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AS/NZS 2311:2017 Guide to the painting of buildings

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AS/NZS 2311:2017

Australian/New Zealand Standard™

Guide to the painting of buildings

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CH-003, Paints and Related Materials. It was approved on behalf of the Council of Standards Australia on 11 February 2017 and by the New Zealand Standards Approval Board on 20 January 2017.
This Standard was published on 3 March 2017.

The following are represented on Committee CH-003:

Australasian Corrosion Association
Australian Institute of Building
Australian Paint Manufacturers' Federation
Australian Wall and Ceiling Association
CSIRO
Institution of Professional Engineers New Zealand
Master Painters Australia
Master Painters New Zealand Association
National Association of Testing Authorities Australia
National Painting and Decorating Institute
Surface Coatings Association Australia

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This Standard was issued in draft form for comment as DR2 AS/NZS 2311:2016.

Australian/New Zealand Standard™

Guide to the painting of buildings

Originated in Australia as AS 2311—1979.
Originated in New Zealand as NZS 7703:1985.
Previous edition AS/NZS 2311:2009.
Sixth edition 2017.

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, PO Box 1473, Wellington 6011.

ISBN 978 1 76035 694 1

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.

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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.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

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 floss 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:

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

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 joins 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 m^2 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.

Concrete surfaces should be surface-dry to obtain good adhesion of hot-applied or solvent-borne bituminous coatings; however, a damp surface is permissible for the application of waterborne paints.

Loose surface material or surface projections may be removed by 'blocking down' with a flat carborundum stone or similar and the surface dusted off.

The final pretreatment procedure is as follows:

(a) Fill unwanted holes and allow to cure and dry before painting. Use only water-resistant fillers such as Portland cement-based types or those comprising water-insoluble organic binders for exterior service or wet areas.

(b) Remove dust and dirt by brushing, hosing, air or water blasting or scrubbing, depending upon the character and amount of contamination.

(c) Remove grease and oil by the use of solvent or by washing down with water and household detergent, then wash down with clean water and dry.

Additional treatments for concrete surfaces are detailed in Clause 3.9.2.2 to Clause 3.9.2.4.

3.9.2.2 *In situ precast, off-form or tilt slab concrete*

Dense or glazed surfaces should be roughened slightly by abrasive blasting, abrasive grinding, by rubbing with coarse abrasive stones, or by etching with 10% sulphamic acid or 5% phosphoric acid by volume. After acid treatment, the treated surface should be thoroughly washed with clean water and allowed to dry. Excess treatment with acid may result in a loose friable surface, which should be removed with a stiff brush prior to coating.

NOTE: The use of hydrochloric acid is not encouraged because of the risk of chloride residues and acid gases attacking surrounding metallic materials and the possible chloride ingress into concrete, which could cause corrosion of steel reinforcing.

Where acid etching is not possible or not required the surface should be prepared by washing with detergent to remove surface contamination. Particular attention should be paid to surfaces which contain release agents.

Efflorescence may be removed by dry brushing followed by wet sponging the concrete surface.

NOTE: The source of water causing the efflorescence should be traced and, if possible, eliminated. Failure to remove the source of water ingress will most likely lead to renewed efflorescence and subsequent damage of the paint film.

Release agents, bond breakers, curing agents, formwork oil and the like may be removed by water blasting, treatment with an alkaline degreaser, or a formulated industrial cleanser, or by a combination of these methods. Failure to remove such materials from the surface may result in the failure of paints applied over them. Their effective removal may be determined by the rapid darkening of the concrete after wetting with water. Following treatment, the surface should be thoroughly washed with water and allowed to dry. The application of a solvent-borne concrete primer is usually recommended if these chemicals are present or are suspected to be present.

The potential for pinholes to occur in tilt slab construction may cause difficulties in the application of a paint coating and these holes should be flush-filled prior to priming and coating.

3.9.2.3 *Cement render*

Care should be taken in building design, construction and specifically to the quality of the site render itself. While some coating systems may have higher or lower tolerance to these variables, builders and specifiers should not rely on these differences as an alternative to good building practice.

These issues include miscellaneous efflorescence problems—water ingress; saponification of coatings—alkali attack and delamination of coatings caused by unsound bagging.

(a) *Efflorescence* Movement of water through a masonry structure causes efflorescence. If the surface is left unpainted, efflorescence would still appear but on the masonry (in this case rendered) surface. The presence of the coating is purely coincidental, and not a cause of the efflorescence.

Some painting systems may have varying levels of efflorescence resistance, but there are no guarantees.

The simple way to prevent efflorescence is in design and construction. Design for drainage on horizontal surfaces where water may otherwise pool is highly recommended. Proprietary factory mixed cement renders (which are lime free and polymer reinforced) are fully resistant to efflorescence.

Efflorescence will be white salts, which should be essentially colourless when wet. If efflorescence is the only factor, the coating will not wash off. Look for places above the salt deposit where water may enter the structure. Horizontal surfaces such as window sills, balconies and parapet walls are likely suspects.

Rectification Painted surfaces damaged by efflorescence should not be repainted until the source of the water ingress has been found and blocked. Waterproofing specialists should be called for advice where necessary. For removal of efflorescence refer to Clause 7.6(a).

(b) *Alkali attack* High levels of alkalinity near the surface of the concrete can cause chemical breakdown of organic binders. Styrene acrylic and 100% acrylic binders have high alkali resistance. These binders are used in all premium exterior and texture brands, providing resistance up to an alkalinity level of pH 10. By contrast, PVA (vinyl) binders have lower alkali resistance, up to a pH level of 9 and are not recommended for applications over exterior render.

NOTE: pH level of 10 is 10 times more alkaline than pH level of 9.

Extra alkalinity in cement render comes from the addition of the lime. If lime is used, delay painting for more than 28 days, unless the surface is tested for pH and shown to be 10 or lower.

Factory mixed dry render products have low and consistently controlled lime levels. This means that pH will be low and it can be painted after only 48 hours.

It is not always easy to identify alkali breakdown in the early stages by visual inspection. In the early stages efflorescence and alkali breakdown look and test the same on top of the coating. Alkali breakdown on acrylic may not be visually obvious until the coating is softened to the point where it rubs off on a wet finger. A job could have both efflorescence and alkali attack conditions.

Measurement pH test Scrape away coating with a knife. Scrape some of the render surface into a small glass jar. Add a spot of water and mix. Test with pH paper. Test as many areas as possible as results will vary with the render mix used on each area.

Rectification A repaint over a highly alkaline surface may also suffer the same problem. The only solution is to water blast the damaged coating back to bare and then wait for pH to drop to 10 or below, which may take months.

This option may not be acceptable to owners or builders. If immediate repainting is required, the owner and builder should be prepared to accept responsibility for subsequent alkali breakdown.

(c) *Unsound render/bagging* Bagging has been a popular low cost technique to achieve a decorative or defect hiding exterior finish. A render mix or excess mortar is smeared over the wall with a (traditionally) Hessian bag. This leaves a low thickness of render, which may dry out before the cement can hydrate or cure. Uncured cement leaves the bagging as a dry, sandy powder, an unsound surface for painting.

Such a defect can be easily identified. Before painting, rub over the surface with a wet rag. Correctly formulated and cured render will not rub off. Unsound render will leave a grey cement colour on the rag.

After the coating has delaminated, test the residual render or the render attached to the back of the paint film.

Rectification Water blast to remove unsound render and coating, then reapply a suitable render mix and repaint.

Cementitious renders should be adequately cured, and should be dry, hard, free of cracks and firmly adherent to the substrate. A minimum drying period of six weeks is typically recommended prior to the application of solvent-borne alkali resistant paints and at least four weeks for latex paints.

NOTE: These periods may vary depending upon the climatic conditions.

In all cases the surface should be thoroughly rubbed down (de-nibbed) with a carborundum rubbing stone or other material harder than the cement render in order to remove unwanted projecting render. The surface should then be swept clean of all loose sand, cement, dust and other friable material.

Where there is evidence of mould, the surface should be treated as set out in Clause 7.3.2, or with a proprietary fungicide, washed with clean water and allowed to dry. The surface should be treated with a proprietary anti-mould wash.

Efflorescence should be removed by brushing only.

3.9.2.4 *Bagged brickwork or blockwork*

The cementitious surface should be adequately cured and dried and adhered to the substrate. Prior to painting a bagged surface, adhesion checks (see AS 1580.408.4) and powdery surface tests (see Clause 3.10.6.4) should be carried out to ensure that the cementitious surface has adequate cohesion and adhesion to the substrate as poor cohesion/adhesion will lead to disbonding of the entire facing.

NOTE: When applying these thin layers of cementitious materials it is essential that water is retained and drying time extended for several days to ensure adequate chemical reaction in the layer. If this is not possible, a polymer-modified formulation should be used.

3.9.2.5 *Stucco and exterior insulation finish systems (EFIS)*

The mortar finishes used in these systems should be cured as described in Clause 3.9.2.3. Particular attention needs to be paid to the positioning of control joints since most coatings have limited crack-bridging ability.

3.9.2.6 *Cement bricks and blockwork*

These materials are generally satisfactory for painting on delivery from the manufacturer but, once cemented in position, they require at least four weeks (see Table 3.1) to enable the mortar to dry and cure before painting. Brushing the surface is desirable to remove any mortar or surface laitance.

Where there is evidence of mould or efflorescence, the treatment should be as described in Clause 7.3.2 or Clause 7.6, as applicable.

3.10 SET PLASTER

3.10.1 General

When painting set plaster, account should be taken of its inherent differences from most other substrates. It is not a standardized, controlled manufacturing process, like plasterboard. Neither it is an inert material, like clay bricks, nor it is a wet-mixed masonry material of familiar composition and properties, like mortar or concrete. Rather it is the product of a chemically reactive mixture of ingredients selected by the individual applicator (plasterer/renderer). The composition is likely to vary with the depth of the plaster and also across the surface of each layer within the setting. Even where composition is relatively constant, the mechanical properties may vary, e.g. due to the plaster mix having been applied or worked after components of relatively rapid setting time, such as cement or gypsum, began to set.

While there are two distinct binders, namely lime and gypsum, commonly employed in the setting or finishing coat of plaster to which paint is applied, there is no clear distinction between ‘lime plaster’ and ‘gypsum plaster’ as far as painting is concerned, because these terms reflect only the predominant component of the binder. Setting coats are rarely if ever based on only one of these binders; instead they are combined in proportions designed to influence properties such as workability, setting time and surface hardness.

The two extreme cases of a setting coat based on only one binder or the other would show the following properties:

(a) Gypsum (calcium sulphate)—

  (i) neither markedly acidic nor alkaline;

  (ii) hardens by a recrystallization process, which incorporates some of the mixing water into the gypsum;

  (iii) rapid development of early strength, but short working time and poor workability;

  (iv) rapid setting to full hardness, which is greater than that produced by hardening of lime, and which is accompanied by expansion; and

  (v) moisture ingress after setting will cause weakening and disintegration if prolonged, as gypsum is slightly water-soluble.

(b) Lime (calcium hydroxide)—

  (i) initially highly alkaline;

  (ii) hardens by reaction with atmospheric carbon dioxide (carbonation) to form calcium carbonate, which reduces its residual alkalinity;

  (iii) slower development of early strength, but longer working time and good workability;

  (iv) slower curing to full hardness, which is less than that produced by setting of gypsum, and which may be accompanied by shrinkage; and

  (v) moisture ingress after setting will not markedly soften or disintegrate the plaster, but may mobilize residual alkaline salts, causing efflorescence at the surface.

When these binders are combined in typical setting coats, their properties may tend to cancel out (e.g. shrinkage + expansion = neutral set), compensate (e.g. early strength development for slower setting), average out (e.g. poor workability + good workability = reasonable workability) or simply add (e.g. neutral + alkaline = alkaline). Some properties, however, may be unaffected by combination with another binder; for example, the working time of the gypsum component remains very short, and the carbonation of the lime component remains very slow.

There is a range of factors that may require attention prior to painting. In the period following the setting of the plaster, residual moisture, alkalinity, and efflorescence may need to be considered. Even when the plaster has been stabilized by time, moisture may have ingressed through structural or design failure, and deficiencies in the soundness (cohesion and adhesion), and evenness of the surface (roughness, patchiness, or cracking) may have developed with aging or structural movement).

3.10.2 Moisture level

Before painting, especially where solvent-borne paints or other relatively impermeable coatings are to be applied, it is advisable to test the plaster with a moisture meter to ensure that the moisture content at the surface does not exceed the acceptable limits for painting (see Note). Latex systems are more tolerant of moisture; however, high concentrations of moisture may cause salt transfer (efflorescence) and blistering.

NOTE: Care should be taken when specifying moisture contents, as different readings may be obtained with the various types of proprietary instruments. A suitable procedure is to trial the meter to be used on some aged, fully cured plaster which shows no evidence of moisture problems, in order to establish a baseline figure, then to monitor the new plaster work as its moisture readings decline towards this baseline figure. If the moisture readings remain elevated, particularly in well-aged plaster (many months or years old), then the possibility of moisture ingress should be investigated and eliminated or rectified.

Moisture ingress into previously painted plaster may be detectable without the use of a moisture meter, through effects such as blistering of the coating, efflorescence below or on top of the coating, mould growth on the coating or the plaster, and softness or disintegration of the plaster. Refer to Clause 3.10.5 for the effect of moisture in plaster; general practice suggests that the elevated moisture content should be below 15%.

3.10.3 Alkalinity

Alkalinity throughout the plaster due to the presence of lime and/or cement will decline slowly from an initial pH in excess of 12 to around 9.5. This may not happen on the same time scale as loss of residual moisture. The recommended minimum drying times for cementitious substrates in Table 3.1 may be used as a guideline, with an allowance for lime carbonating more slowly than cement. If the plaster has not been fully and uniformly incorporated to eliminate lumps, there may be spots of very high alkalinity, which will decline only very slowly. The difference in properties from the surrounding plaster may cause blowing or popping of the plaster over these lumps. Where detected, they should be dug out and the holes stopped up. For measurement of pH refer to Clause 3.9.2.3.

3.10.4 Efflorescence

Salt, generally alkaline, may be transported to the surface of plaster by the movement of moisture to a surface from which it can evaporate. Efflorescence due to residual moisture will cease naturally as the plaster cures, whereas efflorescence caused by moisture ingress may continue indefinitely while there are salts present to be transported, unless the source of moisture ingress is detected and eliminated, whereupon the decline in moisture levels and cessation of efflorescence will proceed as for residual moisture. The cessation of efflorescence may be ascertained by brushing or wiping an affected surface free of existing efflorescence, then waiting for a reasonable period to ensure its continuing absence.

NOTE: Premature painting of plaster may cause major and extended problems. If paint is applied to new set plaster that has not had sufficient time to reach a stable equilibrium with regard to hardening, moisture, alkalinity and efflorescence, there will be a lack of hardening and the residual moisture and alkalinity will affect the integrity and adhesion of the coating through blistering, efflorescence and other defects. In addition, the presence of any coating will reduce the rate of moisture loss from the plaster and the rate of ingress of carbon dioxide into the plaster, thus lengthening the time required to achieve equilibrium and full curing. In the event of incompletely cured plaster causing some form of paint failure, rectification will generally require the plaster to be allowed to cure fully, which may in turn require the coating system to be removed. Removal may damage the plaster surface, requiring its reinstatement, thus setting the

time of curing back to zero. Painters should resist any form of pressure to paint plaster prematurely, unless a statement of release is obtained, which transfers consequential risks to the party applying such pressure.

3.10.5 Moisture ingress

Moisture ingress generally becomes apparent in new plaster work as a failure of moisture levels to decline as expected despite conditions being adequate for such moisture loss to occur, i.e. in terms of time, temperature, relative humidity and ventilation rate. The source of moisture should then be traced and rectified before moisture levels can decline to a normal equilibrium. Any side effects of the elevated moisture levels, such as disintegration of the plaster or mould growth, should also be rectified before proceeding to paint.

3.10.6 Soundness (cohesion and adhesion)

3.10.6.1 *General*

After plaster has been found to be sufficiently dry and cured, it should be assessed for the state of its mechanical soundness. A surface that appears to be solid (i.e. holding its shape under the stress of gravity) may still be unsound due to poor cohesion or adhesion anywhere within the bulk of the solid material. Soundness cannot be assessed by visual inspection but only by testing for responses to selected localized stresses applied to the surface and intended to reveal various types of unsoundness within.

A lack of soundness may take various forms, such as drumminess (looseness of the setting coat or another coat within the set), incoherence (softness due to lack of cohesion or binding), and powderiness (surface dusting). These are detected by the different methods set out in Clauses 3.10.6.2, 3.10.6.3 and 3.10.6.4.

3.10.6.2 *Drumminess (failure of adhesion)*

Drummy patches occur where there has been a failure of adhesion between a pair of layers within the sequence that constitutes the plastering system, namely the substrate, rendering coat (or dash coat), floating coat, and setting coat. Such failures of adhesion may have numerous possible causes, including lack of suitability of the substrate and its preparation, of the mix used in one or more layers or of the initial drying conditions.

Drumminess is detected by lightly tapping the surface and listening for a dull, hollow sound. If the failure is close to the surface, the pitch of the sound will be higher and only light tapping will be required to create a vibration in the loose plaster. If the failure is close to the substrate, the pitch of the sound will be lower and firmer tapping will be required to create a vibration. The closer the failure to the surface, the least stress will cause failure in service. For example, a patch of shallow drumminess might be cracked or dislodged with only a light knock from a solid object, such as a broomstick, whereas a patch of deeper drumminess may require a firm blow from a heavy object to dislodge it, such as hammering in a picture hook. Ideally, all drummy patches should be cut out, replastered and allowed to cure before painting. In practice, however, many patches of deep drumminess have endured years or decades of service without being detected or causing a problem, and it is patches of shallow drumminess to which rectification should first be directed. Excessive efforts to eliminate indifferently adhering plaster in one location may result in impairing the immediately adjacent sound areas.

3.10.6.3 *Incoherence (softness, failure of cohesion)*

Incoherence of the plaster may be due to disintegration of an initially coherent plaster through prolonged ingress of moisture, in which case rectification should only proceed after the source of moisture ingress has been traced and eliminated. Alternatively, it may be a case of initial incoherence or failure to set hard, with possible causes such as insufficient binder in the mix, working past the setting time of a rapid setting binder, or adverse drying conditions.

Incoherence may be suspected during testing for drumminess, where tapping yields a dull but not hollow sound. It can be confirmed by pressing with a hard object, whereupon soft plaster will crumble around the point of the implement. Scraping with a hard object gives a better confirmation, but should not be carried out injudiciously or without first testing by other means, in order to avoid unnecessary damage to normal plaster. In extreme cases, the plaster will crumble away under the pressure of a finger firmly rubbing the surface while checking for powderiness. Incoherence in one of the subsurface layers of plaster may not be detected by localized pressure on the surface, but may be the cause of drumminess.

Rectification consists of removing the unsound plaster until a sound surface is reached, then replastering and allowing the plaster to cure before painting.

3.10.6.4 *Powderiness (surface dusting)*

All plaster surfaces have the capacity to generate dust, for a variety of reasons. There may be residual dust loosely adhering to the plaster after sanding. The setting coat may be incoherent throughout its thickness, allowing it to generate dust continually, no matter how many attempts are made to wipe the surface free of dust. A very thin superficial layer of the setting coat may be less coherent than the subsurface portion of the setting coat, perhaps due to having dried out more quickly, thus preventing it reaching the same degree of cure and hardness as the remainder of the setting coat. It is important to distinguish between these possible cases.

Since dust on the surface may affect the ability of paint coatings to adhere to the plaster, tape adhesion tests have often been used in an attempt to determine the fitness of the surface for painting; however, the results of such adhesion tests may be misinterpreted. Adhesive tape will adhere to whatever is present on the surface. If this is a layer of loose dust, then some of that layer will be removed when the tape is pulled off, without transmitting the full pull-off stress to the remainder of the plaster below. This illustrates a fundamental weakness of tape adhesion testing directly on plaster surfaces, in that if the tape removes any plaster or dust, then the test indicates little or nothing about the plaster below the level from which material was removed. On the other hand, in cases where no plaster is removed by the tape, the stress induced by pulling off the recommended grade of tape is not sufficient to indicate soundness throughout the plaster.

A reasonable interpretation of adhesive tape tests on plaster from which loose dust has been removed by wiping or brushing is as follows:

(a) An absence of dust on the tape does not guarantee sufficient soundness throughout the plaster system, and testing for drumminess and incoherence should still be carried out.

(b) The presence of dust on the tape confirms unsoundness only to the depth of the material removed, and does not confirm that the material below that level is either sound or unsound, so testing for drumminess and incoherence should still be carried out.

(c) If dust is present on the tape in large amounts or as coarse particles or little effort is required to remove the tape from the surface, there is a strong suggestion that the surface may be incoherent to a significant depth, but this requires confirmation by appropriate testing.

In summary, testing with adhesive tape may be used to confirm the presence or absence of dust on the surface of the plaster, or the adhesion of paint coatings to the plaster, but it should not be used to confirm the soundness of the plaster as a whole.

Where testing confirms that powderiness or surface dusting is caused by incoherence in only a thin superficial layer of the setting coat, this may be treated by application of the following solution (using appropriate protective gear and precautions in the work space):

(i) Phosphoric acid (specific gravity of 1.7).....150 mL.

(ii) Water, to make up total volume of..... 1 L.

NOTE: Add acid to water, not water to acid.

After treatment, the surface should be allowed to stand for 10 min and then washed down with clean water.

Phosphoric acid reacts with the lime component of the setting coat to form a matrix of calcium phosphate and, in so doing, binds the powdery material, reduces alkalinity and porosity, and increases density and hardness. This procedure may also quickly reveal blowing or popping due to coarse particles of lime near the surface.

An alternative to phosphoric acid treatment is to apply a pigmented alkali-resistant solvent-borne sealer (Type B15) or waterborne sealer (Type B16A) in order to bind the thin superficial layer of powdery material directly. As the thickness of the layer of powdery material will be uncertain, the ability of the Type B15 or Type B16A paint to penetrate it and consolidate it adequately should be confirmed by painting a test area and allowing it to cure for at least a few days, before checking the adhesion by means of a pressure-sensitive adhesive cellulose tape test (see AS 1580.408.4).

Failure to consolidate a loose superficial layer before applying a coating system is a common cause of coating failure over set plaster, and many other substrates; however, no surface consolidation treatment, whether it be phosphoric acid solution, Type B15 or Type B16A paint, both in succession or another variant, can rectify a lack of soundness below the surface, such as drumminess or lack of coherence in one of the plaster coats.

3.10.7 Evenness of the surface (cracks, crevices, roughness, patchiness)

Hairline cracks in surfaces not subject to movement may be concealed by the coating system to be applied or, if this is not feasible, they may be filled with a suitable compound before painting. Substantial cracks and crevices should be treated in the following manner to marry in with the surrounding surface before painting:

(a) Widen and deepen cracks (back to the lath or other supporting surface if large) ensuring that each side of the crack is sloped back so that the crack is widest at its deepest point and narrowest at the wall surface.

(b) Fill the widened crack with a mortar consistent with the physical properties of the substrate. This may consist of a cement-sand or sand-lime mixture. Fill the plaster to about 6 mm below the finished wall surface, pressing the new mortar onto the supporting surface, and allow to dry.

(c) Fill with stopping plaster or a cellulose-reinforced gypsum filling compound (i.e. a setting-type filler rather than a drying-type filler) to just above the surface and allow to dry.

(d) Smooth the surface by screeding with a finishing plaster if the surrounding surface has not been previously painted. For previously painted surfaces overfill with stopping plaster and sand back to a smooth surface.

NOTE: An alternative method involves filling the crack with stopping plaster in layers not exceeding 6 mm in thickness, allowing each layer to dry before applying the next.

Rough areas caused by uneven trowelling, patches due to repairs, and fine surface cracking may be difficult to detect in unpainted plaster, but may become more clearly visible as each coat of paint is applied, as typically occurs with surface irregularities in both new and repaint work on all substrates. Rough or raised areas should be smoothed by blocking down or sanding, and fine cracks or depressions should be filled with a suitable compound, before resealing and painting.

3.11 FIBROUS PLASTER AND PLASTER GLASS

3.11.1 General

Methods used in preparing plaster surfaces give rise to fundamental differences between the surfaces of a joint and that of an adjacent sheet.

Sheet plaster has a cast surface whereas the surface of a joint is a trowelled or 'worked' surface. As a result, the porosity of a joint is substantially greater than that of a sheet. The degree of porosity may vary from sheet to joint. Some jointing compounds may contain quite a large percentage of lime to assist 'working'.

Proprietary additives such as water-soluble siliconates used in the casting process to reduce porosity or release agents may cause problems in subsequent painting (particularly if water-borne sealers are used) if the amount remaining on the surface is excessive.

Sheets of fibrous plaster are either nailed, screwed or cemented to the building structure (walls and ceilings). Cementing involves fixing by wads of sisal and gypsum plaster called 'scrim'. Water from the wads soak through the sheets, producing damp patches on the exposed surface. When these dry out they leave areas with slightly different surface properties from the surrounding unwetted parts of the sheets.

3.11.2 Release agents

Fibrous plaster surfaces ready for painting should be checked carefully for the presence on the surface of excessive amounts of release agents, porosity control agents (sealing agents), cure control agents, alkali in the jointing areas and excessive moisture from the erection techniques. A suggested way of confirming the presence of sealing agents would be to splash the plaster with water. If the plaster sheet repels the water, a sealing agent is present; if the plaster sheet absorbs the water then no sealing agent has been used.

Visual examination for moisture or residual surface salts or pH tests (see Clause 3.9.2.3) will usually reveal the presence of excessive amounts of alkaline additives or materials. Washing the surface with clean water and allowing it to dry is usually sufficient to remove visible contaminants.

3.11.3 Jointing compounds

Jointing compounds used on plaster sheets may contain a very high percentage of lime, which renders the surface alkaline in the presence of water. The surface should be tested for alkalinity with a universal indicator, if excessive residual alkalinity (greater than a pH of 9) is suspected or if lime additions were known to have been used in the jointings. Surfaces shown to be alkaline should be treated with phosphoric acid (see Clause 3.10.6.4), washed and dried thoroughly before painting. Where some latex paints are used and the surface is not thoroughly dry, moisture will pass through the pores of the latex paint film and carry calcium hydroxide and other soluble salts to the surface to effloresce. These are converted to calcium carbonate, which is not readily removed by water alone.

3.12 GYPSUM PLASTERBOARD

Paper-faced gypsum plasterboard requires checking to ensure that all joints are prepared to a smooth finish and are free of dust before the application of paint.

Various defects including 'popping and peaking' are associated with painted surface finishes on plasterboard. Some of these relate to the methods of installation and condition of the supporting structure. Ensuring that the plasterboard manufacturer's installation instructions are followed will reduce such problems. A common problem encountered is a shadowing effect at the joints, particularly with gloss finishes and oblique lighting conditions. Light reflecting off the stopping and finishing compounds over joints which are slightly higher than the surrounding plasterboard causes this. Reference to the Specification for the appropriate plasterboard finish level to minimize this before painting is essential. For additional information see AS/NZS 2589.

Occasionally a problem known as sheen staining or gloss banding may occur. This is characterised by an increase over time in the gloss level of the paintwork on jointed areas. This phenomena may take several months to manifest itself.

To prevent and/or rectify sheen staining an appropriate sealer is required. Advice on which sealer to use should be sought from the coatings manufacturer.

3.13 PLASTICS

3.13.1 General

The nature and extent of surface preparation necessary to obtain satisfactory adhesion of paints to plastics varies according to the generic plastic type; in some instances coating may be impracticable. Apart from the need to remove all extrusion lubricants, grease, dirt and other contaminants from the surface by wiping with solvent, the impervious, smooth and often greasy surface finish on most plastics usually also necessitates roughening of the surface with fine abrasives or a chemical etch. Where the plastic is soluble in the solvent or suspending medium of the proposed coating, mechanical roughening of the surface may be unnecessary.

3.13.2 Polyesters and phenol formaldehydes

The surface preparation for polyesters (e.g. FRP) and phenol formaldehydes should be as follows:

(a) Wipe all surfaces with acetone or other suitable solvent.

(b) Lightly abrade all surfaces with sandpaper, dust off and immediately apply a two-pack epoxy primer.

NOTE: Polyesters may contain waxes that can inhibit subsequent adhesion and a test area should be painted first.

(c) Topcoat with paint as applicable (see Tables 5.1 and 5.2).

3.13.3 Unplasticized polyvinyl chloride

The surface preparation for unplasticized polyvinyl chloride (uPVC) should be as follows:

(a) Wipe all surfaces with mineral turpentine, methylated spirits or white spirit, lightly abrade with sandpaper and dust off.

(b) Immediately apply finishes for uPVC in accordance with Tables 5.1 and 5.2.

3.14 ASBESTOS ENCAPSULATION OR SEALING

Both clear and pigmented solvent-borne and latex paints have been used to encapsulate asbestos containing surfaces; however, pigmented materials are recommended as they aid quality control of coverage and identify damage in service. Most contemporary products are high-build latex membranes.

Application is by airless spray with operating pressures as low as is practical to avoid the generation of asbestos dust during application. To seal asbestos insulation effectively, the first coat has to be of low viscosity to aid penetration and consolidate the asbestos-containing surface.

Encapsulation of asbestos is a highly specialized task requiring operatives having a full appreciation of the health ramifications (refer to the appropriate WHS regulations). See Clause 1.5.2.5.

SECTION 4 GENERAL DESCRIPTION OF PAINTS, RELATED MATERIALS AND TREATMENTS

4.1 GENERAL

The choice of paint and appropriate painting system that meet the requirements of the job depends on a number of factors, including the following:

(a) Type and complexity of surface to be painted.

(b) Area of use, e.g. interior or exterior.

(c) Cost considerations.

(d) Required durability and protection of asset.

(e) Decorative effect required.

(f) Any special requirements, e.g. resistance to salt spray, resistance to industrial pollutants, low odour demands, high abrasion resistance and similar.

Paints are manufactured to meet different gloss specifications so that those diverse requirements relating to the area of application may be accommodated. Gloss levels range from flat through to full gloss. Five commonly used stages are as follows:

(i) *Flat (matt)*—Up to 5 gloss units.

(ii) *Low-gloss (low sheen)*—Over 5 and up to 20 gloss units.

(iii) *Semi-gloss (satin)*—Over 20 and up to 50 gloss units.

(iv) *Gloss*—Over 50 and up to 85 gloss units.

(v) *Full gloss*—Over 85 gloss units.

NOTES:

1 Gloss units are measured in accordance with AS/NZS 1580.602.2 using a 60° exposure head.

2 Different manufacturers use terms such as ‘eggshell’ and ‘satin’ to describe different levels of gloss. These terms are all defined in AS/NZS 2310. As this Standard allows for quite wide ranges of gloss units for each term there may be discernible differences when comparing similar products.

To assist in the selection process, a general description of paints and their typical areas of use are shown in Table 4.2. Manufacturers’ guidelines should be followed in all cases.

Before choosing an appropriate gloss level finish, a number of factors should be considered, as follows:

(A) Flat or low-gloss finishes tend to mask imperfections such as joints or patchings. Semi-gloss, gloss and full gloss finishes highlight such defects, with the higher gloss level leading to the higher degree of highlighting.

(B) Flat and low-gloss finishes diffuse light and minimize the glare, which may occur when higher gloss finishes are used.

(C) Relative to flat finishes, low-gloss, semi-gloss, gloss and full gloss finishes of the same generic type have an increasingly higher resistance to abrasion, staining and moisture.

(D) Flat finishes are usually more difficult to clean than gloss and more likely to be affected by mould growth because of their rough surface texture. Some flat finishes are more prone to gloss increase when cleaned.

(E) Full gloss and gloss finishes tend to be more durable than lower gloss finishes in exterior applications.

(F) Some solvent-borne products have greater tolerances to surface contamination.

After referring to Table 4.2 and considering the above information on the effects of gloss level, a suitable system may be selected from Tables 5.1, 5.2, 8.2 or 8.3, as appropriate.

4.2 SEALERS

Sealers are generally applied to ensure that the chosen finishing coats are not affected by factors associated with the substrate material or previous coatings. Sealers perform one or more of the following functions:

(a) To seal absorbent surfaces and prevent migration of binder from subsequent coats.

(b) To create a barrier that reduces the migration of one or more chemicals from the substrate material, which could subsequently interfere with the performance of the finishing coat.

(c) To prevent substances which may be included in substrate material or previous coatings from bleeding into finishing coats. In general, solvent-borne sealers prevent bleeding of water-soluble stains while water-borne sealers prevent bleeding of solvent soluble stains.

NOTES:

1 No single sealer will necessarily perform all functions.

2 Where doubt exists as to the appropriateness of the sealer for the application, the coatings supplier should be contacted for advice. Where the nature of the substrate is uncertain trial areas may be painted out on an obscure area of the work using different sealers, i.e. water-based, spirit-based or oil-based, to gauge their effectiveness.

Sealers specific to particular applications are defined as Types B15, B16A, B16 and B30 paints. The appropriate sealing function should be specified.

4.3 PRIMERS

Primers are applied to obtain good adhesion of a paint system to the substrate. They may be formulated for use on a specific substrate, e.g. galvanized iron primer, or may be multipurpose, e.g. all metal primer.

Primers may also be formulated to include the following:

(a) Anti-corrosion properties through the inclusion of an anti-corrosive pigment (applicable to metal primers).

(b) Tannin stain-resistant properties through the selection of binder and extender pigments (applicable to latex-based wood primers).

Primers are classified as Types B10 to B14 paints.

4.4 UNDERCOATS

An undercoat is usually applied as an intermediate coat between a primer or sealer coat and the finishing coat if required. Undercoats perform a variety of functions; they can be applied—

(a) as a filling coat to provide a well-levelled and filled surface onto which the finishing coat is applied (especially where timber is being painted);

(b) as a sanding coat to provide an intermediate coat which may be readily sanded to a smooth surface prior to the application of the finishing coat;

(c) as a stain blocker to act as a barrier over any putty, stoppings or fillings to prevent the finishing coat being affected by soakage blemishes;

(d) as a high opacity film to provide additional opacity, and are often tinted to enhance this property; and

(e) as specialized chemical resistant coating to provide a tie coat between two different chemical types of finish.

General-purpose undercoats are classified as Type B17 paint.

4.5 SEALER/UNDERCOATS

Combined sealer/undercoat are generally latex-based and formulated to give the combined attributes of both a sealer and an undercoat through the application of one rather than two coats. They do not normally provide the stain or chemical sealing properties of a Type B30 paint.

Sealer/undercoats are classified as Type B16 paint.

4.6 SOLVENT-BORNE PAINTS

Solvent-borne paints include sealers, primers, undercoats, semi-gloss and full gloss products. Sealers, primers and undercoats are generally designed for either interior or exterior use, although they may be formulated specifically to cover both interior and exterior usage.

Solvent-borne paints that contain alkyd, urethane-alkyd, urethane-oil or modified alkyd resins have the following characteristics when compared to latex paints:

(a) Embrittle and yellow with time.

(b) Chalk and exhibit loss of gloss in exterior applications and are less flexible on unstable substrates such as timber.

(c) Solvent-borne paints have higher levels of VOCs than latex paints (see Clause 1.5).

(d) Generally produce a harder film than latex-based products, which makes them more resistant to wear and tear and better suited for surfaces that may come into contact with one another, e.g. cupboard doors and trim.

(e) Generally have superior flow and provide a smoother finish on flush surfaces.

Solvent-borne paints are classified as Types B2 to B5 paints.

4.7 LATEX (WATER-BORNE) PAINTS

Latex paints are based on a synthetic polymer (resin), which are manufactured as a stable suspension of solid particles dispersed in a liquid medium, which is principally water. Some examples of synthetic polymers are polyvinyl acetate, polyvinyl acetate/acrylate, acrylic, polyurethanes and styrene/acrylic. A number of other hybrid systems are also available.

Products formulated on these polymers may have the following features:

(a) Rapid dry and short recoat times relative to solvent-borne paints.

(b) Free from flammable solvents, which exhibit an unpleasant odour during application, and pose a fire hazard during storage and in use.

(c) Suitably formulated latex paints have greater flexibility than solvent-borne paints and, therefore, enhanced exterior durability on substrates subject to dimensional changes, e.g. timber.

(d) Do not yellow on ageing.

(e) Do not embrittle with time.

(f) A tendency to block or stick on contact with other latex painted surfaces in higher temperatures; however, some semi-gloss and gloss acrylics are formulated to improve resistance to blocking.

(g) Due to their thermoplastic nature, latex paints are difficult to remove by conventional means such as heat guns, sanding and paint strippers.

Latex paints are classified as Types B6 to B9 paints. Latex enamels for interior doors and trim are classified as Types B41 and B42.

4.8 CLEAR (UNPIGMENTED) FINISHES

Clear finishes such as varnishes do not contain opacifying pigments and so allow light to reach the surface below which, therefore, shows through. Clear finishes have generally lower solids content than pigmented paints and, hence, produce thinner films.

In interior applications, clear finishes may be applied to substrates such as bare or stained timber to increase service life through enhanced resistance to wear and tear, and soiling.

Clear finishes lack opaque pigments to absorb, scatter or reflect light, whether visible or ultraviolet (UV) and, where exposed to direct sunlight, the penetration of UV rays may have two independent destructive effects on a clear-coated surface, as follows:

(a) Organic substrates such as timber are subject to slow deterioration and eventual disintegration under UV attack, allowing an otherwise unaffected and intact film of clear finish to delaminate from the substrate, usually with traces of the disintegrating surface adhering to the underside. (Inorganic substrates such as masonry and metals are virtually unaffected.)

(b) A clear finish will be degraded by UV attack at a rate proportional to the UV susceptibility of the binder type; e.g. acrylics have greater UV resistance than alkyds.

Both of these effects of UV penetration may be mitigated by including UV absorbers in exterior clear formulations to prolong their service life. Organic UV absorbers contribute virtually no colour to the clear film, but are subject to a slow loss of performance as they are degraded by UV. Inorganic UV absorbers, such as transparent iron oxides, impart a slight colour to the film but are more durable in blocking UV.

Even with UV absorbers, performance on exterior timber surfaces is less than that provided by the same number of coats of paint, and maintenance will be required more frequently to ensure sufficient film thickness to enable UV absorption to continue. It is particularly important to adhere to recommended maintenance schedules for coatings that are UV resistant but include a UV absorber to protect the substrate because, in such cases, progressive loss of the UV absorber within the film may not be apparent from the surface condition of the film, allowing the situation described in Item (a) above to occur.

Clear finishes are classified as Types B19 to B21 paints.

4.9 TIMBER STAINS

4.9.1 General

Timber stains include various coloured varnishes, pigment dispersions and dye solutions designed to alter the colour of timber and enhance decorative effects.

4.9.2 Exterior stains

4.9.2.1 *Latex timber stains*

Latex timber stains are semi-transparent paints (B22) usually based on acrylic latex resins. These products are designed to be applied directly to the timber substrate without preparatory coats in most instances; however, certain types of timber commonly hardwoods require some type of surface preparation or the application of a suitable primer. When appropriate numbers of coats are applied at adequate spreading rates on properly prepared timber, these products should be expected to provide extended period of decoration and protection. Many fence stains (Type B22A) are included in this category; however, they may offer a limited period of protection due to the lower solids content or less durable binders than general purpose exterior latex paints.

4.9.2.2 *Solid colour oil stains*

Solid colour oil stains are heavily pigmented opaque stains (Type B23) based on drying oils or alkyd resins. These low solids, low build coatings protect and decorate exterior timber, allowing the texture to be seen while hiding the actual grain. Failure is by gradual chalking or erosion, and this leads to relatively simple refinishing when required.

4.9.2.3 *Transparent and semi-transparent stains*

Transparent and semi-transparent stains are low solids solvent-borne or water-borne stains with relatively low content of traditional or transparent oxide pigments, which allows both the texture and grain to be seen. Generally, when used in fully exposed locations, they have a shorter lifespan than solid colour stains. They are relatively easy to maintain.

4.9.2.4 *Curing*

Many exterior oil stains of the types described in Clauses 4.9.2.2 and 4.9.2.3 include some low molecular weight material which may be referred to as an oil and which does not become immobilized within the film as it forms on the substrate. This oil may serve at least two major purposes, as follows:

(a) Penetrating into a timber substrate and slowing its deterioration by preventing penetration of water.

(b) Maintaining flexibility and elasticity of the film by plasticizing it, thus slowing the onset of cracking.

Even when the film is visibly weathered, some of this oil is likely to remain within it or the substrate; hence, the film may be regarded as not fully curing within its service life. A fully cured coat, whether pigmented or not, should not be applied over a non-fully cured coat, as the uncured, non-immobilized oil may cause problems for the newly applied film; for example, poor adhesion, blistering, slow drying, plasticization, cheesiness, staining, and dirt pickup, depending on whether the oil is trapped behind or moves into the new film.

In many cases, neither the identity nor the generic type of an existing film of oil stain are known, and caution, therefore, dictates either the total removal of the existing film to expose clean timber or ensuring compatibility with any proposed fully curing system by applying test areas under representative conditions of exposure, e.g. on differing aspects of a structure, and evaluating over an appropriate period (which may be measured in months).

4.9.3 Interior timber stains

4.9.3.1 *Soluble dye solutions*

Soluble dye stuffs in organic solvent or water (Type B18) have been used as traditional timber stains for many decades in the furniture industry. These materials are still of principal interest to the furniture industry, and may give a patchy, uneven colour when used on common building timbers such as Victorian ash and many pine species where there is a high variability in the absorbency of the timber. Care in selection of dye bases that are best suited to certain timber species has led to the production of some water-borne dyes that alleviate the problems. Two or three coats of clear varnish should follow to seal and protect the surface.

4.9.3.2 *Pigmented stain (sometimes known as wiping stain)*

Low solids pigment dispersed in water-borne or solvent-borne resin (B18) is applied as a very wet coat by brush or cloth pad with the surplus wiped off with a clean cloth or other absorbent material. These stains may be slightly less transparent than dye solutions, but may be applied to most timber species with minimal difficulty. Two or three coats of clear varnish should follow to seal and protect the surface.

4.9.3.3 *Varnish stains*

Tinted alkyd or polyurethane varnishes enable colouration of interior timber and furniture with fewer steps than when using dye or pigment stains and clear finishes. Care is needed to avoid build-up of colour where overlapping occurs during application.

4.10 PAVING PAINTS

Paving paints are decorative finishes designed for residential use. These coatings may be subjected to demanding service conditions due to weathering, abrasion, salt efflorescence and exposure to contaminants and hydrostatic pressure and may require regular maintenance. The paint manufacturer's advice should be sought on the application of these materials. Where reduced slip is required special products are available.

Paving paints are classified as Type B24 and B24A paints; however, for severe wear and tear service in interior situations Types B294 and B29A are favoured. In trafficking areas, such as the egress of buildings, a skid resistant finish may be mandatory.

4.11 ROOFING PAINTS

Paints formulated specifically for roofs may be solvent-borne, for application onto appropriately primed or sealed surfaces, or latex (generally acrylic), which can be applied to appropriately prepared surfaces.

Some paints described in previous clauses may be used on roofs. The paint manufacturer's advice should be sought to confirm their applicability for use as well as suitability for the collection of drinking water. Not all latex products are suitable for use with drinking water collection systems. Latex roof paints may contain a variety of water-soluble additives, which usually require some amount of wash down prior to the collection of drinking water. The manufacturer's advice should be sought (see also Clause 5.3).

Roof paints are classified as Type B25 and Type B26 paints.

NOTE: The application of primer to the laps during the installation of the roof is highly recommended.

4.12 BITUMINOUS PAINTS

Bituminous paints provide an impervious barrier to moisture and are often used on concrete surfaces and concrete footings to buildings. Because of their ability to wet steel surfaces, they are used as a maintenance paint for steelwork where appropriate surface preparation is not possible. These paints have some shortcomings in that they crack on exposure and give bleeding problems on recoat. This type of paint is generally black and is classified as Type B37 paint.

4.13 SPECIAL PURPOSE PAINTS

4.13.1 Anti-condensation paints

Anti-condensation paints are specially formulated to absorb and release moisture gradually so that condensation does not occur on the surface. Anti-condensation paints provide a porous surface to absorb moisture and to inhibit water droplets forming on the surface; however, they are no substitute for good ventilation. These paints are classified as Type B27.

4.13.2 Fire-retardant paints

4.13.2.1 *Intumescent paints*

Intumescent paints are high-build coatings, which swell when exposed to heat due to an internal chemical reaction. This swelling action produces an insulating layer around the substrate to reduce the exposure to fire, minimize damage to the structure and have low smoke index. These paints are classified as Type B28.

4.13.2.2 *Low spread of flame paints*

Low spread of flame paints are specially formulated to reduce the likely spread of flame on the painted surface. These paints have been tested to AS/NZS 1530.3 to meet specified spread of flame criteria.

Low spread of flame paints are classified as Type B28A paints.

NOTE: It should be noted that, in practice, the nature of the substrate will have a profound effect on the performance of low spread of flame paints.

4.13.3 Chemical-resistant paints

Chemical-resistant paints are specially formulated to resist chemical attack. Formulations will vary depending on the chemical(s) to which the paint film is required to be resistant. Chemical-resistant paints are classified as Type B29 paints.

4.14 MEMBRANE AND TEXTURED COATINGS

4.14.1 General

High build membrane, smooth and textured coatings are applied to provide decorative effect and mask surface irregularities in the substrate. They are variously applied to concrete, masonry, fibre-cement sheeting and similar rigid substrates. They may also inhibit the ingress of moisture and carbonation of concrete surfaces. A variety of finishes may be achieved including textured and stippled coatings and decorative aggregate finishes which, although assisting in the masking of surface imperfections, often encourage dirt retention and may be difficult to clean. Gloss finishes minimize dirt retention and are usually more cohesive. The final appearance is in part related to the application technique. Experienced applicators are required to provide a uniform finish and, in particular, they need to be proficient in matching repairs.

These coatings do not compensate for poor building design. Despite the appreciable thickness and extensibility of many of these coatings they can never be assumed to prevent moisture ingress into the building fabric or prevent the degradation of a water sensitive substrate. This is in part because they can never be assumed to be evenly applied without pinholes and because of movement of the building which may exceed the movement capability of the coating. Such coatings can be particularly vulnerable in areas subject to ponding or on inaccessible surfaces such as roof cappings which cannot be easily inspected for deterioration that may compromise the building‘s long term integrity.

Colour variation of membrane and textured coatings can vary significantly from batch to batch. When applied on a single planar area only material from one batch should be used, or the coating should be overcoated with a colour finishing coat.

Where bright or strongly tinted colours are required, it is recommended that a conventional latex paint of the correct colour be used and that the texture base coat is tinted to a close approximation to the first coat.

Membrane or textured coatings are classified as Type B38 paints.

4.14.2 Latex extensible wall coatings

Latex extensible wall coatings are generally referred to as membrane coatings. They are non-aggregate, flexible, watertight finishes, which are applied to prevent the ingress of moisture and retain flexibility at varying temperatures, so accommodating expansion or contraction of the substrate. Extensible coatings also provide carbonation resistance. These coatings are not intended for use on surfaces where water ponding is possible. They are normally specified in systems that include a sealer and multiple coats.

Application of membrane coatings may be by airless spray, texture roller (low profile texture) or nap roller, to achieve a typical spreading rate of 1.0–2.0 m^2/L (0.5–1.0 L/m^2) per coat. The total film thickness applied will be critical in achieving required levels of performance, particularly crack bridging where higher film thicknesses improves this property. In addition to these products a range of other highly elastomeric liquid applied coatings are available for specialised waterproofing.

4.14.3 High-build low profile latex coatings

High-build low profile latex coatings are water-borne coatings that are designed to be used over textured coatings to elevate the exposure performance of the paint system. These coatings provide a non-aggregate, water-resistant finish that has suitable rheological properties, which produces an even film coverage over an irregular surface profile due to underlying textured coating. They are used to elevate the performance of the underlying coating and also provide dirt shedding and anti-carbonation properties. These coatings are not intended for use on surfaces where water ponding is possible. They are normally specified in systems that include a sealer and multiple coats.

High-build low profile latex coatings are generally applied by ‘nap roller’, but may be airless spray applied to achieve a typical spreading rate of 1.5–6.5 m^2/L (0.15–0.60 L/m^2). These finish coatings may be used with a specified primer as ‘stand-alone’ coatings, to achieve a low relief texture, such as a ‘stipple’ produced with a nap roller.

4.14.4 Non-aggregate textured latex coatings

Non-aggregate, low to medium profile textured latex coatings are selected for aesthetic purposes to provide attractive decorative profiles, according to the application technique used. Application may be by textured roller, airless spray or hopper spray, depending upon the profile required, to achieve a spreading rate of 1.0–2.0 m^2/L (0.5–1.0 L/m^2).

This type of coating is generally specified in a system that includes a topcoat of material where maximum resistance to moisture ingress and dirt pickup is required. These coatings are not intended for use on surfaces where water ponding is possible. They are normally specified in systems that include a sealer and multiple coats.

4.14.5 Aggregate-filled textured latex coatings

Aggregate-filled, medium to high profile textured coatings are selected for aesthetic purposes to provide maximum relief from underlying surface irregularities. The aggregate may consist of sand, marble or other inert mineral constituent. These coatings may be applied by textured roller, hopper spray or trowel, depending upon the material type selected and the profile required, to achieve a spreading rate of 0.4–1.2 L/m^2 (0.8–2.5 L/m^2).

These coatings are generally specified in a system, including a topcoat, where maximum resistance to moisture ingress and dirt pick-up is required. These coatings are not intended for use on surfaces where water ponding is possible. They are normally specified in systems than include a sealer and multiple coats.

4.15 PAINT REMOVERS

Solvent-type paint removers are applied by brush to an old painted surface and, following a suitable reaction time and possible mechanical action (e.g. scraping), are thoroughly washed off. Where paint removers that contain wax are used, it is necessary to wipe down the surface with mineral turpentine to remove all traces of wax residues before repainting.

Latex paints may be difficult to remove; however, the use of a paint remover formulated on solvents with slow evaporation rates will aid removal. Chemical type paint removers are required for multicomponent paints [see Clause 7.5(d)]. Caustic-based paint strippers should not contact aluminium, zinc, polyester or other alkali-sensitive substrates.

Paint removers are classified as Type B36 paints.

NOTE: The health hazards associated with most paint removers should be recognized and precautions should be taken.

4.16 WATER-REPELLENT TREATMENTS FOR TIMBER

Water-repellent treatments are particularly useful for inhibiting water absorption by timber during building construction and are generally used in the pre-fabrication process.

The use of a water repellent on timber does not eliminate the need for priming.

Some water-repellent solutions are coloured whereas others are almost colourless. These treatments leave a clean surface that repels or sheds water and, following appropriate ageing, may be painted with solvent-borne paints. Care should be taken when selecting and applying these products on timber that is intended to be stained or painted, as adhesion problems may occur.

Water-repellent treatments are difficult to detect visually and a test (using water) should be carried out to determine if the timber has been treated. If the timber has been treated, then advice should be sought before applying any paint system. Removal alternatives include sanding or a solvent wipe.

Timber treatments are classified as Type B34 paints.

NOTES:

1 These products may be multi-functional and may contain fungicide to increase the resistance of the timber surface to fungal attack.

2 The presence of a repellent is commonly assessed as follows: sprinkle the surface with water; if the water forms beads it is probable that water repellents have been used and the surface cannot be directly overcoated with a latex paint.

4.17 WATER REPELLENTS FOR CONCRETE AND MASONRY

Water repellents for concrete and masonry are designed to repel surface water and reduce the water permeability of substrates; however, they are not effective in preventing water ingress into cracks that have a width greater than 0.3 mm. They embrace a variety of colourless, low viscosity products and range from highly alkaline water-borne siliconates, used chiefly for tiles, and traditional silicone water repellents, to low molecular weight silanes and siloxanes. These low molecular weight products penetrate the surface to a greater depth than the silicones and, hence, are more effective repellents. They are particularly favoured for protection of concrete where there is a potential for the reinforcement to corrode.

Water repellents should not be confused with clear anti-carbonation coatings, which are typically unpigmented solvent-borne acrylics intended to retard ingress of carbon dioxide into concrete and its resultant carbonation of the free lime.

Water repellents for concrete and masonry are classified as Type B33 paints. A large range of proprietary products, which may perform this function but which are not classed as paints (generally silicate-based coatings which block pores and capillaries to inhibit moisture migration), are available. Manufacturers' advice should be sought.

4.18 ANTI-GRAFFITI PAINTS

4.18.1 General

Graffiti may be managed by the application of anti-graffiti paints or by overpainting. Graffiti may be successfully overpainted provided that the graffiti is not solubized by the solvents in the paint. Thus latex paints may be successfully used over water insoluble stains. Overpainting is a common effective means of managing graffiti. However, the consistent recoating can lead to premature failure of coating systems. Removal of graffiti by specialized graffiti removers is the preferred option.

4.18.2 Surface vulnerability

Selection of the substrate material is most important for minimizing the problem of graffiti. A smooth impervious surface, such as glass or stainless steel, has particular advantages, since removal of graffiti may be achieved by using the strongest organic solvents without detriment to the substrate. In addition, the graffiti will not become ingrained as it does on a more absorbent surface. After a smooth impervious surface, the next most suitable class of substrate is a smooth painted surface.

The use of anti-graffiti coatings on rough or textured or porous surfaces presents a far more serious problem, for the following reasons:

(a) Even with multiple coats, traditional coatings cannot reasonably be applied over rough surfaces, without the formation of pinholes or points where the film thickness is extremely low. At such points, graffiti is able to penetrate to the substrate and resist subsequent removal methods.

(b) Graffiti removal treatments are difficult to apply evenly over rough surfaces.

4.18.3 Paint selection

There are essentially two types of product, 'permanent' coatings, which are readily cleaned free of graffiti, and self sacrificial types, which are readily removed together with any graffiti. Due to the large variety of proprietary products available, manufacturers' advice should be sought on the ease of repainting after the original coating has been weathered or damaged.

For exterior service, a permanent anti-graffiti paint should be used. Only some two-pack pigmented polyurethane paints and two-pack pigmented waterborne epoxy resins are suitable for extended durability performance, although a significantly shorter service life, perhaps of three years, may be anticipated for clear two-pack polyurethanes and chalking is more rapid with two-pack epoxy resins. For interior service, selected two-pack solvent-borne epoxy enamels, single pack moisture-cured urethanes and two-pack epoxy acrylics are also appropriate. Clear single pack acrylic copolymer paints are favoured as temporary products with a service life of three to four years, unless subjected to graffiti remover.

4.18.4 Graffiti removal

There is no single preferred method for the removal of graffiti; however, it is best to use the least severe of the successful methods. For graffiti of uncertain composition, washing with water and a mild detergent may suffice. Alternatively, in increasing severity, mineral turpentine, toluene, a proprietary graffiti remover, a paint stripper, or caustic paint remover may be necessary. Every attempt should be made to remove the graffiti as soon as possible after it has been applied; the longer it is left to cure the more difficult it will be to remove. The technique for removal is also crucial, as the graffiti needs to be removed as soon as it has been sufficiently softened by the solvent to be flushed from the surface. If left too long, the solvent may cause the graffiti to penetrate deeper into the surface leaving a shadow.

Care needs to be taken when handling organic graffiti strippers. Hazards caused by flammability, contact with skin and eyes and the inhalation of vapour need to be recognized. Caustic strippers have implications for some metals, notably aluminium and zinc.

4.19 NON-CONVENTIONAL PAINTS

4.19.1 Paints

4.19.1.1 *Multi-fleck coatings*

Multi-fleck coatings are liquid-applied paints consisting of two immiscible phases. When applied, a fleck finish, usually multi-coloured, superimposed on a single colour background is produced. The finish is used for decorative effect, particularly in heavy traffic areas such as lobbies and stairway walls, where aesthetics, resistance to wear and tear, graffiti and staining are advantageous.

4.19.1.2 *Modern faux finishes*

These paint finishes are designed to provide specialized decorative effect variously to simulate stoneware, textiles and even metals. Their prime role is aesthetic and their advantages and limitations vary significantly from product to product and careful consideration is required in their selection. Application of these products may require specialised techniques and skills.

Coatings to simulate traditional finishes cover a wide range of formulations to provide the effect of traditional finishes such as limewash, marbling, distempers and sandstone.

4.19.1.3 *Hammertone and wrinkle finishes*

Hammertone finishes have the appearance of beaten metal. Wrinkle finishes have a fine wrinkle appearance.

4.19.1.4 *Two-pack epoxy acrylic and acrylic polyurethanes*

Two-pack epoxy acrylic and acrylic polyurethanes are typically applied in two coats at a dry film thickness of 40–50 μm per coat over an epoxy primer to provide enhanced colour and gloss retention and resistance to chalking and wear and tear, relative to conventional latex and solvent-borne paints [similar to acrylic full gloss (two-pack) to AS/NZS 3750.5].

4.19.1.5 *Two-pack solvent-borne epoxy coatings*

Two-pack solvent-borne epoxy coatings are applied to smooth and suitably primed substrates at a total dry film thickness of 100–200 µm. These paints are selected for enhancing resistance to moisture, for use with selected chemicals and solvents, and for wear and tear. Severe chalking precludes their use as decorative coatings in exterior service unless overcoated [similar to full gloss epoxy (two-pack) to AS/NZS 3750.10].

4.19.1.6 *Two-pack polyurethane*

Two-pack polyurethane paints are applied as a two-coat system at 40–50 µm per coat over an epoxy base coat. These paints are used for selective resistance to moisture, chemicals, solvents, wear and tear and durability performance, particularly in exterior service where their enhanced resistance to chalking and loss of gloss is noteworthy [similar to full gloss polyurethane (two-pack) to AS/NZS 3750.6].

4.19.1.7 *Thermosetting powder coatings*

Thermosetting powder coatings are factory-applied to metal surfaces for enhanced resistance to wear and tear, e.g. pre-finished window and door frames. Epoxy and epoxy polyester types provide superior resistance to moisture, and selective solvents and chemicals; polyesters are favoured for enhanced gloss and general appearance (see AS 4506).

4.19.1.8 *Water-borne epoxies*

Water-borne epoxies are applied to masonry, concrete and brickwork in not less than two coats, typically at 50–80 µm per coat. These coatings provide enhanced resistance to wear and tear, moisture and selective chemicals.

4.19.1.9 *Granolithic floor finishes*

Granolithic floor finishes are applied as high-build epoxy coats such as by trowel or as a self-levelling grade, typically applied at 400–500 µm thick, or as an epoxy aggregate screed to 10 mm for very high wear and tear areas. In some instances the aggregate takes the form of flake-like coloured polymer chips in a clear binder to provide a smooth stain resistant and wear and tear resistant finish.

4.19.1.10 *Anti-carbonation coatings*

Anti-carbonation coatings are applied to concrete substrates to limit the ingress of carbon dioxide through the coating, while allowing diffusion of water vapour through the coating. Such coatings are applied to inhibit the carbonation of the reinforced concrete and consequent reinforcement rusting due to decreases in the pH of the concrete matrix. These coatings are principally low-build solvent-borne acrylics and are often unpigmented, so as not to change the aesthetic appearance of the substrate.

4.19.2 Application and maintenance

The application properties and maintenance of this diverse range of products may differ considerably from the recommendations of this Standard which, for the most part, deals with conventional paint systems. Manufacturers' instructions should be referred to for non-conventional paint systems.

4.20 HERITAGE PAINT SYSTEMS

4.20.1 Paints

Heritage paints go somewhat further than contemporary heritage colour paints. Whilst they do attempt to replicate the heritage colours they also attempt to replicate the texture and reflective values of the original products. This presents some difficulties as many of these original products contained ingredients that are no longer available. Any paints used before 1920 included naturally occurring resins such as vegetable oils, copal, damar and similar.

As these resins were natural products, variations in colour, texture and reflectivity were common, notably because of inherent variability in materials and processing techniques.

Variations in resin supplies, colour availability and personal intervention by the painter make exact replication of original heritage paints, using modern methods and materials, very difficult. The following comments provide some general information on some of the more common products used:

(a) *Distemper (e.g. kalsomine is a common version)* This was composed mainly of whiting and glue size. Too much size caused the paint to peel while too little allowed it to wash off. Colouring was by the addition of pigments and further additives such as casein, borax or alum, which were included to improve the resistance to moisture. Distempers range from water soluble to relatively insoluble. Distempers were generally limited to interior use due to low moisture resistance and were extensively used over set plaster walls due to the high alkali resistance. Overcoating problems are encountered if all of the old distemper is not removed.

(b) *Traditional limewash (e.g. whitewash)* Limewash was made by the addition of animal tallow to a solution of fresh rock lime in water, which generated calcium stearate, a binder that provided resistance to moisture. Colouring was by the addition of natural earth pigments. Limewash was generally limited to exterior use although the coating was also used on the interior of some buildings (e.g. stables, laundries and similar). Due to the high alkali content of traditional limewash, as much as possible of the coating should be removed prior to recoating with an alkali-resistant coating system.

(c) *Black Japan* Black Japan was a varnish where bitumen replaced the natural gums used in clear varnish. It was generally used on internal timber and ironwork, particularly on low-grade (bad colour or grain) timber. Achieving adhesion of these varnish products is difficult as the extreme hardness does not allow penetration of subsequent coats into the substrate, and may result in future chipping of any topcoat system. Black Japan should be totally removed prior to undercoating.

(d) *Shellac* Shellac is a spirit-based finish that differs from other resins in that it is soluble in alcohol. Shellac was used extensively on high-grade timber (good colour or grain) in the finishing of furniture and the finishing of joinery. Shellac is traditionally orange in colour but can be bleached to a white finish. Shellac coatings were often overcoated with a wax finish. Before repainting, any residual wax coating should be removed by abrading the shellac.

4.20.2 Application and maintenance

Each of these products has unique appearance, performance, surface preparation and application properties which may not be applicable to more conventional paints. Such paints may exhibit unevenness in colour and appearance, be porous or loosely bound, causing difficulties in recoating and requiring appropriate surface preparation prior to repainting. Appropriate product advice should be sought from the manufacturer or supplier (see also Clause 7.5.1).

4.21 PUTTIES, GROUTS AND SEALANTS

A range of putties, grout and sealants are variously used to fill joints, crevices and cavities in buildings. This is additional to the rigid plaster and cementitious fillers discussed elsewhere in this document. The selection of the most appropriate product will usually depend upon substrate type, the exposure conditions and whether the joint or crevice is static or dynamic. Guidance on some of the key parameters for consideration is given in Table 4.1.

Most of these products can be overpainted if required. However, elastomeric types, which are often difficult or impossible to paint, and epoxy and polyester types are usually colour pigmented. The technology of the more highly elastomeric types can be complex and often requires specialist advice. For example, the use of backing rods to control the width to depth ratio of movement joints and the avoidance of acetic acid liberating silicones in the presence of metal surfaces are two problem areas.

TABLE 4.1

PROPERTIES OF COMMON PUTTIES, NON-CEMENTITIOUS GROUTS AND SEALANTS USED IN THE BUILDING INDUSTRY

Type	Rigid grouts and putties			Moderately elastomeric sealants	Highly elastomeric sealants
Property	**Oil-based**	**Butyl**	**Epoxies/Polyesters**	**Acrylic, epoxy**	**Silicones, polyurethanes**
Long-term tolerance to joint movement	Typically ±3%	Typically ±5%	NIL	Typically ±5% to ±12% depending on type	±25%
Typical drying time	5–7 days	1–24 hours	Epoxy 0.5 to 3 hours Polyesters 10 min	1 to 48 hours depending on type	Surface cure in 1 hour. Through hardening of moisture cured types may take 2 days
Cure mechanism	Solvent evaporation and oxidation	Solvent evaporation	Chemical	Acrylic-solvent or water evaporation Epoxy-chemical cure	Two packs chemically cured, single packs generally by air moisture
Resistance to weathering	Embrittles with age, preferably overpainted	Moderate but prone to dirt retention	Good resistance but epoxy prone to surface chalking	Good resistance except silicones prone to dirt retention	Very good, except silicones prone to dirt retention
Paintability	Readily painted	Painted with normal solvent-borne and latex paints	Needs sanding before painting, but can be pre-coloured	Colour range of sealants, not usually painted	Colour range of sealants, not usually painted
Extent of surface preparation	Brush clean joints and prime	Brush clean joints	Moderate to critical	Solvent-borne acrylic-minimal Water-borne acrylic and epoxy-remove oil/dirt, etc.	Critical to remove moisture, oil, dirt, etc. Primer sometimes required
Application method	Putty knife or gun	Gun or preformed tapes	Pour or trowel	Gun or pour	Two pack—gun, trowel or pour One pack—gun
Typical applications	Interior and exterior timber windows and trim	Interior and exterior timber windows and trim	Floors and other hard surfaces for maximized wear and tear resistance	Control joints on range of substrates where anticipate only moderate movement	Control joints on range of substrates where maximized joint movement and durability required

4.22 LOW VOLATILE ORGANIC COMPOUND PAINTS

Low volatile organic compounds (VOC) paints are being developed to reduce the WHS and environmental impact of paints in their respective generic classes, see Clause 1.5.2.6.

4.23 ECOLOGICAL PAINTS

This group of paints are claimed to have a smaller ecological footprint, i.e. they do not use up the earth's resources as much as conventional paints. However, the ingredients and the lifecycle of these products need to be carefully examined before making a choice to use them.

TABLE 4.2

PAINT TYPES

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B1	Flat paint, solvent-borne	Consists of pigments, extenders, alkyd resin binder and volatile organic solvents	For finishing sealed wallboards, plaster, brick and masonry surfaces to reduce glare and unwanted reflections and make unevenness of surfaces less obvious. Use is discouraged in favour of latex paints because of environmental considerations *Interior painting* Walls and ceilings of living areas	NE	
B2	Low-gloss paint, solvent-borne		Superseded by latex equivalent in most instances	NE	NE
B3	Semi-gloss paint, solvent-borne		For finishing primed, sealed or undercoated timber, wallboards, plaster, brick, masonry and concrete surfaces to obtain a semi-gloss film with moderate washability and resistance to moisture *Interior painting* Walls, ceilings and timber in living areas, office and public work areas, and domestic kitchens, bathrooms and laundries	0015/3	3730.5
B4	Gloss paint, solvent-borne		In aerosols. These paints have limited availability	NE	NE
B5	Full gloss paint, solvent-borne		For finishing primed and undercoated timber, wallboards, plaster or metal with a smooth glossy film with good washability and resistance to moisture *Interior painting* Timber in living areas, office and public work areas. Timber, walls and ceilings in domestic kitchens, bathrooms and laundries *Exterior painting* Primed weatherboard and timber and metal trimwork—downpipes, spouting, eaves, fascias, windows and other metal work	0015/1 0015/1	3730.6 3730.6
B6	Flat latex paint	Consists of pigments, extenders, latex binder and water	For finishing suitably sealed interior areas and suitably primed or prepared exterior surfaces, with a flat film *Interior painting* Walls and ceilings in living areas *Exterior painting* Concrete, brickwork, masonry and soffits	0280/3 0280/3	3730.1 3730.7

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B7	Low-gloss latex paint		For finishing suitably sealed interior areas, and suitably primed or prepared exterior surfaces, with a low-gloss film *Interior painting* Walls and ceilings in living areas, office and public work areas *Exterior painting* Masonry, soffits and timber, except where blocking can be a problem	0280/3 0260/4 0260/2	3730.3 3730.8
B8	Semi-gloss latex paint		For finishing suitably sealed interior areas and suitably primed or prepared exterior surfaces, with a semi-gloss film *Interior painting* Walls and ceilings in living areas, office and public work areas, and domestic kitchens, bathrooms and laundries *Exterior painting* Primed or prepared weatherboards and other timber (except where blocking can be a problem), masonry, concrete and brickwork and other wall area and metal substrates. Some latex products are block resistant	0280/2 0260/2	3730.2 3730.9
B9	Gloss latex paint		For finishing suitably sealed interior areas and suitably primed or prepared exterior surfaces, with a gloss film NOTE: Some are self-priming and require no primer or undercoat. *Interior painting* Walls and ceilings in office and public work areas, and domestic kitchens, bathrooms and laundries *Exterior painting* Primed or prepared weatherboards and other timber (except where blocking can be a problem), masonry, concrete and brickwork and other wall area. Some latex products are block resistant	0260/1 0280/1	3730.12 3730.10
B10	Wood primer, solvent-borne	Consists of pigments, drying oil and/or alkyd resin binder and volatile organic solvents	*Interior painting* Primer is used on dressed timber in living areas, office and public work areas, and domestic kitchens, bathrooms and laundries *Exterior painting* Primer is used on dressed weatherboards, timber windows, eaves, fascias and outdoor furniture	0181	3730.13
B10A	Wood primer, latex paint	Consists of pigments, extenders, latex binder and water	For priming surfaces such as dressed weatherboards, timber windows, eaves and fascias	0183	3730.17
B11	Metal primer solvent-borne	Consists of anti-corrosive pigments (such as zinc phosphate) treated alkyd or oil with binder and organic solvent	*Interior and exterior painting* Steel and other metals in other than severely corrosive conditions	0032 0162/1&2	3730.21

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B11A	Metal primer latex paint	Consists of anti-corrosive pigments (such as zinc phosphate) latex binder, water and special purpose additives	*Interior and exterior painting* Steel work (non-critical areas only) and other metals. Some primers are suitable for the patch-priming of zinc-coated steel	NE	NE
B12	Metal primer for zinc-coated surfaces solvent-borne	Consists of pigment, binder and volatiles organic solvents	*Interior and exterior painting* Used on zinc-coated or zinc-aluminium-alloy-coated steel in mildly corrosive conditions		
B12A	Latex metal primer for zinc-coated surfaces	Consists of pigment, latex, binder and water as the volatile material	*Interior and exterior painting* Used on zinc-coated or zinc-aluminium-alloy-coated steel in mildly corrosive conditions	0134	3730.15
B13	Metal-etch primer (including wash primers)	Consists of a small amount of anti-corrosive pigment, vinyl resin binder, phosphoric acid and volatile solvent	Applied as a thin film to metals such as aluminium, steel, zinc and zinc alloys to improve adhesion of subsequent coat	0035/2 0035/1&3	3750.17 NE
B14	Zinc-rich organic priming paint	Consists of zinc dust as the pigment, organic resin binder and volatile organic solvent	*Exterior painting* Steelwork and rusting zinc-coated and zinc-aluminium-alloy-coated steel under corrosive conditions		
B15	Sealer/under coat, alkali resistant sealer, (concrete set masonry, plaster and wallboard)	Consists of pigment, in binder and volatile organic solvent	Sealing concrete, cement-render and brickwork prior to application of latex or solvent-borne paint. Sealing surfaces of wallboards prior to the application of normal latex or solvent-borne paints, or wallpaper. Plaster and plaster glass do not require an undercoat after sealing. *Interior painting* Walls and ceiling in living areas, office and public work areas, and domestic kitchens, bathrooms and laundries *Exterior painting* Sealing suitably prepared surfaces	0171	3730.22
B15A	Clear low viscosity paint	Clear pavement or concrete sealer	To consolidate or seal surfaces in order to inhibit dusting and ingress or surface contaminants	0208	NE
B16	Concrete and masonry, latex wallboard, sealer/sealer undercoat	Consists of pigment, alkali-resistant latex binder and water as the volatile material	Sealing surfaces of wallboards prior to the application of normal latex paints or solvent-borne paints *Interior painting* Walls and ceilings in living areas, office and public work areas, and domestic kitchens, bathrooms and laundries	0172	NE

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B16A	Set plaster, clay bricks (subject to vanadium bleeding), fibrous plaster, sealer	Water-borne alkali resistant sealer	Sealing surfaces prior to application of normal latex paints undercoats and topcoats. *Interior painting* Walls and ceilings in living areas, office and public work areas, and domestic kitchens, bathrooms and laundries	NE	NE
B17	Undercoat paint, solvent-borne	Consists of pigments, extenders, alkyd resin binder and volatile organic solvent	Used for painting primed timber or metal, and sealed wallboards, and plaster, masonry prior to the application of full gloss or semi-gloss paint, and glossy surfaces prior to repainting *Interior painting* Timber in living areas, office and public work areas. Timber, walls and ceilings in domestic kitchens, bathrooms and laundries	0016/1	3730.14
B17A	Undercoat paint, latex	Consists of pigment, latex binder and water as the volatile material	*Exterior painting* Primed weatherboards, masonry and other wall areas *Interior painting* Timber in living areas, office and public work areas. Timber, walls and ceilings in domestic kitchens, bathrooms and laundries	0163/1&2	3730.18
B18	Wood stain	Consists of dye or pigment in oil or spirit	*Interior painting* Used for changing the colour of dressed timber prior to the application of a clear finish	M-111 NE	NE
B18A	Water-borne wood stain	Consists of dye or pigment in water	*Interior painting* Used for changing the colour of dressed timber prior to the application of a clear finish		
B19	Varnish, flat, semi-gloss and gloss (1-pack) solvent-borne	Consists of clear polyurethane or alkyd resin binder, and volatile organic solvents and may be lightly pigmented to provide colour	*Interior painting* Dressed timber floors, doors, furniture and wood panelling where a clear finish or sandable pre-finish is required or a lightly tinted finish is required to enhance or change the wood grain	0114	3730.25
B19A	Clear or lightly pigmented single pack latex finish	Consists of latex binder and may be lightly tinted to provide colour	*Interior painting* Dressed timber floors, doors, furniture and wood panelling where a clear finish or sandable pre-finish is required	NE	NE

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B20	Gloss or semi-gloss floor varnish (moisture cured or 2-pack)	*Single pack moisture cured* Solution of isocyanate containing pre-polymer in volatile organic solvents, which cross-links after reaction with atmospheric moisture *2-pack* One part being a solution of hydroxyl containing polymer, e.g. acrylic or polyester, which reacts with the second component isocyanate containing pre-polymer in volatile organic solvent	*Interior painting* Dressed timber floors and bench tops where a wear resistant surface is required. Moisture cured product suitable for use on cork tile flooring	0205	3730.27
B21	Marine varnish	Consists of clear stabilized alkyd, polyurethane or polyester resin binder and volatile organic solvents	*Interior painting* Dressed timber *Exterior painting* Dressed timber	NE	NE
B22	Semi-transparent exterior latex stain	Consists of pigments, acrylic latex binder and water as the volatile material	A semi-transparent finish used to maintain the texture and grain of rough-sawn or dressed timber *Interior painting* Exposed ceiling beams *Exterior painting* Patios, verandas, outdoor furniture and fences	NE	3730.16
B22A	Fence stain	Consists of pigments, latex binder and water	Used to decorate fences	NE	NE
B23	Exterior stain, solvent-borne, opaque	Consists of varying levels of pigmentation within drying oils and volatile organic solvents	*Exterior painting* Dressed or rough sawn timber and fences	0115	3730.28
B23A	Exterior stain, solvent-borne, semi-transparent	Consists of varying levels of pigmentation within drying oils and volatile organic solvents	*Exterior painting* Dressed or rough sawn timber and fences	NE	NE
B24	Paving paint, solvent-borne	Consists of pigment, extenders, and volatile organic solvent with polyurethane, acrylic or oleo-resinous binder	*Interior and exterior painting* Residential concrete floors, patios and primed timber floors subject to increased wear and tear	0200	3730.29
B24A	Paving paint, latex	Consists of pigment, extenders and latex binder in water	*Interior and exterior painting* Residential concrete floors, patios and primed timber floors subject to less wear than B24 situations. Also used where a low VOC alternative paint is required.	0202	NE

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B25	Roofing paint, latex	Consists of pigments, latex binder and water as the volatile material	For use on fibrous cement roofing tiles and zinc and zinc-alloy-coated steel	0012/1 0012/2	
B26	Roofing paint, solvent-borne	Consists of pigments, modified alkyd resin binder, and volatile organic solvent	For use on primed zinc or zinc-alloy-coated steel, sealed fibrous cement and roofing tiles	0011	
B27	Anti-condensation paint	Consists of exposed absorbent pigment in latex binder and water as the volatile material	A rough-textured paint designed to absorb and release moisture gradually so that drops of water do not form *Interior painting* Ceilings of buildings in which moisture-sensitive equipment is housed NOTE: Guidance from the paint manufacturer should be sought before this type of paint is specified.	NE	NE
B28	Intumescent paints	Consists of specific formulation	*Interior and exterior painting* To reduce exposure to fire of various substrates	NE	NE
B28A	Low spread of flame paints	Consists of specially formulated systems that have been tested to AS/NZS 1530.3	*Interior and exterior painting* To provide low spread of flame surface where required	0034/1&2 0064/1-4	NE NE
B29	Epoxy paint (2-pack) solvent-borne	Consists of pigmented or clear epoxy resin binder and solvent	Used to produce a film resistant to solvents, detergents, chemicals, steam, impact and abrasion *Interior painting* Walls, bench tops, cupboards, floors, equipment and tank linings in hospitals, food processing plants and on heavy ablution areas of other buildings *Exterior painting* Swimming pools NOTES: 1 Safety precautions are required during application. 2 Guidance from the paint manufacturer should be sought before this type of paint is specified.	2972	3750.10
B29A	Latex-based epoxy (2-pack)	Consists of pigmented or clear emulsified epoxy resin and water	*Interior* Used for porous surfaces that may contain moisture and for concrete walls and floors for enhanced wear, tear and stain resistance. Notably in food processing, hospitals and heavy ablution areas *Exterior* Swimming pools	0167	NE
B29B	Modified epoxy paint (2-pack)	Consists of pigmented or clear epoxy resin binder and a modifier such as acrylic and solvent	Provides the chemical resistance of B29 paints without the limitations on exterior use	NE	NE

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B30	Stain sealer	Consists of pigments, binder and water as volatile material (refer Clause 7.6)	Used to seal back tannin, smoke and oil stains, tar and bitumen on timber, concrete and masonry prior to repainting	0211	
B31	Chalk sealer, surface conditioner	Consists of penetrating drying oil binder and volatile organic solvents NOTE: Usually slow drying and lightly pigmented.	Uses to bind previously prepared chalky and powdery surfaces prior to repainting	NE	NE
B32	Anti-mould (treatment or wash)	Consists of mildewcides, algaecides or fungicides in solution	Used to treat mould and fungus infested surfaces prior to repainting. May be labelled as a POISON	NE	NE
B33	Water repellent for masonry	Consisting of silicon resin- based binder	Used to protect and maintain the natural appearance of masonry by rendering it water resistant. The silicon-based types, particularly silane and siloxanes, are used to inhibit chloride ingress	0116/1&2	NE
B34	Water repellent treatment for timber	Consists of wax or preservatives, or both, in a volatile organic solvent	Used to stabilize timber before painting. Time lapse required before painting (see Clause 4.16)	0096	
B36	Paint remover, solvent type Paint remover, chemical type	Consists of methylene chloride or other suitable solvents, wax and emulsifying agents Consists of alkalis, phenols or other chemical to suit requirement	Used to remove old latex or solvent-borne coatings from surfaces prior to repainting. Care should be taken to remove all wax residues prior to painting. Safety precautions are necessary during use	0219 0048, 0049	NE NE
B37	Bituminous paint	Consists of bitumen dissolved in volatile organic solvent	Used to waterproof concrete surfaces and protect steelwork	0047	NE
B38	High-build membrane or texture paints (exterior or interior)	Consists of pigment, extenders, latex binder and water as the volatile material	*Interior and exterior painting* High-build coatings for finishing suitably prepared concrete and other masonry surfaces. Also suitable for finishing paper-faced plasterboard	0117/1-4 (exterior) 0118/1-4 (interior)	4548.1 4548.2, 4548.3, 4548.4
B39	Clear coating (waterborne)	Consists of latex or other binder with water as the volatile solvent	*Exterior painting* Weatherboards, timber decking, outdoor timber furniture	NE	NE
B40	Sanding sealer	Consists of transparent fillers, organic binder and volatile organic solvent	Used to fill and seal open grain timber prior to varnishing	NE	NE
B41	Semi-gloss latex interior trim	Consists of pigments, extenders, latex binder and water	For finishing suitably sealed interior areas and suitably primed or prepared exterior surfaces, with a semi-gloss film where a harder and more serviceable surface is provided than a B8 paint	NE	NE

(*continued*)

TABLE 4.2 (*continued*)

Paint reference number	Paint type (substrate)	General description	Typical uses	APAS number	AS or AS/NZS number
B42	Gloss or full gloss latex interior trim	Consists of pigments, extenders, latex binder and water	For finishing suitably sealed interior areas and suitably primed or prepared exterior surfaces, with a full gloss film, where a harder and more serviceable surface is provided than a B9 paint	0260/1	NE
B43	Penetrating tung oil type varnish	Consists of a drying oil in a volatile organic solvent	*Interior* Used to penetrate and seal timber floors *Exterior* Used to penetrate and seal timber decks	NE	NE
B44	Gloss-pigmented polyurethane (2-pack)	Pigmented two-part coating, one part being a solution of hydroxyl containing polymer which reacts with the second component isocyanate containing pre-polymer in volatile organic solvents	Dressed timber, bench tops, doors, structural steel and handrails where a stain-resistant surface is required, e.g. food processing	2911	3750.6
B45	Powder coatings	Factory-applied epoxy, polyester or acrylic finish (or a combination) complying with AS 4506	Factory applied to metal hardware such as handrails, fencing, windows or equipment for resistance to moisture and chemicals	0155/1 0155/2‘	NE
B46	Seamless floor finishes	Heavily pigmented or filled two-pack epoxy	Applied by trowel or as a self-levelling finish to concrete floors to resist severe wear, tear and chemical attack. Safety precautions are required during application	NE	NE
		Decorative flake finish, coloured flake polymer chips in clear or lightly filled binder	Decorative finish to provide enhanced wear and tear and staining resistance to walls and floors (e.g. schools, daycare facilities)	NE	NE
B47	Multi-fleck coatings	Two immiscible phases, solid/liquid or liquid/liquid (solvent-borne) which combine to produce a multi-coloured fleck finish	Decorative finish to provide enhanced wear and tear and staining resistance to traffic areas (e.g. stairwells and lobbies)	NE	NE

NOTE: In all cases the product manufacturer, supplier or applicator should be consulted with respect to the constituents, uses and application (preparation) of a particular paint product.

SECTION 5 SYSTEMS FOR THE PAINTING OF BUILDINGS

5.1 CONVENTIONAL PAINTING SYSTEMS

Conventional systems for painting the interior of domestic and public buildings are set out in Table 5.1. Conventional paint systems for the exteriors of buildings are shown in Table 5.2, for a range of new surfaces. Paint systems for specialized and more arduous service conditions are addressed in Clause 5.2. Actual service conditions, aesthetic preference and cost will influence the choice of a painting system for any particular application.

NOTE: Paint systems other than those listed in Tables 5.1 and 5.2 are not precluded; however, it is expected that when other systems are chosen, the specification writer will have had experience with the proposed system under the prevailing conditions of service.

Information contained in Sections 2 and 4 should also be considered when an appropriate painting system is being chosen.

NOTE: The specifications for the various paint systems listed in Tables 5.1 and 5.2 imply the use of paint and like materials that comply with the relevant Australian or Australian/New Zealand Standard as indicated in Table 4.2.

TABLE 5.1

PAINT SYSTEMS FOR INTERIOR SERVICE—NEW UNPAINTED SURFACES

Substrate	Paint system
Walls and ceilings	
Gypsum plasterboard	3 coats of latex paint [1 coat sealer undercoat (B16) and 2 coats of finish coat, flat (B6) or low-gloss (B7) or semi-gloss (B8) or gloss (B9)], (see Notes 2 and 3)
Set plaster, clay bricks (subject to vanadium bleeding), fibrous plaster	1 coat solvent-borne sealer (B15) or 1 coat water-borne sealer binder (B16A) 2 coats latex paint, flat (B6), low-gloss (B7), semi-gloss (B8), or gloss (B9), (see Notes 2 and 4)
Timber, plywood panelling, hardboard, medium density fibreboard (MDF), particleboard NOTE: A latex system is recommended as first coat on MDF.	*Varnish finish* 1 coat wood stain (B18 or B18A) (if required) 2 or 3 coats varnish, flat or semi-gloss (B19 or B19A) *Paint finish* 1 coat undercoat, latex (B17A) or solvent-borne (B17), or latex wood primer (B10A) 2 coats latex paint, flat (B6),low-gloss (B7), semi-gloss (B8) or gloss (B9), (see Note 3)
Organic fibre insulating board	1 coat of solvent-borne undercoat (B17) 2 coats of latex paint, flat (B6), low-gloss (B7), semi-gloss (B8) or gloss (B9)
Concrete, cement render, fibrous cement, clay bricks (vanadium free)	2 or 3 coats latex paint, flat (B6), low-gloss (B7), semi-gloss (B8) or gloss (B9)
Insulating ceiling surfaces, e.g. vermiculite	A mist coat of solvent-borne sealer, allowed to dry, followed by 2 or more coats of latex paint, flat (B6) low-gloss (B7), semi-gloss (B8) or gloss (B9), by spray application to a desired finish (see Note 3)
Doors, cupboards, fittings and trim (surfaces subject to frequent handling)	
Timber and timber-based products NOTE: The appearance of these products can be enhanced by the application of an oil or wax, which should be removed before recoating	*Varnish finish* 1 coat wood stain (if required) (B18 or B18A) 3 coats varnish, semi-gloss or full gloss (B19 or B19A), [see Note 2(e)] *Paint finish* 1 coat undercoat, solvent-borne (B17) except for MDF where waterborne undercoat is required 2 coats solvent-borne paint, semi-gloss (B3) or full gloss (B5) *or* 1 coat latex undercoat (B17A) 2 coats semi-gloss latex (B41) or gloss latex (B42)
Floors	
Concrete	2 coats paving paint (B24), (B24A), [see Notes 2(f), 5 and 7]
Cork	2 or 3 coats floor varnish (moisture cure) (B20) *or* 2 or 3 coats clear coating water-borne (B19A)
Timber, parquetry, particleboard	*Varnish finish* 1 coat compatible wood stain (if required) (B18) 3 or more coats floor varnish (moisture cure or 2 pack) (B19)(B20) or latex (B19A), or a penetrating oil (B43) combined with a wax polish if required *Paint finish* 1 coat wood primer solvent-borne (B10) 2 coats paving paint (B24) (B24A) (see Note 5)

(*continued*)

TABLE 5.1 (*continued*)

Substrate	Paint system
Miscellaneous substrates	
UPVC	2 coats latex paint, low-gloss (B7), semi-gloss (B8) or gloss (B9)
FRP	1 coat epoxy primer (B29) 2 coats solvent-borne paint, semi-gloss (B3), full gloss (B5)
Polystyrene	1 coat of latex undercoat (B17A) 2 coats latex paint, low-gloss (B7), semi-gloss (B8) or gloss (B9)
Iron and steel	1 coat metal primer (B11) 2 coats solvent-borne paint, semi-gloss (B3) or full gloss (B5) (see Note 6)
Aluminium/copper	1 coat metal primer (B11) or (B13) 2 coats solvent-borne paint, semi-gloss (B3) or full gloss (B5) Where required solvent-borne topcoats may be replaced by equivalent latex topcoats (B8 or B9) in certain applications (see Clauses 4.6 and 4.7)
Galvanized iron zinc/aluminium alloy	1 coat galvanized metal primer, latex (B12A) or solvent-borne (B12) 2 coats latex paint, semi-gloss (B8) or gloss (B9) (see Note 2) Where required latex topcoats may be replaced by equivalent solvent-borne topcoats (B1 to B5) in certain applications (see Clauses 4.6 and 4.7)

NOTES:

1 Paint reference numbers ( ), are described in Table 4.2.

2 Specialized high-build solvent-borne and latex coatings are also worthy of consideration, especially for uneven or damaged surfaces (see Clause 4.14). The following qualifications may also be relevant:

(a) An initial coat of solvent-borne sealer (B15) or (B30) may be required on surfaces subject to bleed or plasterboard where sheen staining may occur.

(b) A latex paint system is recommended where maximum chipping/scoring resistance is the prime consideration. A solvent-borne system is recommended where resistance to wear and tear and staining is required.

(c) To obtain a more uniform finish on open grained timber, particleboard and MDF, an additional undercoat is recommended. A sanding sealer may be required (B40) for varnish systems.

(d) To obtain a more uniform finish, a coat of sanding sealer (B40) may be used before varnishing.

(e) The use of a varnish finish in very wet areas may result in considerable discolouration.

(f) Selected two pack coating systems are recommended for surfaces subject to heavy wear.

(g) Direct-to-substrate latex is available for galvanized iron and may not require a primer.

3 Where required latex topcoats may be replaced by equivalent solvent-borne topcoats (B1 to B5) in certain applications (see Clauses 4.6 and 4.7).

4 Where required solvent-borne topcoats may be replaced by equivalent latex topcoats (B6 to B9, B41 and B42) in certain applications (see Clauses 4.6 and 4.7). Gloss or full gloss latex systems specifically designed for timber trim (B42) should not be confused with conventional B9 paints.

5 These paints may become slippery when wet and necessitate the addition of an anti-slip agent.

6 Where required solvent-borne topcoats may be replaced by equivalent latex topcoats (B8 or B9) in certain applications (see Clauses 4.6 and 4.7).

TABLE 5.2

PAINT SYSTEMS FOR EXTERIOR SERVICE—NEW SURFACES

Specific areas	Paint systems
Walls and soffits	
Clay bricks, cement bricks, fibrous cement sheeting concrete masonry, stucco, plaster, cement render or AAC blocks	2 coats latex paint, low-gloss (B7), gloss (B9) or semi-gloss (B8) (see Notes 2, 3, 4 and 11)
Weatherboards, exterior grade hardboard cladding	*System 1* 1 coat wood primer, latex (B10A) or solvent-borne (B10) 2 coats latex paint, low-gloss (B7), semi-gloss (B8) or gloss (B9) (see Note 5) *System 2* 1 coat solvent-borne wood primer (B10) 2 coats solvent-borne paint, full gloss (B5) (see Notes 5 and 12)
Doors, fittings and trim	
Timber (paint finish)	*System 1* 1 coat solvent-borne wood primer (B10) 2 coats solvent-borne paint, full gloss (B5) (see Notes 5, 6 and 12) *System 2* 1 coat wood primer, latex (B10A) or solvent-borne (B10) 2 coats gloss latex paint (B9) (see Notes 5, 6, 7 and 8)
Timber (stain finish)	*System 1* 2-3 coats semi-transparent or opaque stain, solvent-borne (B23) *System 2* 2 coats semi-transparent exterior latex stain (B22) (see Notes 5 and 8)
Other substrates	
Iron and steel	*System 1* 1 or 2 coats of metal primer (B11) 2 coats of solvent-borne paint, full gloss (B5) (see Note 13) *System 2* 1 or 2 coats of metal primer (B11) 2 coats of latex paint (B7) (B8) (B9) (see Note 13)
Aluminium and copper	*System 1* 1 coat metal primer (B11) or (B13) 2 coats of latex paint (B7) (B8) (B9) *System 2* 1 coat metal primer (B11) or (B13) 2 coats of solvent-borne paint, full gloss (B5)
Galvanized iron or zinc/aluminium alloy	*System 1* 1 coat galvanized iron metal primer, (B12A) 2 coats of gloss latex paint (B7) (B8) (B9) (B25) (see Note 13) *System 2* 1 coat galvanized iron metal primer (B12) 2 coats of solvent-borne paint, full gloss (B5) (B26) (see Note 13)
UPVC	*System 1* 2 coats latex paint, (B7) (B8) (B9) *System 2* 2 coats solvent-borne paint, full gloss (B5) (see Note 14)
FRP	1 coat epoxy primer (B9) 2 coats gloss pigmented polyurethane (B44)

(continued)

TABLE 5.2 (*continued*)

Specific areas	Paint systems
Floors	
Concrete	2 coats paving paint (B24) (B24A) (see Note 9)
Pergolas, patios, decking	
Timber	2 coats exterior latex stain (B22) or exterior solvent-borne stain (B23) or a low-gloss latex paint (B7) (see Notes 10 and 15)
Fences	
Rough sawn timber	*System 1* 2 coats semi-transparent exterior latex stain (B22) or semi-transparent exterior solvent-borne stain (B23) *System 2* 2 coats fence stain (B22A) or 2 coats of latex paint (B6), (B7), (B8) or (B9) (see Note 16)
Galvanized or zinc/aluminium alloy coated steel	*System 1* 1 coat galvanized iron metal primer (B12) 2 coats roofing paint, latex (B25) *System 2* 1 coat galvanized iron metal primer (B12) 2 coats roofing paint, solvent-borne (B26)

NOTES:

1 Paint reference numbers ( ) are described in Table 4.2.

2 Depending upon the substrate colour, texture, porosity and hiding power of the finishing coat, additional preparatory or finishing coat(s) or both may be required.

3 A solvent-borne sealer may be used on clay bricks where there is a vanadium or iron bleed. If the surface is absorbent, thinning of the initial coat may be necessary.

4 Where a clear finish is required, two coats of water-repellent solvent-borne acrylic or silicone can be used.

5 A latex paint system is recommended where maximum durability is the prime consideration. A solvent-borne system is recommended where resistance to wear and tear, and freedom from blocking and brush marks is required.

6 Refer to Clause 3.2.8 for information on machine primed timber.

7 The use of a latex undercoat is recommended when an improved finish is necessary.

8 Where exterior timber has been treated with preservative to enhance its durability performance as per the recommendations of AS 1604, water repellents and other constituents of such treatments may be prevented from bleeding into or causing adhesion problems for latex coatings by applying one or two coats of solvent-borne primer; light sanding of the primer film prior to application of latex coatings may be advisable to ensure even spreading and wetting.

9 These paints may become slippery when wet and necessitate the addition of an anti-slip agent.

10 Experience has shown that resinous hardwoods, used for exposed decking, should be fixed in position and weathered for at least six months before painting, and may require special treatment with a solvent-borne primer.

11 These coatings are primarily decorative and may not inhibit the ingress of moisture under all conditions. For alternative specialized painting systems see Clauses 3.9.2.2, 4.14 and 5.2.

12 For enhanced appearance (but reduced durability performance) a solvent-borne undercoat (B17) may be applied over the primer.

13 1 or 2 coats of primer are recommended depending on anticipated atmospheric conditions. These systems are only appropriate for low corrosivity environments. Where extended corrosion resistance is required, system 1 is recommended. Where extended resistance to chalking and colour change is required, system 2 is recommended. For more detail regarding the protection of these substrates from atmospheric corrosion refer to AS/NZS 2312.1 and AS/NZS 2312.2.

14 Where extended weathering resistance is required system 1 is recommended. Where extended resistance to wear and tear and enhanced gloss retention is required system 2 is recommended.

15 The solvent-borne system is recommended where complete obliteration of the woodgrain is undesirable.

16 Where timber protection is required the opaque coatings of system 2 are recommended.

5.2 SPECIALIZED PAINTING SYSTEMS

5.2.1 General

Tables 5.1 and 5.2 focus on conventional painting systems; however, more specialized paint systems may also be appropriate in many factory, sporting, educational and commercial situations. For higher wear and tear situations and other conditions of more arduous service, a range of specialized paint systems may be appropriate, as discussed in Clauses 5.2.2 and 5.2.3.

The systems discussed in Clauses 5.2.2 and 5.2.3 are not interchangeable, each have specific advantages and limitations, which need to be considered for optimum selection. Only the more common specialized systems are discussed and the list is not intended to be exhaustive. In all cases product manufacturers should be consulted and the information contained in Sections 2 and 4 should also be considered when an appropriate painting specification is being chosen.

5.2.2 Interior

The following systems are applied:

(a) *Plaster and paper faced plasterboard* Specialized decorative high-build textured or membrane finishes—products consistent with AS 4548 (B38).

(b) *Concrete, including blockwork, cement render and fibrous cement* Specialized decorative—as for Clause 5.2.2(a) above.

Severe wear and tear, e.g. factories—

(i) 2 coats of two-pack epoxy (B29); or

(ii) 2 coats of two-pack water-borne epoxy (B29A); or

(iii) 2 coats of gloss polyurethane (B44).

Severe wear and tear and maximized appearance—1 coat epoxy primer followed by 2 coats of gloss-pigmented polyurethane (B44), two-pack epoxy acrylic (B29B) or acrylic urethane (B45).

NOTE: Systems detailed in Clauses 4.19.1.2 and 4.19.1.9 are also alternatives.

(c) *Aluminium or galvanized fittings* Severe wear and tear and maximized appearance, e.g. lobbies—

(i) 1 coat two-pack epoxy primer followed by 2 coats gloss-pigmented polyurethane (B44); or

(ii) epoxy acrylic; or

(iii) polyester powder (B45).

(d) *Steel* Severe wear and tear/maximized appearance and wet areas (see AS/NZS 2312.1).

(e) *Timber* Wear and tear areas, e.g. handrails, benches and trim—

(i) paint finish—1 coat epoxy primer followed by 2 coats two-pack polyurethane (B44) or 2 coats epoxy paint (B29); and

(ii) clear finish—3 coats two-pack polyurethane gloss (B20).

Floors, general—3 coats two-pack polyurethane gloss (B20).

Floors, sporting, e.g. basketball and squash courts—3 or more coats moisture-cured polyurethane (B20).

(f) *Concrete flooring* Severe wear areas—epoxy coating system (B29A) to typically 400 μm dry film thickness.

Very severe wear areas—granolithic epoxy aggregate finish (B46) to 5–10 mm thickness.

5.2.3 Exterior

The following systems are applied:

(a) *Concrete, including blockwork, cement render and fibrous cement* Specialized decorative high-build textured or membrane finish consistent with AS 4548 (B38)

Severe wear and tear and maximized performance—1 coat epoxy primer followed by two-pack polyurethane (B20) or acrylic polyurethane (B44).

(b) *Aluminium or galvanized fittings* Severe wear and tear and maximized appearance—

(i) 1 coat two-pack epoxy primer followed by 2 coats two-pack polyurethane (B20) or acrylic polyurethane (B44); or

(ii) polyester powder (B45).

(c) *Steel* See AS/NZS 2312.1.

5.3 SPECIALIZED APPLICATIONS

5.3.1 Roofs

Generally, some weathering of factory-supplied pre-painted metal cladding, concrete or terracotta tiles is required prior to painting, to improve the adhesion of the paint film. Depending on the material in question several years of weathering may be required. It is usually impractical to overcoat new factory precoated roofing materials and, as a minimum pre-treatment, extensive solvent scouring would be necessary. Where painting of new galvanized or zinc-aluminium alloy roofs is required, these should be painted as soon as practicable.

Usually, old tiled roofs are painted to enhance their appearance. These paint treatments are not permanent and they need to be reinstated at intervals. Assertions that painting is necessary to prevent moisture absorption into the tiles, which would otherwise unduly increase the roof mass, are not sustainable.

Before repainting, all repairs and repointing should be completed. Moss and lichen should be removed as shown in Clause 7.5.4(e). After these growths have been killed, the roof surface should be cleaned with a high-pressure water spray jet to remove moss, lichen, dirt, dust and other friable materials. After the surface has been cleaned, all surfaces should be rinsed down with fresh water and should be dried.

Where the surface has become dull, chalky, porous, or otherwise weathered, one coat of solvent-borne penetrating primer (e.g. solution acrylic) should be applied, followed by two acrylic latex topcoats of the required colour and gloss level, by brush or spray. For less weathered surfaces, the primer may be omitted. Higher-build acrylic coatings combined with conventional acrylic latex topcoats are also variously satisfactory; however, their suitability should be confirmed by reference to verifiable case histories of successful performance.

Weathered, pre-painted metal roofs should be treated as for tiled roofs except that the solvent-borne primer may be omitted.

In all cases a small area should be tested with the proposed overcoating system to ensure compatibility with the substrate.

Where a roof is used for the collection of drinking water (see also Clause 4.11) special requirements exist for the type of coating and procedure. Paints designed specially for this purpose are available, and the manufacturer's recommendations should always be sought. In general, the following steps will help avoid contamination of the water supply with paints or chemicals used in the preparation process.

(a) Disconnect and isolate the water collection system prior to the commencement of any surface preparation or pre-treatments.

(b) Collect all residues from surface treatments or preparation and dispose of in an appropriate manner.

(c) Once the final topcoat is adequately cured, check the water collection area and drainage system for pockets of wet/uncured paint.

(d) With the collection system disconnected, thoroughly flush all gutters and downpipes with water to ensure no foreign materials or paints remain in the collection system.

(e) After an appropriate curing period, as specified by the manufacturer, the water collection system may be re-connected. This time will depend on ambient temperatures, coating type, film build and humidity. In general, at least seven days of good drying conditions should be allowed.

5.3.2 Concrete swimming pools

The successful painting of swimming pools is fraught with difficulty largely because of the arduous service conditions and variability of the surface. Unstable substrates, ground water pressure, immersion in chlorinated water and general wear and tear variously combine to limit the life of the applied coating.

Two types of coatings are in common use, chlorinated rubber systems and epoxy systems. Chlorinated rubber paints tend to be favoured where service conditions are moderate and repainting every one or two seasons is realistic. One advantage of chlorinated rubber finishes is that any existing paint may be recoated, provided the existing surface is sound and has been cleaned of dirt, oils and grease. Epoxy systems have greater reliability in more arduous conditions of service or where longer service life is desired. Non-coating options such as ceramic tiles are used, particularly for the pool perimeter and to just below the water line where aesthetics are more important and wear and tear greatest.

Surface preparation is critical and the paint manufacturer's recommendations need to be strictly adhered to. The rendered surface, finished as a sponge or wood float finish, has to be well cured (minimum 28 days), and has to be thoroughly dry before coating. Any concrete curing agents that have been added to the surface need to be removed prior to painting.

For chlorinated rubber finishes it is recommended to acid-etch the rendered surface to remove laitance and provide a key for coating. Adherence to safety precautions and removal of residual acid with copious fresh water is most important. Three coats of chlorinated rubber should be applied to the clean, dry, etched surface.

For epoxy finishes, abrasion of the rendered finish back to a sound, cohesive surface and vacuum removal of residuals is a necessary minimum. The two pack epoxy should normally be applied as a three-coat system to the clean dry surface by spray or roller, at a minimum dry film thickness of 300 μm. The final coat usually includes a coarse filler to provide an anti-slip surface and reduce gloss to mask surface imperfections.

When recoating with epoxy, it needs to be established that the existing coating is also epoxy. (Chlorinated rubber types, which soften on swabbing with acetone, cannot be overcoated successfully by epoxy.) The existing finish should be washed with detergent to remove grease and dirt. The surface should then be lightly abrasive-blasted or water/abrasive-blasted to remove chalky and loose and friable paint in order to provide a key to the existing surface, before overcoating the clean dry surface.

Painting swimming pools is a specialized procedure and selection of a contractor with a proven track record is important.

SECTION 6 PAINT APPLICATION

6.1 GENERAL

This Section gives general guidance on factors involved in painting and highlights some aspects to be considered in paint application. The methods of application used will be controlled largely by the following:

(a) Type of paint.

(b) Climatic conditions.

(c) Type and condition of the substrate.

(d) Geometry and size of item to be painted.

(e) Ease of access.

6.2 PAINT PREPARATION

6.2.1 General

Only paints specified in the contract or order are to be used. Recommended paints are set out in Section 4 of this Standard.

6.2.2 Mixing

Household paints are normally supplied in a ready-mixed condition but still require thorough mixing before use. Any pigment that has settled on the bottom of the container should be reincorporated into the paint with a broad stirring stick.

Where, because of hard settling or gelling, the paint cannot be suitably reincorporated by manual stirring or other mechanical means to a homogeneous condition, the paint should not be used.

Where separation of the paint into layers has occurred, complete mixing is best ensured by ‘boxing’, i.e. by pouring the paint from one container into another and back until the paint is completely uniform. Boxing is advisable to ensure colour uniformity where more than one can of paint is required for a given planar surface. This is desirable as paint may vary slightly in colour from batch to batch of distributor-tinted product.

In the mixing of two-component paint systems, extreme care is required to ensure that the correct proportions are used and mixed as specified by the manufacturer.

For some two-pack paints, a period where the paint is left to stand after mixing (induction period) is required before the paint is used. The pot-life dictates the useable period for the mixed material.

6.2.3 Thinning

Thinning is not normally required for ready mixed paints but the addition of thinners may be necessary for spray painting of absorbent surfaces, or for painting in hot or windy conditions, to make up for evaporation losses. Under such conditions, only the thinner approved by the manufacturer should be used, which has to be added in accordance with the manufacturer’s printed instructions.

Overthinning is to be avoided because it lowers the solids content of the paint and reduces the dry film thickness that can be achieved for the paint. Overthinning may result in paint runs and paint sagging, irrespective of the method of application.

6.2.4 Straining

Paint containing paint skins, or other foreign matter, should be strained through paint strainers or fine mesh material such as stockings.

6.3 CLIMATIC CONDITIONS

6.3.1 General

Painting of exposed exterior surfaces should be deferred until weather conditions are favourable, e.g. on warm, dry days without frost or heavy dews. Painting should not be carried out under damp conditions such as rain, high humidity, fog, frost or heavy dew. In addition, dust-free conditions are required to avoid contamination of the surface before and during painting and while the paint film is drying.

Efficient ventilation, coupled with heating, is desirable for the drying of internal paintwork especially in conditions of low temperature and high humidity.

6.3.2 Temperature

Painting in hot weather, or on surfaces exposed directly to the sun, may be subject to patchiness and blistering, because a rapid loss of solvent interferes with the application properties of the paint. Painting should not be carried out under very cold conditions.

Ideal painting conditions for the majority of paints occur when the substrate and air are both in the temperature range 15°C to 30°C. Temperature limits during application and drying vary with the type of paint but, as a general rule, it is not desirable to apply paint to surfaces with temperatures below 10°C or above 35°C. In some areas, the working temperature may be outside these limits and paints with tolerances to the particular application conditions should be chosen.

6.3.3 Lighting conditions

Where possible during external painting, paints should be applied in shaded areas and painting in the full heat of direct sunlight should be avoided. Internal painting should be performed in well-lit natural daylight conditions and insufficient natural daylight should be compensated for by the installation of artificial lighting.

6.3.4 Moisture and humidity

Where solvent-borne paints are being applied, moisture should not be present on the surface being painted unless the manufacturer’s printed instructions permit application under such conditions.

NOTE: Condensation may occur when the temperature falls below the dew point or during the application of paint thinned with organic solvent. Evaporating solvents reduce the surface temperature of the paint and, when the humidity is high, condensation of moisture can occur. Because of this, an upper limit of 85% relative humidity is usually set for the application of such paints.

Pressure build-up of water vapour behind the paint may lead to flaking and blistering.

NOTE: Moisture on or in the substrate is detrimental to painted surfaces and needs to be avoided. Dampness of surfaces that are absorbent is not easily detected. It is essential that freshly poured concrete, plastered or cement-rendered surfaces, or surfaces exposed to overnight dew be given adequate time to dry out before painting (see Section 3).

6.3.5 Effect of climatic conditions on various paints

Paints may exhibit specific types of defect when applied under adverse conditions. The following are types of examples:

(a) *Wrinkling* Films of solvent-borne paints that are too thick to dry right through the film before a change in drying conditions occurs are liable to show wrinkling of the dried skin over the still-liquid portion of the film below. This is particularly common when there is a rapid fall in temperature at nightfall followed by a temperature increase the next day, and is exacerbated on metallic substrates, such as galvanized iron guttering, which conduct heat and change temperature quickly. It is also associated with heavy dews during spring and autumn. Thick films typically result from attempts to achieve hiding with a single coat. Instead, the response to poor

drying conditions should be to thin the paint and/or spread further to achieve a thinner film.

(b) *Poor coalescence* Latex paints applied and dried either at low surface and air temperatures (typically below 10°C), or under conditions of high humidity may fail to coalesce effectively, and retain a soft and friable finish. In these application conditions their long-term performance may be adversely affected.

(c) *Blistering* Paints applied during certain climatic conditions may show evidence of blistering if subjected to a sudden drop in temperature during the drying period, or when the paint is partially dry. These blisters may disappear once the paint dries out; however, a permanent loss of adhesion will have occurred.

(d) *Blooming* Some gloss paints may develop a bloom, a dulling or surface haziness, if applied and dried when condensation occurs. This is likely to occur at times of high humidity if the substrate temperature drops to or below the dew point, causing condensation to occur.

(e) *Curing problems* Where products are supplied in two or more packs to be mixed together prior to application, the curing mechanism is generally a chemical reaction within the applied film. There is usually a lower temperature limit specified by the manufacturer, below which the reaction will not take place at a satisfactory rate. It is important that this lower temperature limit be strictly observed during application and curing. Likewise, the manufacturer's minimum drying time at the specified ambient temperature should be observed, before the painted surface is handled or placed into service.

(f) *Surface leaching/staining of latex paints* This defect typically occurs during the drying of latex paint particularly at low temperature, high humidity conditions however it may also occur in service. More heavily tinted colours are likely to be more susceptible to this defect than pastel shades. This is also referred to as surfactant leaching. A liquid film which is generally oily or tacky forms on the surface, and may include non-volatile paint additives in addition to the solvents which would evaporate under normal drying conditions. It should be washed off with warm water containing household detergent.

6.4 CONDITION OF THE SUBSTRATE

The size, shape, texture and condition of the substrate, either new or previously painted, and the type of paint proposed to be used all require consideration when an appropriate paint application method is being chosen. (For preparation of each substrate type see Section 3.)

6.5 STOPPING AND FILLING

The stopping of minor holes and cracks, and the filling of uneven areas in the substrate are a vital part of the preparation of surfaces for painting. Attention to detail is important; failure to correctly apply stopping and filling materials and to properly abrade repaired surfaces may seriously affect the final result. Attention is drawn to Section 3 in which differences in stopping and filling are explained, together with requirements for the preparation of the different substrate materials. Some fillers require a primer before being applied to a particular substrate, others can be applied direct.

6.6 SEQUENCE OF OPERATIONS

Surface preparation procedures especially those involving chemical stripping should be completed, prior to the commencement of painting, to avoid risk of damage to newly painted surfaces.

The paint system should be applied in the specified sequence (see Section 5) using the specified paints at the required thicknesses.

Full drying time has to be allowed between successive coats of paint.

NOTE: A solvent-borne paint is usually considered to be dry when, on lightly rubbing down with fine abrasive paper, there is no clogging of the paper. The drying time for solvent-borne paints may be checked using AS 1580.401.5.

Exposure of priming coats, undercoats and intermediate coats without topcoating for a period beyond a few days is not recommended, because extended exposure may lead to surface contamination which may lead to loss of adhesion between coats. Notwithstanding this, deferring topcoating beyond several weeks may lead to the deterioration of the primer/undercoat also leading to a loss of adhesion. Where topcoating delays are unavoidable, appropriate surface preparation and repriming may be necessary. Similarly, chemically cured type coatings have a maximum recoat time, which should be strictly adhered to.

Broad areas may best be finished first, leaving trim until last.

Because of possible variations of colour in different cans of paint, it should be planned for a whole wall to be completed before changing to a different can of paint. Boxing of the paint is an option (see Clause 6.2.2) as is ordering factory-made batches of particular paint colours.

Provision should be made to protect floors and joinery that are to be finished with a natural clear finish by the use of covers or some other protection, or at least by the application of the first coat of clear finish.

Where interior surfaces are to be painted, it is normal to stain and varnish surfaces before painting ceilings, to paint ceilings before walls, to paint walls before joinery, and to paint windows and doors before skirting boards and fittings.

To minimize the yellowing of solvent-borne alkyd paints, the application of these paints should be deferred for two or three days after the application of latex paints due to the presence of ammonia vapour [see Clause 7.6(h)].

6.7 METHODS OF APPLICATION

6.7.1 General

The six most common methods of applying decorative coatings are the following:

(a) Brush.

(b) Roller.

(c) Pad.

(d) Conventional spray.

(e) HVLP.

(f) Airless spray.

In general, the majority of applications make use of spraying techniques, as they are often the most cost-effective way of achieving high film thicknesses, which are usually specified.

Application by brush requires the least amount of set up before use and cleaning afterwards. Brushing is slower than other methods and for application of decorative coatings is usually limited to touch ups on small areas only. Many decorative coatings are designed for spray and lacquer dry or quick touch-dry; hence, they are not good for brush application as they do not keep a good wet edge.

For large flat areas, roller application of decorative coatings is quite common. The principal reason is that spray application skills are not required and the painting project can be completed quickly and efficiently. Other factors that make roller application a more attractive option is the absence of overspray.

Conventional spray was the original method of spray application. A compressor supplies air under pressure via an air hose to a spray gun. This atomizes the paint to produce a fine spray, which is then projected onto the surface. The two main types of conventional spray are suction cup and pressure pot; the latter is the most commonly used in decorative coating applications. With pressure pot application the paint is loaded into a tank, which is then pressurized by compressed air. This pressure then forces the paint through the fluid line, up to the spray gun outlet, where it is atomized.

The conventional spray gun is able to be adjusted to a wide range of flow rates and spray patterns by simple adjustments, unlike the airless spray gun whose flow rate and spray pattern are not adjustable but dictated by the characteristics of the airless spray tip.

Appropriate breathing apparatus or respiratory protection complying with local regulations is required and adequate ventilation should be provided to ensure vapours do not accumulate and create an explosion hazard.

Air-assisted airless spray uses a combination of airless spray with air to provide a finer finish. This method is much faster than any other spray techniques, provides more atomizing energy and atomizes a wide range of high solids coatings. Overspray and transfer efficiency may be high and less control is available compared with conventional or airless spray systems.

For airless spray application pressure is used to force paint through a fine orifice causing the paint to atomize into very fine droplets. No air is added to the paint. The method provides speed and the ability to atomize a wide variety of coatings and gives a smoother and more uniform coat compared with brushing and rolling. Overspray and paint bounce-back need management. Airless spray will not give quality of finish compared with methods using air to atomize the paint. For broad-wall and ceiling areas, in critical light conditions, airless spray application should be back-rolled. Back rolling should occur whilst the paint film is still wet using a paint roller charged with paint then expelled. Do not commence back-rolling with a dry roller.

For plaster jointed substrates such as paper faced plaster boards or fibre cement sheet that are coated by spray application back rolling or sanding of the first seal coat is highly recommended and back rolling of the final top coat is recommended.

Breathing apparatus is needed during the application of most materials, especially epoxies and urethanes. Adequate ventilation should be provided especially when using electric airless spraying systems.

6.7.2 Brush application

6.7.2.1 *Selection of brushes*

To ensure an even distribution of paint, it is important that the brush be appropriate to the type of paint and the size of the surface to be painted.

In general, smaller brushes are used for the application of solvent-borne paints and varnishes than for the application of latex and other water-borne paints, because the latter offer less resistance to the brush. Within these ranges, small brushes are used for ‘cutting in’ and painting small surfaces and large brushes are used to apply paint to broader surfaces.

6.7.2.2 *Procedure*

The brush should be loaded (not overloaded) with paint, and applied firmly to the surface and the transferred paint brushed in. The work should be ‘crossed’, i.e. brushed alternately in opposite directions, and at the same time the stroke pressure should be gradually reduced until the tip of the brush lightly touches the wet paint in the final strokes. (This technique is called laying-off.)

Laying-off should be thorough and complete, otherwise ‘ladders’ or ‘tramlines’ will result. Excessive paint build-up in corners should be avoided, to minimize mudcracking.

Laying-off on timber substrates should be in the direction of the grain. On large areas such as ceilings or walls, laying-off should be towards the source of light.

Wet edges should be maintained during the painting process, i.e. the area next to that being painted should still be wet enough to be readily incorporated. This is especially important where latex paints are being used because they dry rapidly. Maintenance of a wet edge may not always be possible where large areas are being painted but should be encouraged for good paint results.

Fat edges, i.e. inept accumulation of paint at edges, should be avoided by brushing to or along, rather than away from the edges of the surfaces.

With quick-drying paints, it may not be possible to follow the procedure described above during the brush-out, but laying-off is generally the same.

The protective value of a paint is enhanced by brushing the paint well into the surface so that every part is adequately covered with paint, and by paying particular attention to joints; however, care should be exercised to ensure that paint is not unduly brushed out so that the dry film becomes too thin. To avoid sags, wrinkling and paint runs, paint should not be applied in excessive quantities.

Paint should not be applied in uneven layers because uneven stresses within the paint may promote such defects as cracking, peeling or blistering.

As the decorative effect of the topcoat may be reduced by uneven undercoats and pick-up of foreign particles, care is required to ensure that the topcoat is not similarly affected. All foreign particles and other protrusions on primed and undercoated surfaces should be lightly sandpapered and dusted or vacuum-cleaned, before the next coat of paint is applied. Such operations should be carried out from the top downwards, i.e. tops of cupboards, architraves, picture rails and such surfaces should be cleaned and painted before lower sections and surfaces are sanded and cleaned. Tac rags may be used to remove last traces of dust and other particles to help provide a quality finish.

6.7.2.3 *Care of brushes and general cleanliness of equipment*

Only clean, good quality brushes should be used for painting. After use, they should be cleaned of paint by the use of suitable thinners or brush-cleaning compounds then washed in hot soapy water, rinsed in clean water and then dried. Well-worked-in paint brushes should be used when applying solvent-borne enamel finishes.

Brushes used for latex paints should be washed in clean water and detergent, rinsed clean and then allowed to dry in a flat position.

Paintbrushes in continuous day-to-day use with alkyd paints may be suspended up to the stock in water or in a suitable solvent during work breaks and overnight. Water should be removed from the brush by painting out before re-use.

Pencil or lining brushes require thorough cleaning in a suitable solvent. For storage purposes, brushes should be greased thoroughly with tallow or petroleum gel; however, it is necessary to clean the brushes in solvent so that they are completely free of grease before use.

All other equipment, such as knives, spatulas, palette boards and paint pots should be thoroughly cleaned after use, before the paint has dried. All paint containers should be thoroughly resealed and solvent-borne paint containers inverted for a few seconds to avoid deterioration of the contents.

6.7.3 Roller application

6.7.3.1 *General*

To ensure an even distribution of paint, it is important that roller sleeves have a covering compatible with the type of paint selected and the surface of the substrate to be painted.

A number of types of covering are in general use, viz. lamb's wool, mohair, synthetic fibre and open-cell foam plastic. Each of these roller materials has special properties, some being more suited to particular types of paint, substrate conditions and resultant finish than others.

Short-nap rollers hold little paint and produce a fine stipple or low profile dimple appearance.

Medium-nap and long-nap rollers hold larger quantities of paint and are suitable for use on rough and very rough surfaces. They produce a high profile dimpled appearance on smooth surfaces.

Foam rollers are used to apply solvent-borne gloss paints and undercoats on smooth surfaces. They are not suitable for use on rough or very rough surfaces. This type of roller produces an orientation of fine lines in slight relief in the direction in which the roller is operated.

There is a range of speciality rollers available, notably rollers for corrugated surfaces and textured finishes. Table 6.1 provides a guide to situations under which different roller coverings are used. A handle extension may be used to paint ceilings and high walls and is recommended for all large areas to provide uniformity of finish.

6.7.3.2 *Roller kit*

A typical roller kit comprises a tray from which the roller is loaded with paint, a wide roller for large areas, a small roller for edges and narrow areas, and a small brush for cutting in.

A handle extension is useful to paint ceilings and high walls.

To minimize the cleaning of roller trays after use, they may be lined with aluminium foil or a plastic liner before use.

6.7.3.3 *Procedure*

The roller should always be prepared for use by immersing it in water, or an appropriate solvent for a solvent-borne paint, agitating it while immersed and then spinning it dry. These steps are necessary to remove dust and lint, which, if present, will mar the finish.

Areas of difficult access should be coated first. These are best coated with a cutting-in brush so that brush marks are hidden as far as practicable. The finish may be improved by stippling to reduce brush marks and produce a uniform surface profile.

The roller should not be overloaded with paint.

Painting should be systematic and regular, with sufficient pressure (not excessive) first being exerted on the roller to transfer the paint from the roller to the surface. Rolling should then progress over the section of the area being painted and be finished with only light pressure in a direction parallel to that of the wet edge.

Where large areas are being painted, it is desirable to work into rather than away from 'wet' edges so that each new charge of paint is gradually spread out towards the wet edge and a comparatively empty roller used to make the 'join'.

Where walls are being painted, the final strokes should be in a vertical direction, but this is not imperative, provided that a regular method is adopted throughout the job. Paint should be rolled out in direction of the light.

Rollers and trays should be thoroughly cleaned after use, however it is usually more environmentally acceptable to dispose of them. If cleaning rollers it may be helpful to

operate the roller on clean sheets of newspaper to transfer as much paint as possible before washing the roller in an appropriate solvent. Finally, the roller sleeve and tray may be washed in warm soapy water, rinsed clean and then dried. Alternatively, a roller cleaner device can be used to clean rollers effectively with minimal usage of water.

Consideration should be given to possible environmental effects arising from cleaning or disposal of roller sleeves.

TABLE 6.1

PAINT ROLLER SELECTION

Paint type	Smooth surfaces	Semi-rough surfaces	Rough surfaces
Flat, matt, low sheen latex	B, A	E, H	F
Semi-gloss latex	C, D	E, H	E, H
Gloss latex	D	E, H	E, H
Flat paint, solvent-borne	A, B	E, H	F
Semi-gloss, gloss and full gloss paint, solvent-borne	C, D, G	E, H	E, H
Epoxy and polyurethane gloss	C	E, H	—
Primers	B, A	E, H	F
Sealer undercoat/undercoat	B, D, A	E, H	F
Sealers	A, B	E, H	F
Water repellents	A, B	E, H	F

LEGEND:
A Wool or wool blend, typical nap length 12 mm
B Synthetic fibre, typical nap length 10–12 mm
C Mohair, typical nap length 6–8 mm
D Short soft synthetic fibre, typical nap length 6–8 mm
E Long synthetic fibre, typical nap length 20 mm
F Extra long synthetic fibre, typical nap length 32–38 mm
G Foam, typical foam thickness 10 mm
H Wool or wool blend, typical nap length 20 mm

6.7.4 Pad application

Pads are flat rectangular applicators covered with a napped fabric. The pad is dipped into a tray with excess material being wiped off in similar fashion to roller loading. They are available in a range of sizes, including types for cutting-in application. Cleaning is essentially the same as for rollers.

6.7.5 Spray application

6.7.5.1 *General*

Spray application is useful for covering large areas, particularly in one colour. Use in occupied buildings may be severely restricted because of the need to protect furniture and office equipment from overspray. Use on small intricate areas may be uneconomical because of the large amount of masking required; while coating open surfaces, such as lattices, may be costly because of overspray waste.

Special care should be taken with surface preparation when using the spray application technique onto porous or friable surfaces, as the paint may not be as adequately worked-in the surface as with other application methods; e.g. exterior timber should be primed by brush or roller in order to work the primer into the substrate.

To ensure that an even coating of paint is applied to the surface being painted, it is important that the correct type of spray gun is used for the type of paint. The two main types of equipment used in the spray painting of buildings are conventional compressed air and airless spray.

Guidance on the different types of equipment should be obtained from the equipment manufacturers.

Any regulations, occupational health and safety requirements, painting regulations and information from the material safety data sheets that is relevant to particular paints and conditions of use should be ascertained and, if necessary, further guidance should be sought from the paint manufacturer.

6.7.5.2 *Compressed air spraying*

Compressed air spraying is carried out at the appropriate normal ambient temperature (see Clause 6.3.2); the paint should only be applied under relatively dry conditions. Conditions of high humidity are likely to lead to paint defects because of water pick-up.

Spraying may be carried out at either high or low pressure; however, the use of high pressure results in high overspray rates and fog rebound. Spray painting should not be carried out in small rooms unless provision is made for the health and safety of the paint applicator. Overspray protection should be provided for surfaces that are not included in the painting work.

Each stroke of the gun should be made with free movement across the surface, with the gun at right angles to and at the correct distance from the surface. Guns held too close to the surface will produce too high a film build, and uneven deposits and sagging, while guns held too far from the surface may produce a somewhat dry and rough finish. The paint should be sprayed at the conditions specified by the paint manufacturer.

Special retarder-based solvents are required for certain climatic conditions to improve drying properties. In such instances only those solvents recommended by the manufacturer should be used.

To obtain an even paint film thickness, it is essential that the preceding stroke of the gun be overlapped by the next stroke, generally by up to 30%.

Oil and water separators should be included in the air lines to avoid contamination and degradation of the paint. Such equipment should be checked regularly.

Cleanliness of all equipment is vital for satisfactory spray painting performance. Accordingly, all spray guns, feed lines and other equipment should be thoroughly cleaned each day after use when the spraying operation ceases. The solvent recommended for clean-up work, as directed by the paint manufacturer, should always be used.

6.7.5.3 *Airless spraying*

As the name suggests, airless paint spraying allows paint and other related materials to be sprayed without the use of compressed air. The spray action is caused by pumping the material at extremely high pressures through a small opening at the tip of an airless spray gun. The high velocity at which material passes through the nozzle causes it to atomize into a fine spray while maintaining sufficient momentum to carry the particles to the surface. This process is known as atomization.

An example of what is actually occurring may be ascertained when one watches water from a garden hose pass through a nozzle. Because the nozzle opening is much smaller than the fluid passage in the hose, there is a build-up of pressure, which causes the water to separate into a fine spray when it is released. Due to the low viscosity of water, this is accomplished at very low pressure. Paint and other coating materials, however, have much higher viscosity, requiring higher pressures to separate the particles and allow atomization.

Airless tips are a key component for the successful operation of an airless system. They define the spray pattern, control the flow and ultimately tell the pump how hard it should work. Airless tips are available in many different sizes, each offering an assortment of fan widths and orifice sizes (actual opening measured in thousandths of an inch). The orifice size determines the amount of fluid to be sprayed while the shape of the orifice determines the fan width. The orifice is always elliptical in shape and, therefore, creates a similarly shaped spray pattern. The more elongated the orifice the wider the spray pattern.

Due to the small opening (orifice) in an airless tip (approximately half the diameter of a pin) blockages can present a problem. Therefore, it is essential to always clean the equipment properly, strain the paint and always use pumps and guns that incorporate filters. Additionally, a self-cleaning tip is always recommended.

Some paints are not suitable for airless spraying and advice on those paints that are suitable for this equipment should be sought from the paint manufacturer.

Airless spraying applies paint rapidly and may allow a heavy build-up of paint coating very quickly, and care should be taken that excessive film builds do not cause defects in the dry paint film. Airless spraying is particularly suitable for the painting of large areas.

As the paint is ejected at very high pressure it is necessary to take special precautions to prevent injury to personnel.

Only trained personnel should operate the airless spraying equipment. Particular attention should be given to the use of the equipment in accordance with the manner specified by the equipment manufacturer.

6.8 TOUCH UP

Touching up is the recoating of only a small portion of a surface in order to conceal damage or defects. It generally applies only to the period shortly after the application of paint to the rest of the surface, as it is not feasible to achieve a match between newly applied paint and the same paint affected by in-service conditions such as weather, wear or soiling. Achieving a touch up that is invisible under all or most conditions of lighting and viewing requires the application of the same sample of paint that was originally applied to the surface, by a method matching the original application method, to achieve a film build, surface texture and sheen level matching the surrounding area. Hence, touch ups call for technique, skill and practice.

The brush or roller sleeve should be similar to those used in the original application, as should the equipment loading, speed, and pressure and direction of application. Alternatively, combined application methods may be used, such as brushing to apply paint to the affected area, followed by laying off with a slightly dampened roller to provide a match with the surrounding rolled texture. Ironically, the absence of surface texture in sprayed films does not make touching up easier but virtually impossible, as it allows the borderline that surrounds any touch up area to stand out more clearly, even if all else matches. Full gloss finishes are also difficult to match as the junction between the old and new surface is difficult to obliterate.

Ease of touching up generally increases with decrease in gloss level, consistent with the general principle that flatter paints conceal surface irregularities better.

SECTION 7 MAINTENANCE OF PAINTED SURFACES

7.1 GENERAL

In most situations, the service life of paint coatings is much shorter than the specified life of the building to which it is applied. Good quality paints have a relatively long life on interior surfaces and repainting is normally undertaken only when soiling has occurred, or when there is a desire for a colour change; however, in external conditions of service, paint life varies with the environment, the nature of the material painted, the degree of surface preparation, the quality of the paint and the number of coats of paint applied.

To assess the effectiveness of a painting system, it is necessary to inspect the painted surface at regular intervals, such as annually. Washing of exterior painted surfaces to remove any accumulated dust, dirt or (particularly for metal substrates) coastal salts will assist in maintaining paint serviceability. Removal of surface chalking often restores the decorative value of exterior paintwork.

The existence of lead paint on old buildings (typically pre-1970) may cause public health and environmental hazards and management procedures should be in accordance with AS 4361.2 in Australia. Refer also to the appropriate WHS regulations.

The build-up of excessively thick coats of paint on some surfaces, particularly timber, is undesirable. Repainting too frequently may be harmful and may give rise to flaking and blistering, particularly where the temperatures are high or moisture is present. The minimum thickness of paint that will adequately protect the surface should be maintained. For preference, the application of new paint should balance that lost by weathering; however, this balance is difficult to achieve in practice. Following a number of successive repaintings, it may be necessary to remove the existing paint system before repainting the surface, as in the case of new work.

For all of these tests on any particular painted surface, the acceptability or otherwise of adhesion has to be gauged in the context of what can be reasonably achieved for the specific coating on the particular substrate.

In a marine environment or in a location where industrial fall-out occurs (see AS/NZS 2312.1 and AS/NZS 2312.2), it is vital that all salts and residues be removed by washing prior to painting and in more extreme cases between coats.

Practices for the repainting of different substrates are set out in Clauses 7.4 and 7.5. These Clauses cover the repainting of surfaces in both good and poor condition.

7.2 CRITERIA FOR ASSESSING WHEN TO REPAINT

The reason for repainting may be a requirement for a colour change or a change of gloss level, to suit climatic conditions, to freshen up generally the appearance of a building, and to prevent deterioration of the substrate where coatings have blistered and flaked.

The most important factor to be considered is the need to repaint before the substrate starts to deteriorate. This is particularly critical for timber substrates.

Maintenance should be undertaken prior to the commencement of coating failure. This point is not easy to detect, but heavy chalking or paint defects are indications that maintenance is necessary. In any case, it is always preferable to repaint before existing paintwork starts to disintegrate; i.e. while a sound continuous coating persists. The decorative appearance of a chalked finish may possibly be reinstated by washing so avoiding the need to repaint.

A paint film that has weathered to the stage of cracking and flaking or shows poor adhesion is not a satisfactory base on which to apply fresh coats of paint.

Where the repainting of metallic surfaces for long-term protection is being considered, guidance on assessment criteria is given in AS/NZS 2312.1 and AS/NZS 2312.2.

7.3 PRETREATMENT BEFORE REPAINTING

7.3.1 Assessment of surface soundness

Where maintenance is undertaken at regular intervals, it is seldom necessary to strip off the old paint before repainting, but thorough surface preparation is most important. The criteria for removal of the paint system are largely dictated by the soundness of the existing coating and the type of substrate.

The testing of paints for adhesion is by no means a simple task because the selection of the most appropriate type of test will depend on the generic paint type, substrate and service conditions.

AS 1580.408.2, AS 1580.408.4 and AS/NZS 1580.408.5 set out methods for testing paint adhesion. AS 1580.408.5 allows the qualification of coating adhesion by the determination of the tensile force (perpendicular to the coating surface) necessary to detach the film. It is appropriate for coatings on very cohesive, rigid surfaces such as metal, concrete and masonry; however, it is time consuming and usually only used in the verification of other semi-quantitative procedures.

AS 1580 408.4 (adhesion cross-cut) describes a semi-quantitative test that involves making a series of parallel cuts through the coating and a further similar series at right angles so as to form a grid pattern. On applying, then removing, pressure-sensitive adhesive tape the extent of detachment of the coating is measured. The method is not suitable for friable substrates such as plaster, where the cutting action may impair the substrate. Results also vary between coating types because of the variations in the shear force necessary to cut through the film. Thus, a hard cohesive coating will tend to be judged more severely than a soft or friable coating.

AS 1580.408.2 provides two simplified variations of the cross-cut test: Method A, a pass/fail test with just two parallel cuts, and Method B which allows a diversity of thicknesses and coating types to be tested. As with the cross-cut test, the value obtained will vary greatly with coating type.

Another approach, usually suitable for conventional decorative finishes on interior broad wall areas is the application of an agreed quality pressure sensitive adhesive tape (see AS 1580.408.4) applying it to the wall for 30 s and quickly pulling the tape off at right angles to the surface. A variation of this is to apply the tape over an area where the paint has been cut through to the substrate.

For all adhesion tests involving pressure-sensitive tapes it is important that the surface be cleaned of dirt, grease and chalking prior to adhering the tape.

7.3.2 Treatment of surfaces affected by mould

After verification that mould is present (see Figure 7.1), it is necessary to sterilize and remove surface mould before repainting. The following procedure is recommended:

(a) Wash the entire surface with detergent to remove any grease or dirt.

(b) Wash or sponge the entire surface with a freshly diluted solution of sodium hypochlorite household bleach with a final hypochlorite concentration of 1% to 2%. Washing-down cloths or sponges should be regularly washed with clean water to prevent recontamination and the spread of mould spores.

(c) Allow bleach to remain moist until the stain is decolourized, typically 15 to 30 min. Reapplication may be required for dry conditions or persistent stains.

(d) Rinse the surface with copious quantities of clean water. Where one application of bleach fails to remove the mould, a repeat application may be necessary.

(e) Severely infested surfaces should be treated with anti-mould solution (Paint Type B32) as directed by the manufacturer.

To prevent recurrence of mould, an addition to the paint of a fungicidal additive is recommended.

As mould requires moisture for growth, there should be adequate ventilation to reduce the humidity.

NOTES:

1 Mould treatment does not remove rust stains.

2 If infestation is heavy or recurrent, a critical examination of the area should be carried out with a view to reducing any structural or environmental moisture. If the ground under a building is excessively damp, the subfloor ventilation should be improved (refer to building regulations for guidance). Environmental moisture can be reduced by improving ventilation. In severe situations mechanical ventilation may be necessary (see Clause 2.1).

7.3.3 Gap filling

All cracks, holes, indentations and damaged surfaces should be made good as far as is practicable with such preparations as linseed oil putty, plaster filler, wood filler, plastic wood and flexible paintable sealants, as appropriate (see Clause 4.21). All such fillers should be used in accordance with the manufacturer's instructions and allowed to dry or to set before being sanded back to level with the surface. Flexible paintable sealants (e.g. acrylic latex types) need to either be well cured (typically 48 hours) or be spot sealed with a solvent-borne undercoat prior to overcoating with a latex paint, to prevent cracking of the finish coat. In any case, the following points should be noted:

(a) *Timber* To prevent oil-based putty from shrinking and falling away owing to absorption of oil by the timber, all timbers should be prime-coated before being filled with putty. This is especially important with timber that has deteriorated through exposure.

(b) *Plaster* To assist the adhesion of plaster filler, all plaster should be dampened and dovetailed before application of the filler. Large gaps should be undercut before filling. For deep cracks, several applications may be necessary because of shrinkage. Where cracks extend into the structure behind the plaster, these need to be repaired first.

(c) *Hardboard* The stopping or filling of large holes in hardboard is not recommended; however, nail holes and small indentations may be filled with putty, plastic wood or multi-purpose filler. All damaged sections should be replaced.

(d) *Exterior service or service in areas subject to wetting* For exterior service or service in areas subject to wetting, only portland cement-based or water insoluble organic-based gap fillers should be used. Rigid rapid setting fillers are not suitable where there is excessive timber moisture content and these should only be applied to the bare dry surface.

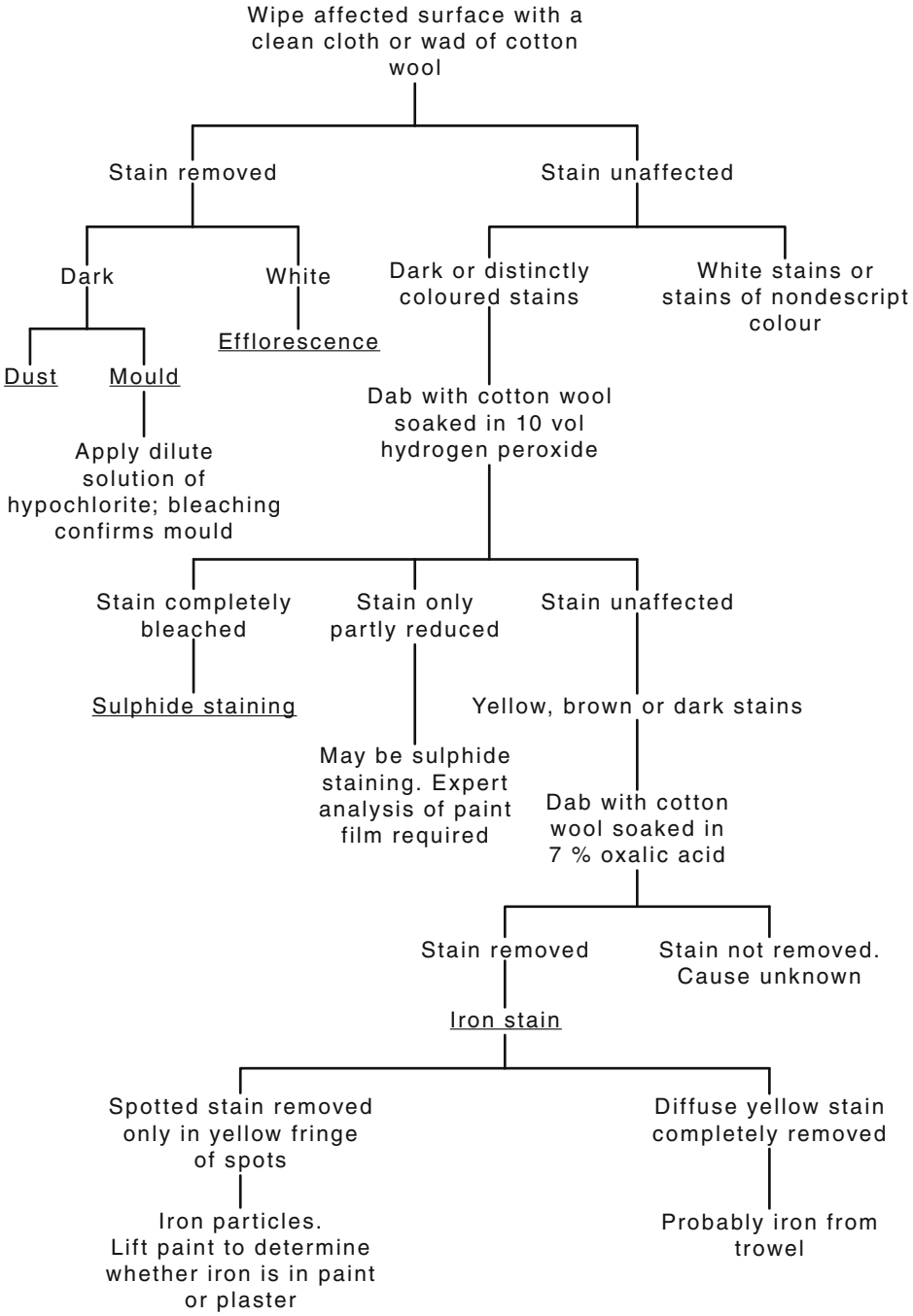

FIGURE 7.1 IDENTIFICATION OF DARK STAINS AND EFFLORESCENCE

7.4 PAINTED SURFACES IN GOOD CONDITION (ALL SUBSTRATES)

Paintwork in good condition first requires cleaning to remove surface contaminants.

Most surfaces may be adequately washed down with warm water and ordinary household detergent (5 mL/L to 10 mL/L) or with a solution of commercial sugar soap. Soap powders leave a deposit and are not recommended.

To be effective, washing down requires frequent changes of water and a second wipe over with clean absorbent rags to prevent surface smears.

Heavy smoke and grease deposits, sometimes found in kitchens, may not respond to washing with water. Instead they should be cleaned with an ammonia-based detergent solution or with a sugar soap solution, followed by rinsing.

Next for solvent-borne finishes a thorough sanding or equivalent to achieve a dull or flat finish should be undertaken to ensure good adhesion of succeeding coats. For epoxy, polyurethane and other thermosetting coatings, the surface needs to be heavily sanded or lightly whip-blasted to provide a key for subsequent coats.

7.5 SURFACES IN POOR CONDITION

7.5.1 Removal of paint

Paint that is blistering, flaking or cracking should be completely removed. Similarly kalsomine, limewash and other loosely bound paint systems may also need to be completely removed. This may be an indication of a wider adhesion problem, and adhesion checks of the entire paint film should be undertaken. In the case of a breakdown of a solvent-borne paint system on only part of the area, some of the paintwork may appear sound and resist removal by scraping and sanding. It is possible, however, that this paintwork will fail and repainting may hasten such failure.

Adhesion checks to determine the integrity of the existing layers should be undertaken. In cases where poor adhesion is observed, the removal of the existing coating may be necessary to give maximum life to the new coating. Similarly, surfaces exhibiting excessive chalking should be washed to give a sound base for further painting. Paint removal may be achieved by one of the following methods:

(a) *Heating* Heating involves the application of heat, using a flame or air from a hot-air gun, to the painted surface, which causes the solvent-borne paint film to soften and swell. The paint is then scraped off. This method is effective on substrates that are not affected by heat, and is suitable for both interior and exterior use. Although appropriate safety precautions should be taken, heating may be achieved by using a hot-air gun or flames from a kerosene or LP Gas torch. Heating is the most effective method of removing old solvent-borne paint. It is particularly applicable where gum exudation has been a problem. Charring of the substrate should be avoided.

Heat removal may be a dangerous process and requires care. Paint scrapings may ignite and set fire to grass or articles on the ground; it is good practice to wet nearby grass and shrubs before starting work and to keep firefighting equipment such as a hose or bucket of water handy. A complete inspection of the building should be made and any flammable materials such as leaves, birds' nests or straw should be removed. If a definite fire hazard exists, an alternative paint removal method should be used. Local regulations may require the fire brigade to be notified prior to any work being commenced. This process should not be carried out in windy weather.

To avoid the risk of a delayed fire, paint removal should be stopped at least 90 min before ceasing work. This allows smouldering embers in cracks or crevices to be detected thereby avoiding the possible danger of fire after the building and site have been vacated. Any charred material should be removed at the close of each day's operations. It is also good practice to cease removal early enough to permit sanding and priming of the exposed timber on the same day. This procedure also avoids the wetting of exposed timber by overnight rain or dew.

NOTE: The fumes from paints may be toxic and operators should avoid inhalation. Where paint contains lead additional precautions should be taken (refer to the appropriate WHS regulations).

(b) *Abrasive grit or water blasting* Blasting involves projecting a substance at high speed or under pressure, which will remove the paint film by grinding away, as with abrasive grit, or by lifting it with a high pressure water jet. Abrasive grit blasting may be carried out in either wet or dry conditions. In each case, environmental considerations need to be taken into account. Blasting is typically used on sound substances such as concrete, masonry, metals and paving and in areas where the residue can be contained (see AS 1627.4).

NOTES:

1 Grit blasting may be prohibited in some jurisdictions and containment requirements may render this option impractical in many situations.

2 Water blasting is a common preparatory technique, however, as it does not always ensure the removal of all unsound paint films, additional scraping or sanding may be necessary.

(c) *Grinding and sanding* Grinding and sanding involves the use of abrasive materials to wear away the paint film. This may be achieved manually using abrasive paper, such as garnet, carborundum or glass paper, or with mechanical assistance such as disc sanders, belt sanders, orbital sanders or abrasive wheels. Abrasive surfaces moving at high speeds should be treated with care as improper use may injure personnel and damage the surface being prepared. This form of stripping may be used on both interior and exterior surfaces. The use of an organic vapour/particulate respirator (Class P2) complying with AS/NZS 1716 is recommended.

Rotary disc sanders may be used initially, with orbital or belt sanders being used for finishing. With fixed rotary disc sanders, only the edge of the disc should be used and care should be taken to avoid pressing the disc into soft surfaces. Small areas should be sanded by hand.

NOTE: Airborne dust from sanding can be a health hazard. Where appropriate, operators should wear either a respirator or face mask.

(d) *Chemical stripping* Chemical stripping involves the use of a chemical means of removing paint and is broken down into three general classes. Not all methods will work on all paint film types, and the effectiveness of a method should be established by trial with a test area or reference to the manufacturer's recommendations. Chemicals may be variously applied as a thixotropic gel, a poultice, a tape or blanket to prolong the stripping action and provide greater effectiveness of removal. The three classes of chemical stripping are the following:

(i) *Fast acting solvent stripping* A single solvent or mixture may be used to remove paint and these systems are particularly effective for removing thin layers. The solvent usually causes the old paint film to 'fry' up and is easily removed from the surface by scraping. Methylene-chloride-based strippers are commonly used on solvent-borne paints. This solvent is highly toxic and appropriate safety precautions should be taken. Special attention may need to be given to the neutralization of alkali residues due to the wax content of these systems.

(ii) *Slow acting solvent stripping* A mixture of solvents in a paste or gel may be used to remove paint and these systems are particularly effective for thick or multi-layered films. The mixture softens and penetrates the paint film, often many layers thick, to allow easy removal by scraping after an extended contact time. Residues may be removed by water wash down or simple neutralization techniques and these systems are generally less toxic.

(iii) *Chemical stripping* A mixture of a chemical, such as ammonia and caustic soda, in a proprietary paint stripper. This procedure is usually much slower than fast acting solvent stripping but is more environmentally sound and very suitable for moulded surfaces. Special attention may need to be given to the neutralization of alkali residues. Some chemical strippers may attack some substrates notably zinc, aluminium and some timber species.

(e) *Scraping* Scraping involves the removal of old paint film by scraping with a sharp edge. There are many specially designed tools for this purpose, ranging from knife edges to specially designed hook scrapers. Scraping is usually followed by sanding and may be carried out on both internal and external surfaces.

(f) *Hammer gun* Hammer gun encompasses a range of mechanical devices including needle gunning, scabblers and power wire brushes. They are typically suitable for use on metal, concrete and other robust surfaces. Since these methods are extremely noisy, the use of hearing protection is recommended. Similarly hazards due to dust generation need to be addressed.

Selection of the means of removing the paint film is based on a number of concerns including the type of substrate, pertinent environmental considerations and the cost of labour and materials (see also Clause 1.5). For example, the use of mechanical methods on timber substrates would be restricted to those methods that leave a uniform surface suitable for painting although all other stripping methods would be satisfactory.

7.5.2 Timber and hardboard surfaces

Holes or depressions in timber due to mechanical damage or natural defects such as resin or gum pockets, knotholes and surface splits should be scraped clean of any loose or soft material and, after priming, should be filled with fillers compatible with the proposed paint system. Timber that is particularly resinous may need to be heated using a hot-air gun to allow subsurface resin to diffuse to the surface for subsequent mechanical removal prior to painting.

Some timbers (including *pinus radiata*) are susceptible to resin bleed. Where solvent-borne preservative treatments (e.g. LOSP) are used, resin bleed is more common. Resin exuding on the surface of timber, or through paint, should be scraped off before painting. Where the resin is still soft, wiping with mineral turpentine will help remove residues. Heating with a hot-air gun will bring resin to the surface. Heavy resin bleed is likely to re-occur over summer months and the only completely successful treatment for badly affected timber is replacement.

Where the appearance of timber has discoloured or otherwise deteriorated due to weathering, it should be sanded or dressed back to a firm, fresh surface. Indeed, exposure of the timber substrate for even a few weeks of weathering will have a detrimental effect on the adhesion of paint coats.

Where timber has decayed, the source of the moisture causing the decay should be eliminated. Leaking spouts or pipes, poor flashing and improperly sealed butt joints are frequent causes. Areas of damaged or decayed timber should be scraped out or, where the area is extensive, cut out and neatly replaced.

Corroded nails that have sprung or become loose should be withdrawn and corrosion-resistant nails placed in a new position. Provided that adequate fixing is achieved, it may be preferable in some circumstances to repunch loose or sprung nails. After punching, all nail holes should be primed and puttied.

7.5.3 Set plaster, gypsum plasterboard and fibre reinforced plaster

Paint flaking from loose, powdery, or otherwise unsatisfactory surfaces should be completely removed and the surface treated as set out in Clause 3.10.6.4.

Paint applied to interior walls should first be scraped and then sanded. If the remaining paint is considered unsound, it should be removed with appropriate chemical or solvent strippers.

Bare surfaces should then be treated as for new work.

All surface cracks, pores and irregularities should be filled with an appropriate filler, trowelled smooth and allowed to dry. When dry, the treated areas should be lightly sanded to a smooth finish.

7.5.4 Masonry and concrete surfaces

Because of the absorbent nature of masonry and the consequent penetration of paint into the surface, the use of abrasive grit blasting is the most efficient method of cleaning. This is only satisfactory on exterior surfaces, whereas solvent or chemical strippers are satisfactory on interior surfaces.

The following faults in surfaces of concrete, cement render or brick masonry should be treated as indicated before painting (see also Section 3):

(a) *Crumbling mortar* Rake out crumbling mortar, make good with fresh mortar and allow to dry thoroughly before painting.

(b) *Dampness* Locate and remove the source of moisture. Dry out dampness before painting. Where any doubt exists, the use of a moisture meter is recommended to establish that the wall is dry (see the procedures set out in Clause 3.10.2).

NOTE: Paint or 'sealers' applied over an area to 'cure' dampness will either fail after a short time or divert the damp into another position; e.g. higher if the source of water is from the ground.

(c) *Corroded bricks* Replace isolated soft or underfired brickwork before painting. Alternatively, the consolidation of corroded bricks may be an option.

(d) *Filling of cracks and crevices* Remove all loose matter from cracks and crevices and fill with an appropriate compound. Clean out deep holes in masonry, wet with water and fill with mortar no stronger than the existing substrate or an appropriate patching compound and allow to dry.

NOTE: If there is any doubt about whether a crack is continuing to widen, seek expert advice as to the cause. A check of crack movement may be made by gluing to one side of the crack a glass microscope slide positioned over the crack. The position of the other side of the crack is marked on the slide and observed for a few weeks or months, as appropriate.

(e) *Moss and lichen* Remove all loose and powdery growth in moss-affected areas. Treat the affected surface with one of the following solutions:

(i) 20 g of copper sulfate (hydrated) in 1 litre of water.

(ii) Benzalkonium chloride solution.

(iii) Other equivalent proprietary solution.

NOTES:

1 The solution containing copper sulfate should not be applied to zinc-coated or aluminium surfaces because of discolouration and corrosion nor should any run-off impinge on such surfaces.

2 Copper sulfate, benzalkonium chloride and some proprietary solutions are poisonous and should not be allowed into drinking water or stormwater drains.

The procedure should be as follows:

(a) Apply the solution to the affected area and leave until the moss and lichen turn brown and become loose. This usually occurs within three days to six days.

(b) Scrub down with a hard bristle brush, hose liberally with water and allow to dry.

(c) Swab the treated areas using a solution of one volume of household bleach diluted with two volumes of water. Allow to remain for 30 min.

(d) Treat the surface with a proprietary algicide solution following the label directions.

(e) Wash down with clean water and allow to dry thoroughly before painting.

After treatment to remove moss and lichen, surfaces may be discoloured. Surrounding surfaces should be protected to avoid unnecessary staining.

(f) *Spalling concrete* Usually caused by the expansion or rusting of metal reinforcement within the concrete causing surface concrete to fall off. For methods of treatment, see HB 84.

(g) *Old paint coatings* Remove old coatings by the use of water/abrasive jets.

7.5.5 Metalwork in poor condition

All stripping systems in Clause 7.5.1 are satisfactory for metal surfaces; however, interior and exterior limitations should be borne in mind. In severe environments, reinstatement should be in accordance with AS/NZS 2312.1. In mild environments, reinstatement may be deferred to suit the maintenance program owing to significantly reduced steel corrosion rates. It will be necessary for corroded areas to be appropriately cleaned and spot-primed before application of the recommended system.

Recommended systems for metalwork exposed to the elements are listed in AS/NZS 2312.1.

7.5.6 Plastic surfaces

Plastic surfaces are not generally resistant to abrasives or solvents; however, the use of chemical strippers and mild abrasives offer the most suitable methods for stripping painted surfaces.

7.6 DISCOLOURATION AND STAINING OF PAINT FILMS

Staining of paint films is comparatively rare, but cases that are unsightly and difficult to remove do occur. Further difficulty may be experienced in identifying a stain.

Figure 7.1 provides guidance on how to identify stains.

Procedures for the treatment of some of the more common stains are as follows:

(a) *Efflorescence* Efflorescence is caused by the migration of moisture from certain substrates, bringing salts to the cement render surface. Efflorescence will continue unless the source of the moisture is determined and eliminated.

White efflorescence from plaster, concrete and masonry consists mainly of calcium carbonate. White efflorescence on the surface consists mainly of alkaline salts. This may be removed by brushing with a stiff bristled brush and wiping down with a mild acid solution such as 5% acetic acid (white vinegar). The whole area should then be wiped down with a damp cloth and allowed to dry thoroughly. When dry it may be appropriate to apply an alkali-resistant solvent-borne sealer and appropriate topcoats. Where further efflorescence is anticipated, application of a moisture permeable finish may be advantageous to allow any residual efflorescence to diffuse to the surface.

(b) *Dust* Dust provides a nutrient source for mould and needs to be eliminated to prevent contamination.

Vacuum cleaning or brushing the affected area with a clean dry brush is sometimes sufficient to restore the appearance; however, surfaces affected by the deposition of dust may also be susceptible to occasional condensation which leads to adhesion of the dust particles, resulting in a stain that cannot be completely brushed away. Smoky atmospheres aggravate this condition. In such cases, the surface should be washed with a dilute detergent solution.

Smoke stain often occurs on acoustic tiles, especially if the paper backing is faulty. If this occurs, an attempt should be made to reseal the back of the tile, as the stain will probably recur if air continues to find a passage through the tile.

(c) *Sulfide stains* This type of stain is caused by lead or mercury compounds in old style paints, which form sulfides with contaminants in the air. These stains are dark, ranging in colour from a brownish or purplish hue to grey and are usually easy to diagnose.

Once a surface has been contaminated with lead compounds, some difficulty may be experienced in eliminating their effects. Repainting hides the stain for a while, but the lead usually succeeds in penetrating the covering paint film.

Lead sulfide stains are usually readily removed by treatment with hydrogen peroxide, which can be applied either by spraying or with a cloth soaked in the reagent. Mercury sulfide stains are removed by sodium hypochlorite; however, this treatment may not be permanent. Permanent treatment may be achieved by sealing prior to repainting with an appropriate sealer specified by the manufacturer. Better ventilation to reduce humidity may prevent recurrence.

NOTE: Direct contact of undiluted hydrogen peroxide with the skin should be avoided. Refer to the manufacturer's instructions.

(d) *Iron stains* Iron stains variously show up as spots arising from contamination of the surface with metallic iron or more generally from contamination by iron compounds in the substrate. They are usually removed by treatment with a solution of 7 g of oxalic acid in 100 mL of water. Unless the iron contaminant is gouged out, staining will reappear. To prevent the stain from reappearing after treatment, the area should be coated with a solvent-borne sealer.

NOTE: Oxalic acid can present a health hazard and appropriate safety precautions should be taken. Refer to the MSDS for the product in use.

For more persistent staining the addition of 2 g of sodium fluoride to the solution is recommended. Following stain removal, any residual acid should be removed with a 5 g/100 mL sodium bicarbonate solution.

Rusting metalwork surfaces need to be exposed, cleaned from rust and other surface contamination and coated, typically using an inhibitive metal primer (see AS/NZS 2312.1 for details). Where the rusting surface is inaccessible for painting such as at lintels and other gaps, which allow moisture ingress, these should be sealed.

(e) *Tannin stains* Tannin stains are derived from various timbers and may be avoided by priming with an appropriate sealer before finish coat (see Clause 3.2) or by use of a sufficient thickness of a tannin-resistant topcoat. For timbers with excessive tannin migration (e.g. cedar, merbau and similar) a solvent-borne primer (B10) may be necessary.

(f) *Grease* The surface should be washed down with warm water in which sugar soap powder preparation (1:40) or household liquid detergent has been dissolved. The washing should be repeated until the grease is removed, the surface should be well rinsed with clean water. The surface should be allowed to dry thoroughly.

(g) *Stains of undiscovered origin* No specific treatment is recommended for other stains because their nature is not known; however, the following treatments may prove effective:

(i) Dark stains that do not fit the description of iron stain are sometimes removed by oxalic acid, dilute hydrochloric acid or selected organic solvents.

(ii) Lustre stains, i.e. stains that reflect light differently from the surrounding areas, and 'grinning-through' stains, i.e. stains in which the paint appears thin, may be overcome by applying a fresh finishing coat.

(iii) For unidentified stains, it is prudent to apply a solvent-borne sealer before finishing coats. Where this is unsuccessful, a latex sealer should be applied.

(h) *Yellowing* Enamel paints on interior trim areas often dry to a yellowish 'off colour' due to application of the enamel while fumes from latex-based wall and ceiling paints or undercoats are still present in the room. This discolouration is permanent and may only be avoided by providing ample ventilation to ensure that all fumes have been eliminated prior to commencing application of enamel trim paints.

Alkyd enamel paints discolour to a cream/yellow colour in rooms or areas where there is little or no sunlight such as passageways, behind doors and inside cupboards. This discolouration is reversible, and allowing direct sunlight into the area for a few days will usually restore the colour to its original shade.

Polyurethane-based enamels and varnishes discolour permanently when exposed to strong sunlight for extended periods. On varnished timber this may be further accentuated by discolouration of the timber (e.g. *pinus radiata*) while other species may fade and thereby mask the colour change of the varnish (e.g. cedar, redwood).

Many epoxy and polyurethane coatings discolour under the influence of sunlight. Care is needed to specify non-yellowing resin combinations for these materials if colour retention is a critical property.

(i) *Vanadium stains* Vanadium stains consist of yellow, green, or reddish brown discolouration of paint applied over light coloured bricks. They may be chemically treated with—

(i) caustic soda or caustic potash applied as a 10% by weight aqueous solution; or

(ii) hypochlorite bleach applied as a 10% solution of liquid pool chlorine.

Both treatments should be rinsed thoroughly with copious amounts of clean water after the stain has disappeared.

Hydrochloric acid, which is often applied to brickwork to remove mortar stains and residues, should be avoided where vanadium stains are present as the vanadium darkens in the presence of this chemical and becomes more difficult to remove.

NOTE: These chemicals require care in handling. Observe all safety precautions issued regarding the use of any of these materials.

SECTION 8 MAINTENANCE PAINTING SYSTEMS

8.1 GENERAL

Maintenance painting systems may differ from those specified for new work, as detailed in Section 5. If the previous system has lost its integrity, i.e. it has failed to such an extent that the substrate is exposed over a substantial area of the surface necessitating complete removal of the old paint, a painting system applicable to new surfaces should be adopted.

There are many reasons why it may be necessary to repaint. These include requirements for a colour change, a change in gloss level to suit exposure conditions, and to freshen up the appearance. The choice of system will depend upon the selected course of action, e.g. whether to—

(a) retain the existing paint system, gloss and colour;

(b) retain the existing paint system but change gloss or colour; or

(c) change the existing paint system.

Painting systems for maintenance painting are shown in Tables 8.2 and 8.3. Preparation of surfaces prior to repainting is detailed in Section 7.

The adhesion of reinstatement coats will be indifferent on existing old finishes that are chalking, brittle or contaminated; therefore, consideration should be given to the surface preparation (see Section 7). Should a loss of film occur when preparing the surface, additional coats will be required to achieve a uniform gloss, colour and finish.

Where spot-priming is required on exterior surfaces, the recommended primer and undercoat for the particular system, as listed in Table 5.2, should be used.

Specific recommendations for each of the above courses of action are given in Clauses 8.2 to 8.4.

Table 8.2 outlines suitable interior paint systems for a range of previously decorated surfaces and assumes that the existing paint system is compatible with the intended maintenance system. It lists acceptable alternatives, subject to the qualifications in the appended notes and any paint incompatibility. The number of finishing coats will depend largely on the colour and texture of the existing coating.

Table 8.3 outlines suitable exterior paint systems for previously decorated surfaces. It lists acceptable alternatives, subject to the qualifications in the appended notes and any paint incompatibility. The number of finishing coats will depend largely on the colour and texture of the existing coating.

8.2 RETAIN EXISTING PAINT SYSTEM AND GLOSS AND COLOUR

The systems given in Tables 8.2 and 8.3 should be used. Two-coat systems are recommended for exterior application; however, in many interior situations where the degree of fading or discolouration is not marked, one topcoat may be satisfactory.

8.3 RETAIN EXISTING PAINT SYSTEM BUT CHANGE GLOSS AND COLOUR

The systems recommended in Tables 8.2 and 8.3 apply, but there should be two finishing coats. Where strong colours are to be changed or the selected topcoat has low opacity, it is also necessary to apply first an undercoat, preferably tinted, to approach the colour of the final topcoat.

8.4 CHANGE OF PAINT SYSTEM

Special precautions may be necessary where paint systems are changed, in order to ensure that the combination of paint types is not mechanically unsound due to excessive differences in hardness and flexibility, and that the proposed paint is not chemically incompatible with the existing paint due to excessive solvent interaction.

With regard to the former point, the general principle should be observed that the layer being applied to the surface should not be markedly less flexible or elastic when fully cured than is its substrate, otherwise it may crack or peel prematurely. Given that latex paints are thermoplastic and, therefore, more flexible than air-drying alkyds or other cross-linking paints, the following practical consequences apply:

(a) Latex paints may be applied over properly prepared solvent-borne enamels, but having made this change, the system should not revert to a solvent-borne enamel at a subsequent repaint; however, latex topcoats should not be used over solvent-borne undercoats in humid conditions.

(b) Solvent-borne enamels should not be applied over latex paints, with the exception of a latex primer, sealer or undercoat applied directly to the substrate (i.e. not over previous paint), because the mechanical properties of a thin layer of latex paint will be constrained by its intimate association with the substrate.

(c) In particular, a flat solvent-borne paint should not be applied over a flat latex paint on a ceiling, due to uncertainties which have been associated with numerous paint failures.

With regard to the latter point, chemical incompatibility between paints due to solvent interaction will become obvious within the time taken for all of the solvents to disappear from the system, which is generally not more than a week or two even for the slow solvents in latex paints. Therefore, it can be tested for by application of proposed paint systems to sample areas. For example frying of previous paints, due to attack of strong fast solvents in lacquers applied to some alkyd enamels, will occur within minutes, whereas the cracking that can occur when acrylic latex paints, particularly flats, are applied over PVA-acrylic latex paints, may take several days to appear.

This contrasts with mechanical incompatibility, which might take months or years to become apparent and so could not be tested for in this way.

8.5 TEST FOR EXISTING PAINT SYSTEM

8.5.1 General

Some field tests may give an indication of the make-up of the existing paint system; however, in the final instance expert advice should be sought.

8.5.2 Specific test methods

Various broad classes of paints may, with practice, be readily distinguished simply by gentle rubbing of a small area with a droplet of one of few common solvents.

The method works on the principle that paints may be divided into classes based on the binder type that gives them their basic performance characteristics, and that each binder type behaves differently towards each solvent, being either dissolved, softened or unaffected by the solvent. Large variations in the proportion of binder in samples of any one binder class may cause small variations in behaviour when rubbing with solvent, so a little practice may be necessary to overcome these minor variations. Alternatively, prepared samples of known paint types may be tested alongside the unknown sample to provide comparison and assurance.

When testing a spot with a solvent, it is important to let the solvent do the work; the fingertip is there only to sense the degree of softening. Rubbing should be so gentle that the fingertip barely moves over the surface.

All coatings are softened by the strongest solvents. Hence, there is little value in starting to test with a solvent any stronger than is necessary to soften the paint. The difference between responses to various solvents allows discrimination between binder types. The most efficient method is to start from the weakest solvent and work upwards in strength until the required result is obtained.

In the absence of specific information the solvent tests of Table 8.1 should be carried out in descending order.

Most paints will slowly wear away if rubbed hard enough; the solvent is then simply a lubricant for the finger, and has little softening effect on the binder. In such cases, only trace amounts will be visible on the fingertip when it is removed, whereas genuine solvent softening of the binder will cause the paint to stick to the finger as it is removed, transferring a significant amount onto the fingertip.

If in doubt as to whether the binder has been significantly softened, rub a larger area with cotton wool moistened with solvent, and then allow it to dry out. If the cotton wool remains soft and flexible, negligible binder has been removed. If the dry cotton wool is hard, a significant amount of binder has been transferred into it after solvent softening and rubbing.

TABLE 8.1

SOLVENT TESTS FOR DECORATIVE PAINT PRODUCTS

Test solvent*	Remarks
Water	Softening indicates kalsomine, limewash and distempers
Alcohol (methylated spirit)	Marked softening or stickiness indicates PVA-acrylic copolymer
Acetone	Softening indicates acrylic or styrene-acrylic copolymer
Methylene chloride	Softening indicates alkyds
Methylene chloride	No softening indicates two-pack epoxy or polyurethane

*CAUTION: THESE SOLVENTS REQUIRE CARE IN HANDLING, OBSERVE ALL SAFETY PRECAUTIONS ISSUED REGARDING THE USE OF ANY OF THESE MATERIALS.

TABLE 8.2

PAINT SYSTEMS FOR INTERIOR SURFACES—MAINTENANCE PAINTING OF SURFACES IN SOUND CONDITION

Specific areas	Painting system
Walls and ceilings	*Existing latex paint* 1 or 2 coats latex paint, flat (B6), low-gloss (B7), semi-gloss (B8) or gloss (B9) *Existing solvent-borne paint* 1 coat of solvent-borne undercoat (B17) *and* 1 or 2 coats solvent-borne paint, semi-gloss (B3) or full gloss (B5) *or* 1 or 2 coats latex paint, low-gloss (B6), semi-gloss (B8) or gloss (B9) (see Notes 1 and 2) *Existing varnish* 1 or 2 coats flat, semi-gloss or full gloss varnish (B19)
Doors fittings and trim	*Existing latex paint* 1 or 2 coats semi-gloss latex (B41) or gloss latex (B42) *Existing solvent-borne paint (see Note* 3) 1 coat solvent-borne undercoat (B17) 1 or 2 coats solvent-borne semi-gloss (B3) or full gloss (B5) *or* 1 coat latex undercoat (B17A) 2 coats semi-gloss latex (B41) or gloss latex (B42) *Existing varnish* 1 or 2 coats flat, semi-gloss or full gloss varnish (B19) (see Note 8)
Floors	*Existing latex paint* 1 or 2 coats paving paint (B24A) (see Notes 4 and 5) *Existing solvent-borne paint* 1 or 2 coats paving paint (B24) (see Notes 4 and 5) *Existing varnish* 1 or 2 coats flat, semi-gloss or full gloss floor varnish [Single pack latex (B19), (B19A) or moisture cure or 2-pack (B20)] (see Notes 6, 7 and 8)

NOTES:

1 Specialized high-build finishes can usually be overcoated with latex paint finish but may necessitate test areas and discussion with product supplier.

2 The solvent-borne undercoat may be omitted from this system where the existing paint film is thoroughly sanded, or equivalent, back to a dull finish (e.g. flatten gloss). This method will also improve the maintenance painting system performance.

3 Where occupancy demands necessitate a low odour or low VOC finish, an existing solvent-borne paint may be overcoated with a system consisting of one latex undercoat and two coats of latex paint.

4 These paints become slippery when wet. The addition of an anti-slip agent is recommended. Incorporation of particulate matter in the final coat will improve slip resistance.

5 Selected two-pack systems are favoured for high-wear areas but the existing surface coating has to be removed.

6 Existing moisture cure or two-pack materials should be completely removed prior to reinstatement.

7 The use of a varnish finish in very wet areas may result in considerable discolouration.

8 Many old timber finishes may bleed or cause defects and a small area of the existing surface should be tested for compatibility with the overcoating material.

TABLE 8.3

PAINT SYSTEMS FOR EXTERIOR SURFACES—MAINTENANCE PAINTING OF SURFACES IN SOUND CONDITION

Specific areas	Existing paint system	Maintenance system
Walls and soffits	Latex paint or high-build textured finish	1 or 2 coats latex paint, flat (B6), low-gloss (B7), semi-gloss (B8) or gloss (B9)
	Solvent-borne paint	1 coat of undercoat, (B17) 1 or 2 coats latex paint, flat (B6) low-gloss (B7), semi-gloss (B8) or gloss (B9) (see Note 1)
Weatherboards, doors, fittings and trim	Latex paint	1 or 2 coats latex paint, gloss (B9)
	Solvent-borne paint	1 coat undercoat, (B17) 1 or 2 coats latex paint, gloss (B9) *or* 1 or 2 coats solvent-borne paint, full gloss (B5) (see Notes 1 and 2)
	Latex stain	1 or 2 coats latex stain (B22)
	Solvent-borne stain	2 coats solvent-borne stain (B23)
Floors	Paving paint	1 or 2 coats paving paint (B24) (see Notes 3, 4 and 5)
	Clear floor finish	2 coats clear floor varnish (B20) (see Note 3)
Pergolas, patios, decking	Latex or solvent-borne borne stain	1 or 2 coats exterior latex stain (B22)
Fences (timber)	Latex or solvent-borne fence finish	1 or 2 coats exterior latex stain (B22) or fence stain (B22A) (see Note 6)
Roofs	Latex paint	1 or 2 coats exterior latex paint (B25) (see Note 7)
	Solvent-borne paint	As above or 1 or 2 coats roofing paint solvent-borne (B26)

NOTES:

1 The solvent-borne undercoat may be omitted from this system where the existing paint film is thoroughly sanded, or equivalent, back to a dull finish (i.e. flatten gloss). This method will also improve the maintenance painting system performance.

2 Latex paint is recommended where maximum durability is the prime consideration. Solvent-borne finishes are recommended where resistance to wear is to be maximized and brush marks and sticking of contact surfaces are to be avoided.

3 Selected two-pack systems are favoured for high-wear surfaces, but the existing coating has to be removed.

4 These paints become slippery when wet. The addition of an anti-slip agent is recommended. Incorporation of particulate matter in the final coat will improve slip resistance.

5 Compatibility of the maintenance painting system with the existing paint system should be confirmed by testing a sample area.

6 Latex stain (B22) is recommended where timber protection is required.

7 Where drinking water is to be collected, roofs painted with latex paint should be rinsed (to drain) several times.

SECTION 9 PREPARATION OF PAINTING SPECIFICATIONS

9.1 GENERAL

The painting specification is an important document and considerable care should be taken with its preparation.

A sound specification is essential if the expected life of a painting system is to be attained. It should set out the requirements for substrate preparation, priming, intermediate and topcoat systems. A correct specification will minimize controversy and disputes during the period of the contract and will protect the interests of both the principal and the contractor. A correctly specified system enables accurate pricing of the work to be carried out and ensures that quotations are made on an equitable basis.

To achieve the maximum benefit, specifications should be clear and concise, be unambiguous and, most importantly, technically sound and practicable.

While the level of detail required would vary with the size and complexity of a particular job, a sound specification should cover the following where relevant:

(a) *Scope* Reference to the following should be included:

- (i) Location (address and aspects of the job).
- (ii) The area to be painted.
- (iii) Schedule of work and time for completion.
- (iv) Sequence to be followed and timing/coordination with other trades.
- (v) If pre-testing and/or sampling is required.
- (vi) If any inspection will be required.
- (vii) Any standards (AS, ISO, NZS, APAS, etc.) to be followed.

(b) *Surface preparation* Reference to the following should be included:

- (i) Level and type of surface preparation required.
- (ii) The types of substrates to be coated.
- (iii) Types of existing coatings.
- (iv) Removal of contaminants.
- (v) Actions to be taken with regard to surface imperfections.
- (vi) Protection of environment and personnel.

(c) *Painting system and materials* Reference to the following should be included:

- (i) Priming and/or sealing coats.
- (ii) Intermediate coats, e.g. undercoats.
- (iii) Finishing coats, e.g. gloss level required, etc.
- (iv) Type of paints, e.g. solvent-or waterborne.
- (v) Quality of paints and accessory materials, e.g. putty.
- (vi) Expected film thickness or coverage.
- (vii) Colour and gloss level of final coat.

(d) *Application* Reference to the following should be included:

(i) Protection of surfaces including previously painted surfaces, surfaces to be left unpainted and surrounding areas.

(ii) Acceptable temperature and humidity conditions.

(iii) Ventilation requirements.

(iv) Method of application (brush, spray, roller, etc.).

(v) Special requirements, e.g. double priming of timber end-grain.

(vi) Reinstatement of damaged coating.

(vii) Recoating and handling time including the drying time needed between painting adjacent surfaces with different paint types (see Clause 6.6).

(viii) Site clean-up and removal of waste.

(e) *Testing* The specifier would need to establish a list appropriate to the project and may include references, e.g.—

(i) moisture content, substrate cleanliness, identification of poor areas of adhesion, drummy surfaces and alkalinity;

(ii) submission of samples before starting; and

(iii) stages at which inspection is to be carried out (if required).

9.2 CONTENT

9.2.1 Scope of the work

9.2.1.1 *Areas and items to be painted*

Details of the areas to be painted should be clearly specified, preferably by reference to drawings, photographs and the schedule of finishes. Items not requiring painting or requiring special treatment should be specified.

NOTE: Prepainted or prefinished fittings should also be covered in the scope.

9.2.1.2 *Painting procedure*

The painting procedure has to be integrated into the basic building program of construction. The schedule for painting, showing such information as whether material is to be sealed or primed before or during erection or on completion of the building, should be detailed in the procedure.

NOTE: To create a good rapport, it may be necessary to hold frequent meetings between the parties concerned—

(a) to establish the initial program and arrange coordination between other trades;

(b) to modify or revise sections of the work to allow proper finishes or protection to be applied to surfaces, so as to ensure that subsequent building operations do not cause damage to the final paintwork; and

(c) to establish the level of finish.

Where a project is to be completed in stages, the order of painting and date required should be specified.

Similar information is also necessary for maintenance painting.

9.2.1.3 *Supplies of equipment and paint*

Items of equipment, storage space and paint, which are to be supplied by each party (principal and contractor), should be clearly stated. In this respect, paints should be stored in clean, dry and well-ventilated areas and with due regard to safety. Other particulars to be specified at this stage should include equipment and facilities, e.g. such items as platforms and scaffolding, light, power, toilet, washing facilities and storage areas.

9.2.1.4 *Regulatory requirements*

Health and safety regulations or other regulatory requirements related to the work should be detailed.

9.2.1.5 *Responsibility for repair of damaged coatings*

The party to be responsible for the repair of any damaged coating should be included under this heading.

Where touch-up of damaged surfaces is deferred, or differs in formulation from the original work, the specifier may need to define the extent and method of touch-up. This is intended to avoid differences in appearance as the surface ages.

9.2.2 Surface preparation

The areas detailed in the Scope have to be referred to in this Section. See Section 3 of this Standard for surface preparation of new unpainted surfaces and Section 7 for previously painted surfaces.

Where appropriate reference should be made to Standards, such as AS 1627.

9.2.3 Painting system

The following details should be specified:

(a) The full coating system to be used including colour, texture and gloss. Where specific items are to be coloured, reference to the appropriate national Standard for colour coding should be included, e.g. AS 1345 or NZS 5807.

(b) Paint types, trade and product names and details of other materials to be used and, where appropriate, any National Standard, e.g. the AS 3730 series of Standards; or approvals list, e.g. APAS lists of Approved Products.

(c) In the event of proprietary paints being specified the paints should be unambiguously identified by, if necessary, specifying brand name, product code or generic performance requirements.

(d) Where required, the spreading rate (coverage) of each coat of paint to be applied should be specified.

(e) Procedure to be followed in the event of contamination of a prepared surface, intermediate coat or the final coated finish.

9.2.4 Samples of painting

On major or complex projects, sample areas of the various painting systems could be called for. These areas should be large enough to show clearly the finish and colour that will be achieved. The painted areas when approved should then be used as the standard for the work and be allowed as part of the finished work. Sample areas should be approved before further work proceeds.

On other work, reference may be made to manufacturers' colour swatches of the paints specified.

9.3 PROVISION OF DOCUMENTS

Where practicable, copies of drawings and building specifications should be provided. The inclusion of a schedule of finishes setting out details of location, nature of surfaces, paint system and colours is recommended.

A master set of the contract documents should be kept at the contract location for reference by the parties to the contract or subcontract.

NOTE: A contract is a signed agreement between the parties concerned to carry out the work. It is recommended that a painting specification be attached to this agreement, that it be initialled by both parties and that it forms part of the contract documents.

Specifications are subject to amendment by agreement of all parties and the amended specification including initialled and dated alterations should be made available to all parties.

9.4 DEFECTS LIABILITY PERIOD

Consideration should be given to the provision in the contract for a defects liability period where these are not covered by statutory regulations.

The specification should set out the defects to be covered and the remedial action to be taken, e.g. cutting out, stopping, pointing up, making good, repainting.

NOTE: Defects are to be limited to faulty paint materials and workmanship. Painters should not be held responsible for faults due to other trades, although a painter should not knowingly paint over faulty work.

APPENDIX A

CHECKLIST FOR THE PREPARATION OF A PAINTING SYSTEM SPECIFICATION FOR NEW SURFACES

(Informative)

A1 SCOPE

This Appendix provides guidance on a step-by-step procedure using this Standard, to prepare a painting system specification for the painting of previously unpainted surfaces. Where no specific application standards apply, the minimum standard to follow is the recommended specification for the relevant manufacturer specific to the product type or substrate.

A2 CHECKLIST

The following checklist should be used:

		Refer to
Step 1	Determine what is in this Standard (AS/NZS 2311)	Table of Contents
Step 2	Ascertain whether there is a need to alter existing designs in light of advice contained in this Standard	Section 2
Step 3	Ascertain the exposure conditions under which the system is expected to perform, e.g. sunlight, rain, abrasion, interior lighting	Section 1
Step 4	Select the surface preparation for the building material in use, appropriate to the painting system to be applied	Section 3
Step 5	Specify paints by either— (a) by reference to national Standards or approved products list; or (b) by manufacturer and brand name Include reference to colour and gloss	Section 4 Section 5 and Table 4.2
Step 6	Specify painting system, coat by coat	Section 5
Step 7	Specify paint application procedure (include those to be excluded)	Section 6
Step 8	Specify inspection system (frequency, etc.) and the name of the inspector or inspecting authority	Appendix C
Step 9	If necessary, specify commencement date and completion date for each section	Contractual; to be agreed
Step 10	Specify procedure to be followed in the event of contamination or damage to a prepared surface, intermediate coat of paint, or the final coat of paint	Contractual; to be agreed
Step 11	Ensure that all requirements are embraced by the specification	Section 9

APPENDIX B

CHECKLIST FOR THE PREPARATION OF A MAINTENANCE PAINTING SYSTEM SPECIFICATION FOR PREVIOUSLY PAINTED SURFACES

(Informative)

B1 SCOPE

This Appendix provides guidance on a step-by-step procedure, using this Standard, to prepare a maintenance painting system specification for the painting of previously painted surfaces. Where no specific application standards apply, the minimum standard to follow is the recommended specification for the relevant manufacturer specific to the product type or substrate.

B2 CHECKLIST

The following checklist should be used:

		Refer to
Step 1	Consider the condition, performance and generic type of the previous paint system	Section 7 and practical experience
Step 2	Where premature failure has occurred, establish the cause and extent and take appropriate action to eradicate the failure	Section 7 and practical experience
Step 3	Consider whether any repairs or replacement of building material is necessary	Visual inspection
Step 4	Specify surface pre-treatment, type and degree of surface preparation required	Section 7
Step 5	Specify paints either— (a) by reference to national Standards or approved products list; or (b) by manufacturer and brand name Include reference to colour and gloss	Section 8 and Table 4.2
Step 6	Specify repainting system, coat by coat	Section 8
Step 7	Specify method of application of paints	Section 6
Step 8	Specify inspection system (frequency, etc.) and the name of the inspector or inspecting authority	Appendix C
Step 9	If necessary, specify commencement date and completion date for each section	Contractual; to be agreed
Step 10	Specify procedure to be followed in the event of contamination of the intermediate or final coat of paint	Contractual; to be agreed
Step 11	Ensure that all requirements are embraced by the specification	Section 9

APPENDIX C

INSPECTION AND TESTING

(Informative)

C1 SCOPE

This Appendix provides information on the need for inspection and the duties that should be assumed by the person(s) assigned to the task.

C2 GENERAL

It is desirable, particularly for major projects, to appoint an inspector. The inspector should be responsible to the architect, builder, project manager, agent or other site representative in charge of the project, to ensure that the whole protective paint system is applied strictly in accordance with the specification including any amendments agreed to and initialled by all parties. The inspector should be of reliable character and should have access to, and be competent in, the necessary testing equipment and materials required to carry out all inspections in accordance with Clause 9.2.

Prior to commencement of the job, a site conference should be arranged between the architect, paint manufacturer, painting contractor and paint inspector to ensure that all parties are familiar with the specification and the method of inspection to be adopted by the inspector. The inspector should ensure that the specification is technically correct, and the painting work proposed is practicably and technically achievable.

For preference, minutes should be taken of the meeting with copies being made available to all parties concerned.

Furthermore, the authority of the inspector should be sufficient to ensure that the decisions of the responsible person are enforced; however, the inspector should not give verbal instructions directly to the painting contractor or subcontractor or to the applicator of the materials. Such instructions should be supplied in writing to the person selected for this purpose, at such site meetings. The result of the inspection procedures adopted by the painting inspector should aim at achieving good trade practice and encouraging sound paint application techniques, to prevent problems and other defects in the coating system.

Inspections should be carried out at regular intervals or at specified pre-determined hold points, as set out in the specification, in order to assess the painting work performed and approve painting work to proceed. Written comments and signatures should be provided on work sheets, indicating whether work standards conform or do not conform to the pre-determined quality of the painting work.

The inspector should work in close collaboration with the painting contractor and the principals of the project.

C3 INSPECTOR'S DUTIES

NOTE: The following list of duties is not exhaustive.

C3.1 Paint materials

The inspector should ensure that all materials comply with the relevant Australian or Australian/New Zealand Standard or other specified Standards nominated in the specifications prepared for the proposed painting work.

C3.2 Surface preparation

The inspector should ensure the following:

(a) On-site conditions are satisfactory for the preparation of the surfaces to be painted and the premises are suitably equipped with water and power.

(b) Surface preparation has been correctly carried out according to the specification or to the amended and initialled alterations that have been agreed to at meetings held between the various parties.

(c) All surface preparation and sealing or priming of bare surfaces has been carried out in such a manner and during such weather conditions, that temperature and humidity conditions are acceptable for surface preparation, and that the work performed is not affected by rain, condensation or dew.

(d) When surface preparation is completed, precautions are taken to prevent contamination of the completed prepared surfaces or the sealed or primed surfaces, and that they will not be affected by fumes, toxic materials or other deleterious substances.

(e) No damage is caused to pre-painted surfaces and that other surfaces adjacent to the areas being painted are protected and that no damage occurs to the sealed or primed surfaces, during the ensuring drying period.

(f) Any damage that has occurred to the prepared and sealed or primed surfaces is made good before proceeding with the work.

(g) All coats of sealer or primer that are to be applied are of the correct type and are correctly applied.

C3.3 Paint application

The inspector should ensure the following:

(a) All paints in the paint system are applied to the various surfaces in the correct sequence and in accordance with the prepared specifications and the paint manufacturer’s recommendations, regarding thinning of the paint and paint coverage rates.

(b) There is proper paint covering applied to all corners, crannies, thin edges, arrissed surfaces, properly stopped-up cracks, end-grain and other difficult places of paint application.

(c) The paint containers carry the label of the correct brand of paint, and the type and the colour of the paint is considered acceptable; all containers are inspected for the presence of leaks or damage, which may cause the contents to deteriorate; and the condition of the paint is checked for such problems as undue settling, thick surface skin, gelling, presence of foreign matter and paint skins.

(d) The condition of the paint in the container being used by the paint applicator is checked for undue thinning or adulteration and that wet or dry film thickness of the coatings are as specified, or equivalent to the paint manufacturer’s spreading rate.

(e) Two-pack paint products are correctly measured and mixed according to the paint manufacturer’s instructions and are not used after the expiration of the pot life of the mixed material, as recommended by the manufacturer.

(f) Before application of the succeeding coat of paint, each existing coat is given the drying time recommended by the manufacturer. The date of paint application should be recorded and should the paint not sufficiently dry, the paint should be given sufficient additional drying time.

(g) Sufficient paint of the correct type and colour is 'boxed-together', prior to commencement of painting, to ensure that there is enough paint available to complete the whole of the wall or building being painted.

(h) All surfaces are dry and condensation related to ensure reduction in temperature does not occur before the surface-dry condition of the paint has been reached.

(i) Any defective work is corrected; the surface preparation is performed and the paint systems specified for use are correct; the recoating follows precisely the correct paint system nominated, according to the original or amended/initialled and dated specification.

(j) Samples of each batch of paint are taken from the paint pot or paint container being used by the paint applicator, as well as samples from previously unopened but thoroughly stirred paint containers, so that samples may be analysed if required, in order to determine the quality and composition of the paint and allow it to be checked for compliance, as set out in the specification. Such tests should be conducted by the paint manufacturer or an independent registered testing authority.

(k) All intermediate coats of primer and undercoat are properly scuffed between coats, in order to remove dust pick-up, protruding fibres and coarse particles, and are thoroughly dusted or wiped clean, before the application of the following coatings in the paint system specified.

(l) The painting work and the inspection are performed in well-lit, natural or artificial lighting conditions. Lighting conditions during inspections should be similar to the final anticipated lighting conditions as excessive or poorly directed illumination can lead to the misinterpretation of the quality of the paint finish.

(m) A complete record of the work is compiled, including the area of surfaces to be coated by the applicator, the date of paint application of the surfaces involved, coating progress, brand and batch numbers of coatings used, weather conditions, reasons for delays, coating thickness and all other pertinent information.

(n) Each coat of paint specified for use in the paint system is in accordance with this Standard, and the following qualities and properties are satisfactory:

  (i) The paint coatings applied have uniformity of finish, colour, texture, gloss level, opacity, hiding power, paint film thickness and that the proper number of coats of paint have been applied in the correct sequence and in accordance with the specification.

  (ii) The paint is free of application defects and blemishes such as paint runs, paint sags, wrinkling, fatty edges, entrained paint skins, bristles from paint brushes, human hair, dust, bare or starved painted areas, surface cracks, irregular and coarse brush marks, ladders and blistering or other discontinuities.

C4 FINAL INSPECTION

The final inspection should ensure the following where appropriate:

(a) The painted surface shows—

  (i) uniformity of gloss, colour and opacity;

  (ii) correct range of dry film thickness of paint;

  (iii) freedom from painting defects such as—

    (A) tackiness and paint application defects; and

    (B) brush marks, roller coater marks, spray application defects and those irregularities in texture, which are inconsistent with good trade practice.

NOTE: Differences in appearance will occur; however, where such differences are not clearly discernible from a distance of typically 1.5 to 2 m when viewed under normal lighting conditions the finish is usually considered acceptable. Joinery should be also inspected for the presence of light surface grit or coarse particles which may only be identified by touching the surface.

(iv) General cleanliness and absence of disfigurement, related to paint application.

NOTE: Surfaces, fixtures and fittings should be checked to ensure that they have been masked or removed, and that all paint spills or stains have been removed as set out in the specifications.

(b) The surrounding area is clean, tidy and undamaged, and all of the paint contractor's materials, equipment and debris related to the work performed, are removed from the premises or site.

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The reference given is the appropriate Clause, Table (T), Figure (F), Section or Appendix designation.

NOTES

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

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The first national Standards organization was created in New Zealand in 1932. The New Zealand Standards Executive is established under the Standards and Accreditation Act 2015 and is the national body responsible for the production of Standards.

Australian/New Zealand Standards

Under a Memorandum of Understanding between Standards Australia and Standards New Zealand, Australian/New Zealand Standards are prepared by committees of experts from industry, governments, consumers and other sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian/New Zealand Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

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ISBN 978 1 76035 694 1

Printed in Australia