5 FINISHES

5.1 General

This Section provides a framework for the specification of the performance and application of surface coatings which are common place in the finishing of facade components. It does not set out to be exhaustive and specifically avoids other treatment finishes such as stone, GRP, GRC, laminates, etc.

To assist the user in more detailed considerations of specific coating treatments, reference should be made to relevant British Standard Codes which are applicable and are quoted within the text.

- Designers should be aware of the BSI policy that as a revision of existing standards falls due, and when new standards are written, they will usually be changed from SPECIFICATIONS, to METHODS OF SPECIFYING. This change places upon the designer the responsibility of specifying explicitly what he requires, using the BS as a guide, rather than merely quoting a specification number without further qualification.
- 5.1.3 It is incumbent upon the Specifier and his design team to give careful consideration to the practicality of the finish when choosing an appropriate coating finish for facades. One of the aspects for consideration must be the local environment and reference to the MAFF map of corrosive atmospheres in the UK would be appropriate. With paint and powder coatings intended to serve in aggressive environments, especially industrial and marine environments, suppliers and applicators may require an increase in coating thickness above normal, before they can give a guarantee. Advice should be sought in these cases.
- **5.1.4** Attention should be paid to the factors which cause differing appearances on metal finishes brought about by differing sub-structure/material.

Whenever a treatment of finish is applied to a metal surface, attention is drawn to the importance of preparation, cleaning and pre-treatment of all metal surfaces.

5.2 Steel Components

- 5.2.1 All steel framing members, reinforcement to framing members, steel fixing brackets, etc. should be either:
 - Hot dip galvanised after manufacture, including welding, holing and slotting in accordance with BS 729.
 - Coated utilising one of the appropriate equivalent treatments described in BS 5493.

The selected treatment should be appropriate to the life expectancy of the member to which it is applied.

5.2.2 The Specifier should state any requirements based on durability. Where tubular steel members are utilised, care should be taken to ensure that the inside of the section is coated to an equivalent standard, or alternatively that the inside is totally sealed against corrosive attack.

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- **5.2.3** Mild steel straps, lugs, washers, shims and other such fixings, also mild steel fixing bolts, anchors, screws, rivets and nuts should be coated with one of the following finishes:-
 - Hot dip galvanising in accordance with BS 729.
 - Sherardizing within BS 4921 Class 1 with a passivation post-treatment.
 - Zinc plating in accordance with classification Zn12 of BS 1706 with chromate conversion to Class 2C or 2D.
 - Sprayed zinc in accordance with Zn7 of BS 2569: Part 2.

These finishes are not strictly comparable and their use and the environments in which they are to serve should be carefully considered before making a choice.

5.3 Polyester Powder Paint Finish

- 5.3.1 Polyester powder finishes should comply with the requirements of BS 6496 for aluminium alloy components and BS 6497 for steel components. The components should be factory finished by applicators approved by the supplier of the polyester powder. Where conditions allow, only one applicator should be used for the whole of the works. One powder supplier only should be used for the whole of the works.
- 5.3.2 The reference to one applicator is made to ensure the greatest control of colour consistency throughout the production period. Ideally, arrangements should be made with the powder supplier to provide one batch of powder paint, which is more conducive to colour consistency than one approved applicator.

The Specifier should note that some applicators may not be licensed for more than one proprietary powder coating system.

5.3.3 The Specifier should be aware that within the British Standards are conditions which call for certain decisions/agreement to be entered into.

The guarantees/warranties which are available must be supplied by the applicator, fully titled and countersigned.

5.3.4 All components should be coated on all significant surfaces to a minimum thickness of 40 micrometres on aluminium substrate and 60 micrometres on galvanised steel substrates.

For certain colours and locations minimum thicknesses greater than 40 micrometres may be required, for example on the faces of large individual panels. With paint and powder coatings intended to serve in aggressive environments, especially industrial and marine environments, minimum thicknesses greater than 40 micrometres are required. Advice should be sought in these cases.

An appropriate definitions of the terms significant surface and minimum local thickness are to be found in BS 5411: Part 1

5.3.5 Only the total coating thickness (zinc coating + paint or powder) can be measured by non-destructive means on galvanised steel substrates. It is therefore essential to record the thickness of the zinc coating at re-locatable sampling points on selected components, prior to the application of paint or powder, and to measure the total thickness at these points after coating. The paint or powder coating thickness is then found by difference.

The recommendation given in BS 6497 to measure the thickness of the powder coating by the eddy current method (BS 6497 clauses 10.5, 13.3.1 and 13.3.2) does not give reliable results because of the presence of a magnetic substrate (steel) and the large variations in local thickness of the zinc layer.

5.3.6 Pre-finished lengths of aluminium alloy materials are permissible for internal components provided care is taken in design to ensure that unpainted edges of components are not finally visible.

The machining requirements of pre-finished lengths of materials for external use should be carefully considered to satisfy the Specifier that any bare unsealed edges are not visually unacceptable and that any subsequent edge corrosion will not lead to degradation of the finish.

5.3.7 There should be no 'seeding' of the cured film, which should be dense and consistent. The coating should be free of pin holes, blisters, tears, damage and other coating defects when evenly illuminated by diffuse daylight and viewed using normal, corrected vision from a distance of one metre.

'Seeding' is brought about by surface contamination, which when over painted can be seen and felt by touch.

- 5.3.8 The appearance of the finish, including the gloss, colour and surface texture should be agreed between Specifier and sub-contractor and sets of colour and texture control examples should be produced and approved, with a set to be retained by the Specifier, the facade manufacturer, and the coating applicator. Samples from the production material should be submitted to test for film thickness and hardness, curing, gloss and adhesion.
- Many oven baked paint processes display a degree of 'orange peel texture' to the cured surface dependent upon thickness and flow of coating during the hot cure process. The 'orange peel texture' should not be obtrusive.

Metallic pigmented finishes require specialist advice.

Any rejected components should be stripped of the total finish by the subsequent applicator of any new finish.

5.4 Anodised Finishes

5.4.1 Anodic oxidation coatings to aluminium alloy components should be applied so that the finish to each individual component conforms to the requirements of BS 3987, except as shown below with regard to minimum thicknesses.

Aluminium alloys 6063 for extrusions and J57S for sheet are necessary where colour consistency is a pre-requisite.

5.4.2 Where colour matching is important the anodising should be carried out by a single plant.

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5.4.3 All components anodised by sulphuric acid processes should be coated on all significant surfaces to a minimum local thickness not less than 25 micrometres, and a maximum local thickness not exceeding 40 micrometres.

All components anodised by Duranodic, Permalux, Calanodic and other integral colour processes should be coated on all significant surfaces to a minimum local thickness of 25 micrometres.

Definition of a significant surface, minimum local thickness, and maximum local thickness are to be found in BS 5411: Part 1.

The achievement of dark colours, utilising integral anodising processes is relative to the thickness of coating beyond the 25 micrometre minimum thickness.

5.4.4 Pre-finished lengths of materials are permissible for internal components provided care is taken in design to ensure that uncoated edges of components are not finally visible.

The machining requirements of pre-finished lengths of materials for external use should be carefully considered to satisfy the Specifier that any bare unsealed edges are not visually unacceptable and that any subsequent edge corrosion will not lead to degradation of the finish.

- **5.4.5** Light and dark colour limits should be agreed between Specifier, facade manufacturer and anodiser and sets of examples shall be retained by each party. Samples from the production material should be submitted to test for film thickness, sealing quality to BS 3987 and abrasion resistance to BS 6161: Part 18.
- 5.4.6 In order to ensure a colour match of anodised aluminium, it may be necessary to use a single batch of alloy or to restrict each batch to specific areas such as a complete elevation, where contract size allows. Any such requirement should be agreed in writing with the aluminium alloy producer and QA procedures adopted accordingly.
- 5.4.7 Anodic oxidation coatings coloured by combining dyeing with electrocolouring, such as are produced by the 'Sandalor' colouring system shall be tested for light fastness by the method specified in BS 6161: Part 8. Change in colour shall not exceed 30 cielab units.

5.5 PVDF Polyvinylidene Fluoride

5.5.1 There is no British Standard written for PVDF, but such systems may reasonably be specified to be in accordance with BS 4842 or AAMA 605.2 and the paint manufacturer's specification.

For architectural use PVDF/acrylic blends should contain no less than 70 per cent of Polyvinylidene fluoride resin.

The components should be factory finished by applicators approved by the paint supplier. Where conditions allow only one applicator should be used for the whole of the works.

- **5.5.2** The reference to one applicator is made to ensure the greatest control of colour consistency throughout the production period.
- 5.5.3 All components should be coated on all significant surfaces with a spray primer coat to a thickness recommenced by the paint supplier and allowed to cure for the interval recommended by the manufacturer before spray application of top coat to a minimum dry film thickness of 25 micrometres.

An appropriate definition of a significant surface is to be found in BS 5411: Part 1.

5.5.4 The Specifier is urged to ensure that all components of the system, primer and colour coat should come from the same supplier.

For certain metallics and light sensitive pigments a clear film coating can be applied of minimum dry film thickness 10 micrometres to provide a three coat finish and the performance required.

5.5.5 The Specifier should ensure that special QA procedures are in place to make certain that components are independently examined and approved or rejected at source. PVDF coatings are relatively inert and existing stripping procedures tend to damage the substrate. Consequently trade coaters prefer to apply additional material, since PVDF generally accepts recoating without difficulty if properly undertaken. Specifiers should seek authoritative advice on this.

Given that excessive coating may cause tolerance problems and that overpainting can be used merely to hide defects that may cause serious problems at a later date, Specifiers must ensure that any re-coating is rigorously controlled. If this is not possible to the Specifier's satisfaction, then the components should be scrapped completely and re-supplied. It should be noted that this rejection rate, from experience, averages around four per cent of components numbers.

5.5.6 Pre-finished lengths of materials are permissible for internal components provided care is taken in design to ensure that unpainted edges of components are not finally visible.

The machining requirements of pre-finished lengths of materials for external use should be carefully considered to satisfy the Specifier that any bare unsealed edges are not visually unacceptable and that any subsequent edge corrosion will not lead to degradation of the finish.

- **5.5.7** There should be no 'seeding' of the cured film which should be dense and consistent. The coating should be free of pin holes, blisters, tears, damage and other coating defects, when evenly illuminated by diffuse daylight and viewed using normal, corrected vision from a distance of one metre.
- 5.5.8 The appearance of the finish, including the gloss, colour and surface texture should be agreed between Specifier and sub-contractor and sets of colour and texture control examples should be produced and approved, with a set to be retained by the Specifier, the facade manufacturer, and the coating applicator. Samples from the production material should be submitted to test for film thickness and hardness, curing, gloss and adhesion.

5.6 Acceptance Testing

5.6.1 The Specifier should ensure that provision is made for acceptance testing. Such inspections should be made at the applicator's finishing plant before parts are shipped and, if possible, before small individual parts are pre-fabricated into large unwieldy items.

The reports of the inspections should be made to the Facade contractor for onward transmission to the Specifier.

- The Specifier may wish, particularly on large contracts, to employ an independent inspector for acceptance testing. The reports and recommendations of the independent inspector should be made to the Specifier and should be the basis on which the finished work is accepted or rejected. Before such independent inspections commence, samples which have been agreed with the Architect and which show the colour, texture and level of gloss of the project should be supplied to the independent inspector.
- **5.6.3** The inspection certificates should demonstrate that the appearance of the surface finish complies with agreed samples.

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- 5.6.4 These certificates should demonstrate that all relevant tests in accordance with the appropriate British Standard have been carried out and that the finish complies with the appropriate standard in all respects.
- Sampling should be in accordance with BS 6001, General Inspection Level II. Where three or more batches, in continuing production, are inspected, sampling plans should be chosen so as to accept those lots for which the properties of the sample indicate a quality equal to, or better than the following acceptable quality levels (AQL):

For minimum local total film thickness, curing of the film, adhesion, freedom from entrapped dirt (seeding), pin holing and aesthetic defects: AQL of one per cent.

For gloss, hardness, colour matching and absence of obtrusive roughness: AQL of four per cent.

5.6.6 If components are submitted as a single isolated lot, the sampling plans should be chosen from BS 6001: Part 2, to accept a lot whose properties indicate a quality at least as good as the following limiting quality (LQ) at a probability of acceptance of ten per cent:

For minimum local total film thickness, curing of film, adhesion, freedom from entrapped dirt (seeding), pin holing and aesthetic defects: LQ of 5.0 per cent

For gloss, hardness, colour matching and absence of obtrusive roughness: LQ of 12.5 per cent.

5.7 Protection of Factory Applied Finishes

- All significant surfaces of painted/anodised finishes for facade components should be protected against abrasion during manufacture and installation processes. Except as stated below the protection should remain in place until all works potentially damaging to the component or its finish are complete. However, no protection should be left in-situ for more than six months and should the protection requirement extend beyond this time, then the original protection should be stripped off and immediately renewed. Materials used for this temporary protection should be compatible with and subsequently peelable from the surface and finishes without detriment to the finish and should be approved by the paint supplier, anodiser or Facade contractor. They should also be used in accordance with the tape manufacturer's instructions.
- 5.7.2 Temporary protection must not stay on the surface for more than six months or difficulties may be experienced stripping the tape and/or adhesive film from the component. Damage to the finish may also result which will invalidate any guarantees.

5.8 Site Remedial Operation

- 5.8.1 Site rectification of damage to the finish of components should only be carried out with the Architect's approval and on those elements of the works where removal and replacement of the damaged component would cause major disruption. Such remedial measures should be carried out on small localised areas of the surface only.
- 5.8.2 The Specifier should obtain an approved remedial specification early in the contract, ideally as part of the contract specification, rather than at the time remedial measures are seen to be required.
- **5.8.3** Where significant surface damage occurs to cosmetic clip-on components which have been incorporated into the works, such components should be removed and renewed.

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5.8.4 Remedial paint measures should be carried out strictly in accordance with the paint suppliers/anodisers remedial specification and by specialist paint contractors who are approved by them.

'Touching-up' by installation operatives should not be allowed.

5.9 Durability

5.9.1 All finishes applied to facade structural components, with the sole intention of preventing corrosion through time, should have a design life of at least 25 years without appreciable loss of performance and without the need for maintenance.

This clause applies to fixing brackets, lugs, cleats, reinforcements to framing, etc., including fixing bolts, anchors and fasteners generally. It does not apply to components which are finished for cosmetic/architectural purposes.

- **5.9.2** Factory-applied finishes to internal surfaces of facade components should have a design life of at least 25 years without appreciable degradation and without the need for maintenance, other than regular cleaning as identified in an authorised maintenance manual.
- **5.9.3** Factory-applied finishes to external surfaces of facade components should have a design life of at least 25 years without appreciable loss of performance and without the need for maintenance, other than regular cleaning as identified in an authorised maintenance manual.
- 5.9.4 The durability of external finishes is dependent upon the environment and exposure conditions. Warranties are available, but are of lesser duration than the design life, as practical experience demonstrates that whilst the protective function may be retained, other qualities, such as colour and gloss level, may deteriorate.

Bright colours, eg, reds and blues are substantially less colour fast than other colours and written statements should be obtained from the paint supplier, anodiser or Facade contractor regarding colour fastness.

5.9.5 It is possible to design facades with external face caps and other removable components, which may be re-coated or replace with new, should their finish have a shorter life expectancy than the facade as a whole.

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