, additional roughening of the surface by sanding or whip blasting is necessary.

For painting galvanized or other zinc-coated steel in corrosive environments refer to AS/NZS 2312.2.

3.5.3 In-line galvanized products

Continuous lengths of angle, channel and flat sections are coated in accordance with AS/NZS 4791 and hollow sections in accordance with AS/NZS 4792. The zinc coating on these products is significantly thinner than fully hot-dipped products of the same gauge and the inner surfaces of some tubular products is not coated with zinc. The ends are cut after coating and therefore depending upon the service conditions may need to be sealed to prevent corrosion. The surface should be treated in similar fashion to that described in Clause 3.5.2. However, the zinc coating is very smooth and paint adhesion may therefore be limited. Where abrasive blasting or sanding is undertaken the zinc coating is largely depleted and the selected paint system must provide the corrosion protection required.

3.5.4 Steel strip and coil

Where painting is envisaged it is usually more cost effective and more reliable to use quality precoated metal cladding.

Where new strip and coil is to be painted it should be noted that the material might be coated with a light film of oil derived from the manufacturing process. The surface may be cleaned with an appropriate water-borne industrial cleaning solution. It may then be painted in accordance with the specifications of Table 5.1.

Galvanized coil coatings may be overpainted in a similar manner to hot-dip galvanized steel (see Clause 3.5.2). While some zinc/aluminium alloy coil coating may also be overpainted as for galvanizing, most steel strip and coil is now coated with a thin layer of acrylic resin to assist in forming and in maintaining the appearance of the product during transport and storage. In particular, this product has enhanced resistance to wet storage staining and is relatively easy to coat. Etching of this product is both unnecessary and futile.

Where the steel has been weathered, the corrosion product should be removed prior to painting, either by mechanical or chemical means. Expert advice should be sought on appropriate removal methods. Chemical etching with dilute hydrochloric acid, copper sulphate solution and similar etchants or deliberate weathering before overcoating have been used in the past but are now discredited systems.

Where steel sheet or cladding exhibits widespread red rusting, it is probably impractical to cost effectively reinstate the surface for more than short term service even in low corrosivity environments. It is possibly the best option to replace such cladding at the onset of perforation.

3.5.5 Electroplated products

Electroplated metal coatings (refer AS 1789 and AS 1897) are relatively thin coatings of zinc or cadmium and are rarely appropriate for exterior service.

3.6 ALUMINIUM

Aluminium surfaces are generally smooth and do not provide a good key for the adhesion of paint. To improve adhesion, surfaces should be treated with any one of the following options:

- (a) Lightly abrade (with fine grade abrasive) wash thoroughly, prime and paint.
- (b) Chemical etch, prime and paint.
- (c) Treat with etch-primer and paint.

Surfaces should be washed, dried, etched, primed or etch-primed as appropriate and painted as soon as possible, preferably on the same day.

3.7 COPPER AND BRASS

Copper and brass surfaces should be wiped with an emulsified degreasing agent, to remove all dirt and grease. To improve adhesion, surfaces should be lightly abraded with a fine emery cloth, using a degreasing agent as the lubricant, and wiped clean.

NOTE: It is important that all loose particles of copper be removed from the work or surrounding areas to prevent subsequent staining by verdigris.

Where the natural metal colour is required for an indoor feature finish, the surface may be brightened by treatment with a solution of—

- (a) 5% acetic acid solution (commercial white vinegar may suffice)..... 1 L; and
- (b) sodium chloride (common salt) 40 g.

The solution is used at ambient temperature. After treatment with the solution, the surface is washed with water, dried, and then coated as soon as possible.

Copper and brass substrates are usually coated with a single-pack urethane, or a clear acrylic lacquer containing appropriate corrosion inhibitors designed for this purpose.

3.8 LEAD

New lead surfaces should be thoroughly washed with water, dried and coated with a semi-gloss or gloss latex paint. Lead should be formed and fixed before overcoating.

3.9 MASONRY

3.9.1 Clay brick surfaces

Clay brickwork generally requires little preparation for painting except for the complete removal of mould growth, accumulated brick dust, dirt, projecting mortar and other loose particles, and, finally, cleaning by hosing with clean water.

Where excessively deep pointing or obvious holes and imperfections occur, these should be filled to prevent ponding and absorption of water.

All holes should be filled with compatible mortar and allowed to dry. Grease should be removed by solvent or by washing down with water and household detergent, after which the brickwork should be washed down with clean water and allowed to dry.

Highly glazed bricks should be mechanically or chemically roughened to increase paint adhesion. It should be noted that chemical roughening might be extremely hazardous. Chemically treated brickwork should be neutralized and rinsed clean. Mechanically roughened bricks should be swept clean prior to painting.

Bricks with potential for a vanadium bleed may pose a problem. Such bricks should be sealed with a solvent-borne concrete and masonry sealer or water-borne concrete and masonry sealer (Type B15 or B16A paint). Where there is doubt on whether vanadium is present, it is prudent to apply one coat of latex flat (Type B6 paint), low-gloss (Type B7 paint) or semi-gloss (Type B8 paint) to a trial area of brickwork and to inspect for staining after at least four weeks.

3.9.2 Concrete surfaces

3.9.2.1 *Cure and moisture content*

With few exceptions, concrete must be dry and satisfactorily cured before painting. When new, concrete is damp in the interior even though the surface is dry, and this moisture may later cause blistering and peeling of the paint film. New concrete is also highly alkaline, which is particularly harmful to oil-based paints because of their susceptibility to saponification. Although lacquers and many latex paints are generally resistant to mild alkalis (some PVA paints have poor alkali resistance), the presence of dampness may cause blistering.

Surface treatments with acids to reduce the alkalinity of new concrete have been used with varied results. Such treatments at best provide only a temporary neutral surface; they do not affect the reserve of alkalinity within the concrete and risk the possibility of corrosion of steel reinforcing. Any later seepage of moisture will bring the alkalis into contact with the paint film.

Ageing of the concrete is considered to be more reliable than surface treatment as a means of conditioning concrete for painting, since surface alkalinity is reduced as the free lime carbonates with age. Also, the free moisture content is decreased except, of course, where concrete is exposed to a permanent source of water. Table 3.1 shows recommended minimum drying times before painting.

TABLE 3.1
RECOMMENDED MINIMUM DRYING TIMES
FOR CONCRETE BEFORE PAINTING

Paint type	Drying times (weeks)
Latex	4
Solvent-borne acrylic	4
Oleoresinous and alkyd	12*

* The minimum drying period will depend upon the thickness of the concrete and the impermeability of the applied coating. For highly impermeable coatings it should be increased by four weeks for each 25 mm of thickness above 100 mm thickness. Where two sides of the surface are exposed and well ventilated, then the drying time should be increased by two weeks for each 25 mm of thickness above 100 mm thickness. Where concrete has been wet cured or left exposed during rainy periods, this additional time should be added to the recommended curing time.

While in most instances the acceptance criterion for painting concrete is based on the curing time of the surface and the period of time it is free from exposure to weather as detailed in Table 3.1 above, in critical situations, or when there is conjecture as to the dryness of the surface, quantitative or qualitative testing is necessary.

Measurements of substrate moisture may be made by using an electrical moisture meter.

A more credible and better-documented procedure is the use of a humidity box. This consists of a shallow box open on one side and with a humidity meter on the other. The box is mounted with its open side against the surface being measured, in a manner that completely seals-in the base environment. The box is left for 24 h and the humidity checked after that time. For a subsequent coating which can tolerate little substrate moisture, the relative humidity in the box needs to be less than about 70% for most barrier type coatings.

An alternative method involves the placement of a weighed amount of calcium chloride in a similarly sealed container. The calcium chloride is recovered after 24 h and the quantity of absorbed water determined.

Nuclear density and radiofrequency methods are also used for assessing moisture content.

An easier procedure, which is commonly used for assessing the concrete moisture prior to laying resilient flooring, involves placing an impervious sheet, such as glass, polyethylene, perspex or rubber (approximately 0.5 × 0.5 m) on the concrete for 24 h and examining the contact surface after that time for wetness, as evidenced by a darkening of the covered area. The edges of the sheet usually require sealing, except for floors where heavy rubber mats work satisfactorily without sealing.

The sheet method has practical advantages in that a number of areas may be checked simultaneously at minimal cost. One test for every 50 m² of surface is typically specified.

Ageing or some other treatment of concrete is generally unnecessary where heavy coats of bituminous paints are applied on the back of the concrete surface against which backfill is to be placed. These coatings are alkali-resistant and, because water or backfill pressure is developed against the coated surface, there is little danger of blistering. Blistering may occur, however, if the coating is applied while the concrete is still moist and the coated surface is exposed to direct sunlight. If exposure to sunlight cannot be avoided, application of a light-coloured latex paint over the bituminous paint will minimize blistering until backfill is placed in position or the coated surface is otherwise covered.