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Surface Preparation

Materials used today in buildings, plant and equipment include mainly mild steel, concrete, brickwork, aluminium, galvanized steel and timber.

Steel and concrete are usually selected for areas subject to chemical exposure because of their inherent properties and, furthermore, they may be protected from corrosive attack by the proper paint coating. Aluminium, galvanized steel and timber because of their characteristics are used in less demanding areas and they, too, are capable of protection by means of coatings. Irrespective of the material chosen, an adequate degree of surface preparation with due consideration of the environment is essential since it is on this basis that the adhesion of the correct painting system is dependent.

It is of supreme importance to consider the following factors in any decision of surface preparation:

- Length of service required
- The type of exposure:
 - Normal coastal
 - Industrial
 - Rural or tropical atmosphere
 - Exposed to the elements or under cover
- Nature of chemical exposure:
 - Continuous or intermittent contact with acids
 - Alkalis
 - Salt solutions
 - Condensation
 - Fumes or fall-out
 - Immersed or underground conditions

Irrespective of the surface chosen, it is mandatory that before painting all dirt, dust, oil and grease or other loose surface contaminants be removed since it is obvious that paint applied to them will have poor adhesion to the underlying surface and the paint will flake off exposing the substrate to attack, resulting in costly maintenance, unsightly appearance and perhaps failure of the structure. Painting must always be carried out as soon as possible after, and usually no later than the same day, as the surface preparation.

The following sections deal with each type of surface grouped under the following headings:

- Steel
- Non-ferrous
- Non-metallic

A detailed section covering surface preparation methods for steel is included.

STEEL

Mild steel for its strength to weight ratio and cheapness is one of the most widely used construction materials. However, it readily rusts and must be painted to prevent this corrosion and to provide to it a decorative appearance.

Mill scale found on new steel is a hard, brittle coating of several distinct layers of iron oxides formed during processing of steel such as hot rolling of girders, tank plates and other structural shapes. Usually bluish black in colour, mill scale cracks and fissures readily, permitting air and moisture to penetrate and rusting at the interface of the underlying steel occurs; the pressure of the rust build up sloughs off the scale. Mill scale is cathodic to the steel substrate and so great is the electrical potential between them that deep pitting of the steel results.

Rust is an oxide of iron formed by the action of air and water. It is voluminous and occupies one and three-quarter times the volume of the steel from which it originated. Rust forming under a paint coating or through breaks in the coating, can burst through and may creep under the coating resulting in flaking so that repair is both difficult and costly.

It may cost a little more for a better surface preparation than at first thought necessary, but as the paint coating will last many times longer, the overall cost saving in maintenance will justify the increased initial expense.

Other types of steels, such as low alloy steels which are selected in areas requiring increased strength, hardness or improved resistance to corrosion, such as Austen 50, can also be prepared by the following methods.

The various methods of preparing steel for subsequent painting are given in Australian Standard 1627, issued by the Standards Association of Australia, with reference to pictorial standards depicted in Swedish Standard SIS 05 59 00, Aust. Standard 1627.9 and are equivalent to U.S.A. Steel Structures Painting Council Preparation Methods. It is strongly recommended that the appropriate Standard be stated to define clearly the degree of surface preparation required.

These methods are summarised as follows and specifying personnel are welcome to abstract relevant sections for their own specification.

(a) BLAST CLEANING, Australian Standard 1627.4 is a method of removing rust and mill scale by the physical impact of an abrasive propelled on to the surface by compressed air or by centrifugal force from a multiwheel machine. Non-metallic abrasive sand, ilmenite or copper slag are used for on site blasting, while in the fabricating shop a combination of round steel shot and steel grit may be used, the shot on impact breaks the mill scale and rust while the grit imparts profile or tooth to the abraded surface.

Blasting may be carried out by any of the methods and using any of the types and grades of abrasive quoted in Australian Standard 1627.4. In any event the maximum profile height shall be $75\mu\text{m}$ and if this figure is exceeded, for each $25\mu\text{m}$ over, an additional $25\mu\text{m}$ of paint shall be applied.

If compressed air blasting is used, the air shall be free of detrimental amounts of water and oil. Adequate traps and separators shall be provided at the compressor.

"WHITE" METAL BLAST CLEANING

1. All surfaces to be coated shall be blast cleaned to a White Metal finish according to Australian Standard 1627.4 Class 3. This degree of preparation approximates Standards Sa 3 of Swedish Standard SIS 05 59 00, AS 1627.9 and Steel Structures Painting Council Spec. SSPC-SP5.

2. **A White Metal Blast Cleaned Surface Finish is defined** as a surface from which all mill scale all rust and all foreign materials are entirely removed. The surface when viewed without magnification shall be free of all oil, grease, dirt, visible mill scale, rust, corrosion products, oxides, paint and any other foreign matter. The colour of the clean surface may be affected by the particular abrasive medium used. Photographic or other visual standards of surface preparation may be used if required to further define the surface if specified in the contract.

"NEAR WHITE" METAL BLAST CLEANING

1. All surfaces to be coated shall be blast cleaned to a "Near White" metal finish according to Australian Standard 1627.4 Class 2½ . This degree of preparation approximates Standards Sa 2½ of Swedish Standard SIS 05 59 00, AS 1627.9 and Steel Structures Painting Council Spec. SSPC-SP10.

2. **A "Near White" Metal Blast Cleaned Surface Finish is defined** as a surface from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very slight shadows, very slight streaks or slight discolourations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain. At least 95% of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to the light discolouration mentioned above. Photographic or other visual standards of surface preparation may be used if required to further define the surface if specified in the contract.

"MEDIUM OR COMMERCIAL" BLAST CLEANING

1. All surfaces to be coated shall be blast cleaned to a Medium or Commercial finish according to Australian Standard 1627.4 Class 2. This degree of preparation approximates Standard Sa 2 of Swedish Standard SIS 05 59 00, AS 1627.9 and Steel Structures Painting Council Spec. SSPC-SP6

2. **A Commercial Blast Cleaned Surface Finish is defined** as a surface from which all oil, grease, dirt, rust scale and foreign matter have been completely removed from the surface and all rust, mill scale and old paint have been removed except for slight shadows, streaks or discolourations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain.

If the surface is pitted, slight residues' of rust or paint may be found in the bottom of pits. At least two-thirds of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to the light discolouration, slight staining or light residues mentioned above. Photographic or other visual standards of surface preparation may be used if required to further define the surface if specified in the contract.

"LIGHT" OR "BRUSH OFF" BLAST CLEANING

1. All surfaces to be coated shall be blast cleaned to a Light or Brush Off finish according to Australian Standard 1627.4 Class 1. This degree of preparation approximates Standards Sa 1 of Swedish Standard SIS 05 59 00, AS 1627.9 and Steel Structures Painting Council Spec. SSPC-SP7.

2. A Light or Brush Off Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, rust scale, loose scale, loose rust and loose paint or coatings are removed completely, but tight mill scale and tightly adherent rust, paint and coatings are permitted to remain provided that all mill scale and rust have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface. Photographic or other visual standards of surface preparation may be used if required to further define the surface if specified in the contract.

(b) PICKLING, Australian Standard 1627.5 of steel is the removal of mill scale and rust using chemical solutions, usually acids. Pickling cannot be used on erected structures and is essentially a process for the workshop. Carried out efficiently it is equivalent to white metal blast cleaning and leaves a relatively smooth surface on which it is often easier to obtain a more even paint coating; however, with some very high build paint coatings such as tar epoxies applied up to 500 μm the "tooth" from a blast cleaning profile may be preferred.

Steel surfaces pickled to Australian Standard 1627.5 approximates the United States Steel Structures Painting Council Specification SP-8.

1. A Pickled Steel Surface Finish is defined as one from which all mill scale, all welding scale, all rust and other foreign matter are removed.

2. Solvent or alkaline cleaning 1627.1 or mechanical methods 1627.4 shall be used initially to remove heavy deposits of oil, grease, dirt and other matter not removable by pickling. Small quantities of such matter may be removed by the pickling procedures, provided that no detrimental residues reduce the efficiency of the pickling solutions. Weld splatter and slag shall also be removed prior to pickling.

3. Pickling may be carried out by any of the methods using either acid, alkaline or electrolytic baths, or combination, provided adequate precautions are observed to (a) ensure sufficient inhibitor has been added to minimise attack on the base metal when pickling in acid solutions. (b) Acid pickling or cathodic treatment methods are not used on steel having a tensile strength greater than 1000 Mega Pascals (MPa) or on the welded areas of low alloy steels as these heat affected zones would approach 1000 MPa. This precaution is necessary to prevent hydrogen absorption and subsequent embrittlement which may result in failure due to hydrogen cracking.

4. The pickled steel surface shall be free of unreacted or harmful acid or alkali, smut, metal deposits, improperly cleaned areas and any inhibitive iron phosphate coating shall be firmly adherent to the underlying metal.

(c) POWER AND HAND TOOL CLEANING are the least effective methods of surface preparation processes as they do not permit complete removal of tight mill scale and rust, especially in the bottom of pits, corners and angles.

Power and hand tool methods can be uneconomical of labour compared with Class 1 or 2 of blast cleaning, and hand tool cleaning is physically arduous and may require constant supervision to ensure the specification is followed.

Generally these methods of preparation are adequate for use on structures exposed to mild conditions only or in maintenance painting where blasting is not possible. Due consideration must be given to a painting system compatible with a surface retaining varying amounts of rust.

POWER TOOL CLEANING OF STEEL SURFACES

1. All surfaces to be coated shall be cleaned by the use of power-driven tools according to Australian Standard 1627.2. This degree of preparation approximates Steel Structures Painting Council Specification SSPC-SP3. Reference is made to Pictorial Standards of original unpainted surfaces of Australian Standard 1627.9 and to painted surfaces with varying amounts of visible rust, the amount rated typified by the Reference Standards of Australian Standard 1580 Method 481.3.

2. **Power Tool Cleaning is defined** as a method of preparing new, corroded or previously painted steel surfaces prior to painting by removing loose mill scale, loose rust, loose paint and all welding scale, with power impact tools, power grinders, power sanders, power wire brushes or a combination of these tools. Tightly adhering mill scale and rust in deep pits will not normally be removed by this method of cleaning.

3. Three standards of preparation are defined:

Class 1: is produced by power wire brushes only.

Class 2: is produced by power impact tools followed by a light wire brushing.

Class 3: is produced by the use of power impact tools or power sanders, followed by impact tools and then lightly wire brushed.

4. All tools should be operated in such a manner that no burrs or sharp edges are left on the surface and no sharp cuts are made in the steel. If such defects occur they shall be removed with sanders or grinders or any other appropriate method. Excessive power wire brushing producing a polished or glossy appearance shall be avoided, such a surface provides a poor anchor for paint. A slight burnishing or polishing is unavoidable and can be tolerated.

HAND TOOL CLEANING OF STEEL SURFACES

1. All surfaces to be coated shall be cleaned by the use of hand cleaning tools according to Australian Standard 1627.7. This degree of surface preparation approximates Steel Structures Painting Council Specification SSPC-SP2 and the Pictorial Standards depicted in Swedish Standard SIS 05 59 00 and AS 1627.9.

2. **Hand Tool Cleaning is defined** as a method of preparing new, corroded or previously painted steel surfaces prior to painting by removing loose mill scale, loose rust and loose paint by using hand wire brushing, hand sanding, hand scraping, hand chipping or a combination of these methods. Preliminary cleaning of large deposits of oil or grease, soluble fluxes and fume deposits from areas adjacent to weld runs shall be carried out by solvent cleaning, detailed in Australian Standard 1627.1 or by fresh water washing as appropriate.

3. Three standards of surface preparation are defined:

Class 1: is produced by "light wire brushing" to at least as good as Swedish Pictorial Standard St 1.

Class 2: is produced by "thorough scraping and wire brushing", and heavy rust scale first removed by hand hammering. The prepared surface to be at least as good as Swedish Pictorial Standard St 2.

Class 3: is produced by "very thorough scraping and wire brushing", any heavy rust scale being first removed by hand hammering. The prepared surface to be at least as good as Swedish Pictorial Standard St 3.

4. All hand tools should be operated in such a manner that no burrs, or sharp ridges are left on the surface and no sharp cuts made into the steel. Edges of remaining old paint shall be feathered and shall have sufficient adhesion so that it cannot be lifted as a layer by inserting under it the blade of a dull putty knife.

5. Hand tool cleaning should only be specified when it is an acceptable method of preparation. It is suitable for normal atmospheric exposures and interiors when the painting system includes a primer of good wetting ability. Hand cleaning will not remove all residues of rust, nor will it remove firmly adherent mill scale. When removal of rust and mill scale is required other Australian Standards, Power Tool Cleaning 1627.2, Blast Cleaning 1627.4, or Pickling 1627.5 should be considered.

NON-FERROUS

Metals included in this group comprise Galvanized Iron (also Zincanneal and Galvabond, each of which are steel coated with zinc), Zinalume, Aluminium and to a lesser extent Copper, Brass, Bronze and Zinc and Aluminium metal spray.

The selection of galvanized iron and aluminium is in increasing use for roofing and cladding and both have a long history of satisfactory service when used for those purposes. When used in chemical or industrial plants or coastal atmospheric exposures a suitable paint system may be desirable to give protection and added durability. The selection of a correct painting system is essential to prevent subsequent failure.

Adequate surface preparation is essential to ensure adhesion of the paint system and surface preparation with non-ferrous surfaces is usually confined to complete cleanliness such as removal of dirt and oil or grease, and this is adequately covered by **Australian Standard 1627.1 Degreasing of Metal Surfaces**, which can be summarised as follows: -

1. This specification refers to **Australian Standard 1627.1** by which suitable liquids, other than acids are used to remove detrimental foreign matter such as soluble or loosely adherent oil, grease, drawing and cutting compounds, wax, dirt and perspiration from metal surfaces. Large quantities of dirt may first be removed by hand or power tool cleaning.
2. This method may be used for the removal of the above substances prior to the application of paint or in conjunction with other methods of surface preparation such as 1627.4 for the removal of rust, mill scale or paint.
3. A metal surface prepared to this degree of cleanliness is one which is then suitable for the subsequent protective coating and the type of protective coating to be applied.
4. Degreasing may be carried out using any of the methods described in Australian Standard 1627.1 except that alkaline cleaning is suitable only for steel surfaces. The Solvent Methods of cleaning are suitable for ferrous metals, galvanized iron, copper, tin, brass, bronze, aluminium and its alloys, magnesium and its alloys, zinc and its alloys.

GALVANIZED IRON

Many of the failures of paint systems on galvanized surfaces, peeling and flaking, are caused by the use of an incorrect prime coat or no prime coat at all. Whether new or weathered galvanized iron Supalux Heavy Duty Coatings recommendation is to use a prime coat as follows:

For Conventional Topcoats, alkyds such as Supalux Supagloss Enamel or any Alkyd resin based coating such as Aluminium Paint or spraying machinery enamel.

- (a) Supalux Global Zinc PS, which is a zinc dust-zinc primer, refer to Technical sheet, at a dry film thickness of 40-50 μm then one or two coats of alkyd topcoat.
- (b) Supalux, Global metal etch (single pack) Primer, refer to Technical sheet, apply at a dry film thickness of 20-40 μm ,
Alkyd enamel topcoats applied directly to galvanized surfaces, especially new galvanized iron, are liable to have poor adhesion at the zinc-paint interface because of a chemical reaction

between the zinc and alkyd resin which results in the alkyd paint becoming brittle due to hydrolysis of the resin. The use of either of the above will prevent this occurring and will ensure satisfactory adhesion.

If chemically resistant topcoats are required, for Global Chlorinated Rubber systems, apply over a prime coat of Global Metal Etch. For epoxy or vinyl systems if the thickness is such that distortion will not occur, we recommend abrasive blast cleaning using ilmenite or fine Garnet sand to leave a fine profile. Then self prime with Global High Build Epoxy. The use of an etch primer is not required.

On weathered galvanized surfaces with deposits of zinc corrosion salts or "white rust" formed due to moisture condensation, these should be removed by hand or power tool cleaning or, if necessary, by careful blast cleaning using a non-metallic abrasive. The selected prime coat should then be applied as soon as possible and in any event on the same day as any surface preparation. If in close proximity to the sea, a fresh water wash to remove salt is recommended.

ALUMINIUM

If conventional alkyd enamel topcoats are to be applied, Global Metal Etch is ideal

If chemically resistant topcoats are required, for Global Chlorinated Rubber systems, For epoxy or Solvent based Acrylic systems. Apply over a prime coat of Supalux, Global Metal Etch

METAL SPRAYED STEEL SURFACES

If a painting system is to be applied to either zinc or aluminium metal spray the same priming paints as used for galvanized or aluminium surfaces respectively can be used. These sprayed metal coatings have a rough surface and are porous and the priming paint should preferably be applied soon after and on the same day as spraying, since the pores soon become filled with corrosion products and it may be difficult later to obtain satisfactory adhesion.

COPPER, BRASS AND BRONZE

If these surfaces are to be painted, the priming paint for all types of topcoat, both alkyd and chemical resistant finishes is a two-pack Epoxy. An etch primer, such as Supalux, Global Metal Etch should be applied

NON-METALLIC

For exterior exposure the surfaces included under non-metallic are concrete, masonry, brickwork, asbestos cement and timber. Timber must be painted to prevent the ingress of moisture and resultant cracking. The other surfaces may be painted only for decorative reasons to improve appearance, but if exposed to corrosive conditions, chemically resistant systems must be applied. Concrete structures such as bridges may be coated with a highly water impermeable system such as Solvent Acrylics/ Epoxies/Chlorinated Rubber or Elastomeric water based Acrylics. ,See technical data sheets on Global Acrylic Mastic, .Supalux Texture Acrylic to seal against the entry of moisture.

For interior exposures surfaces such as fibrous plaster, and wallboards, both soft, and hardboards are used, and these generally require painting for appearance purposes only with decorative coatings.

Irrespective of the type of surface, prior to painting, the removal of contaminants, dirt, dust, oil or grease is essential to ensure adequate adhesion of the coating.

CONCRETE, MASONRY, BRICKWORK AND ASBESTOS CEMENT

With brickwork and asbestos cement, the basic requirement is that the surface must be clean

and dry. With concrete and masonry, additional problems may be caused by efflorescence, chalk and loose material, and from new or insufficiently aged concrete by (1) unbound moisture within the concrete (and in the mortar joints of other masonry) remaining from the original mixing with water, (2) the presence within the material of soluble alkaline substances that are brought to the surface by the outward movement of moisture and deposited as efflorescence, (3) possible contamination with form oil or concrete curing compounds, (4) glazed areas resulting from casting against a smooth, non-absorbent form.

The most effective method of obtaining a satisfactory surface for painting is to blast clean carefully using a non-metallic abrasive such as sand or ilmenite, taking care not to expose aggregates unduly.

Alternatively treatment with a mixture of two parts fresh water, one part hydrochloric (muriatic) acid. Wet the surface first with fresh water then apply the acid mixture, liberally, by brush or swab so that all areas show a bubbling reaction. After 5 -15 minutes rinse off with copious quantities of fresh water and at the same time scrub with stiff brooms to remove loose concrete salts. Allow to dry, avoid any contamination of the etched surface and paint preferably within three days.

Either of the above methods of preparation are desirable especially when painting with epoxy, vinyl, chlorinated rubber or polyurethane coatings when subjected to corrosive conditions.

If the paint system is for primarily decorative purposes, sufficient cleanliness of the surface and removal of loose cement particles by abrading with coarse carborundum stones is usually adequate.

Emulsion paints, such as Supalux Lo-Glo or Suparoll can be applied to concrete any time after about four weeks ageing. If efflorescence is present this must be removed by blasting or acid treatment as above.

PLASTER AND WALLBOARD

These surfaces are generally unsuited to corrosive conditions and are confined to interior areas and painted for decoration only.

All surfaces must be clean and dry before painting. Damage, cracks, holes should be repaired with patching plaster or plastic wood on hardboard and sanded smooth. Emulsion paints can be applied direct. If a gloss alkyd finish is required apply over a sealer coat of emulsion paint such as Lo-Glo

Set plaster should be checked for a loose surface layer by placing on a strip of cellulose tape and quickly pulling off. If a significant quantity of plaster adheres to the tape, apply by brush or swab a solution of 500ml of phosphoric acid to 4 litres of water. Allow to dry 48 hours and do not rinse. This method binds the surface layer and ensures satisfactory adhesion of the paint system.

TIMBER

This surface is not used under corrosive conditions, but on the rare occasions it is, protection may be obtained by coating with an Epoxy, Vinyl or Chlorinated Rubber system applied as indicated on the respective Technical Data Sheet. Adequate cleanliness and dryness is the only prerequisite and the coatings should be applied direct.

With decorative paints, for interior or exterior exposure, a system of primer, undercoat and finish is required. Wood surfaces should be clean free of dirt, oil and grease and have a moisture content less than 20%.

First prime with Supalux Pink Primer for Wood, allow to dry minimum overnight, then fill all cracks, nailholes and indentations with putty or plastic wood. With putty allow 48 hours drying

then apply one coat of Supalux Mult Purpose Undercoat followed after a minimum of overnight drying by Supalux Gloss/Satin or flat Enamel or a Silicone Alkyd for a gloss finish or Lo -Glo for a lo sheen 5%-10% finish. Sand lightly between coats, especially on interior work to obtain a good finished appearance.

Supalux Polyester High Gloss Clear is ideally suited as a hard wearing clear finish on sanded floors, paneling, desks, tables, benches, etc.

Disclaimer

The manufacturer warrants that its products have been manufactured under strict control and conforms to its highest standards. The performance of the product will vary according to the nature of the surface to which it is applied and the preparation and mode of application of the product. As the manufacturer cannot supervise the above procedures no warranty as to the fitness of the product for a particular purpose can be given provided that nothing herein shall be deemed to exclude, restrict or modify any condition or warranty expressed or implied by any statute whether State or Federal. With the constant advancement in technology we suggest that the information used in making recommendations from the literature be reviewed every six months.