

SURFACE PREPARATION

SURFACE PREPARATION : For any given paint system, surface preparation is the single important factor which would determine its performance. Various surface preparation methods are adopted depending on the requirements of the paint system used and the substrate. The substrate could be steel, galvanized steel, aluminium, concrete or wood.

a) STEEL AS SUBSTRATE : Various methods of surface preparation are adopted viz. degreasing, high pressure fresh water hosing, hand tool cleaning, power tool cleaning, blast cleaning etc. Degreasing is done to remove all oil and grease prior to manual or blast cleaning. The most common method is by solvent washing followed by wiping dry with clean rags. A suitable detergent solution can also be made use of, which has to be subjected to fresh water hosing to remove traces of detergents.

The following are the most important surface preparation standards commonly followed Worldwide.

1. Swedish Standard SIS 05 59 00 - (1967 - Pictorial Surface Preparation Standards for Painting Steel Surface)
2. Steel Structures Painting Council (SSPC), U.S.A.
3. British Standards Institution - Surface Finish of Blast Cleaned Steel for Painting (BS 4232)
4. International Standard ISO 8501-1 : 1988

Except for BS 4232, all other standards consider the state of steel surface to be painted by classifying it into various grades A,B,C and D. Steel surface with mill scale but little rust is graded A, and surface which has begun to rust and from which mill scale has begun to flake is graded as B. Surface from which mill scale has rusted away with slight pitting is grade C and surface with general pitting visible is grade D.

The Swedish Standard being the prominent among all the standards, let us discuss it in detail.

SWEDISH STANDARD SIS 05 59 00 - 1967 : The four grades for blast cleaning according to this standard are Sa 3, Sa 2.5, Sa 2 and Sa 1.

Sa 3 : Blast cleaning to visually clean steel. Surface should be completely free from oil, grease, mill scale & rust.

Sa 2.5 : Very thorough blast cleaning to achieve near white metal inferior to Sa 3.



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- Sa 2 : Widely known as commercial blast. Inferior to Sa 2.5.
- Sa 1 : Light blast cleaning to remove mill scale, rust and paint.
- St 3 : Very thorough power tool cleaning to remove loosely adhering millscale, paint and rust. However, it cannot remove tightly adhering millscale.
- St 2 : Loosely adhering millscale, rust and old paint coatings are removed from steel by wire brushing, sanding, scraping and chipping.

International Standard ISO 8501 - 1 - 1988 makes use of the same photos as used by Swedish standard with the help of four additional photos from German standard DIN 55928.

British Standard BS 4232 - 1967 classifies blast cleaned surfaces into three categories viz. First Quality, Second Quality and Third Quality based on the proportion of the clean bare metal to the total area. For First Quality, 100% area should be clean bare metal, for Second Quality, at least 95% of the area should be clean bare metal and for Third Quality, it should be at least 80%.

The following chart gives an approximate equivalent between various standards:-

<u>Swedish Standard</u> <u>SIS 055900</u>	<u>British Standard</u> <u>BS 4232</u>	<u>Steel Structures</u> <u>Painting Council, USA</u> <u>SSPC</u>
Sa 3	First Quality	SSPC - SP - 5
Sa 2.5	Second Quality	SSPC - SP - 10
Sa 2	Third Quality	SSPC - SP - 6
Sa 1	--	SSPC - SP - 7

ANCHOR PATTERN OR SURFACE PROFILE :-

Surface texture of a metal, produced by abrasive blasting, to assist the adhesion of a coating, is called anchor pattern or surface profile. Most paint systems, especially inorganic zinc coatings, require an anchor pattern-characterised by a surface roughness and a roughness profile to obtain proper adhesion. It is usually assessed by standardised comparator viz. Rugotest No. 3 and Keane-Tator Surface Profile Comparator.

Anchor pattern obtained depends on the type of abrasive used for blasting. Using fine sand of mesh size 80, maximum height of profile is found to be 35-37 microns whereas with iron shot of mesh size 14, it is found to be 90 microns.

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b) GALVANISED STEEL AND ALUMINIUM AS SUBSTRATES :-

Galvanised metal as well as aluminium presents a very difficult surface for painting because of the problems of getting proper adhesion of the paint system to the surface. Galvanised metal is very smooth which poses a serious threat to adhesion. So, it is imperative that an etch primer be applied on the surface subsequent to degreasing, before the application of a proper paint system. Application of the etch primer results in a tacky surface which ensures proper adhesion of the paint system to the surface.

c) CONCRETE AS SUBSTRATE

Although concrete appears as a dense, homogenous material it contains a lot of small pores, which, if opened, contribute to a faster breakdown of the concrete. Fresh concrete possesses an alkalinity of upto pH 13. This alkalinity protects the reinforcement against corrosion. Reinforcement steel starts to corrode when pH of the moisture in the concrete is lower than 9. This happens due to the following reaction.



Both H_2CO_3 (Carbonic acid) and $\text{H}_2 \text{SO}_4$ (Sulphuric Acid) are reaction products of CO_2 and SO_2 present in the atmosphere.

Another trouble maker is laitance. Laitance is a thin layer of surplus cement and water which rises to the surface during setting of concrete. Unless removed, it will severely reduce adhesion and cause failure of the paint system. Efflorescence, seen as a salty stain on walls has to be removed before painting. Efflorescence is caused by moisture moving towards the surface of concrete.

Prevention of these faults is cheaper than renovation and this can be achieved by providing the concrete surface with a protective coating.

The concrete surface should be clean, dry and sound, prior to painting. When all trouble makers have been identified, they have to be removed which is best done by mechanical cleaning and power tooling combined with detergent cleaning if grease is present. An alternative to blasting is acid etching.

For concrete, all coatings have to be alkali resistant. Furthermore, it has to prevent moisture, sulphur dioxide and carbon dioxide from penetrating the concrete.

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d) WOOD AS A SUBSTRATE :

All new wooden surfaces like soft woods, hard woods, plywood etc. should be dry, clean and free from foreign particles. Smooth down with glass paper and apply a suitable knotting/preservative. This should be followed by primer for protection against moisture. On previously painted surfaces, apply paint removers followed by the method described above.

STANDARDS FOR VISUAL ASSESSMENT OF DEGREE OF RUSTING ON PAINTED AREAS :

Similar to the standards for degree of cleaning of steel surfaces, there are several standards for the description of the degree of paint breakdown and rusting on painted steel surfaces. Most common are :

- 1) The European Scale of Degree of Rusting for Anti-corrosive paints, devised issued by the Committee of Paint and Printing Ink Manufacturers' Association, Paris.
- 2) ISO 4628 / 3 - 1982 : International Standards Organisation, London.
- 3) SSPC - VIS - 2-68 T : Steel Structures Painting Council, USA; and
- 4) ANSI / ASTM D 610 : American National Standards Institute / American Society for Testing and Materials.

All these standards contain photographic references. Amongst all, the European Scale is the most widely used. A comparative chart of the standards is given below :

SSPC VIS - 2- 68T		ANSI / ASTM D 610		EUROPEAN SCALE		ISO 4628 / 3	
Ref.	% Rusting	Ref.	% Rusting	Ref.	% Rusting	Ref.	% Rusting
10	-	<0.01	Re 1	0.05	Ri 0	0	
9	-	0.03	Re 2	0.5	Ri 1	0.05	
8	-	0.1	Re 3	1.0	Ri 2	0.5	
7	-	0.3	Re 4	3.0	Ri 3	1.0	
6	-	1.0					
5	-	3.0	Re 5	8.0	Ri 4	8.0	
4	-	10.0	Re 6	15/20	Ri 5	40/50	
3	-	16.0					
2	-	33.0	Re 7	40/50			
1	-	50.0	Re 8	75/85			
0	-	100.0	Re 9	95			

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ONE	Concrete, Plaster, Masonry, etc.
	- Surface should be clean, dry and free from all contaminants.
	- High pressure water cleaning (minimum 2200 p.s.i).
	- Oil, grease or similar material must be removed by abrasive blasting.
	- Loose material, dust and other contaminants must be removed by stiff brushes.-Acid etching or roughening may be needed for smooth surfaces.

TWO	Wood :
	- Surface should be clean, dry, and free of dust.
	- Smooth down with sandpaper, wipe off the wood dust . Wood may be treated with wood preservative.

THREE	Steel :
	- Degrease and blast clean to Swedish standard Sa 2.5
	- The surface must be clean and dry.

FOUR	Steel :
	- Degrease and hand or power tool clean to Swedish standard St 2.
	- The surface must be clean and dry.

FIVE	Galvanized Surfaces & Aluminium:
	- Degrease and sand paper with abrasive paper and solvent.
	- The surface must be clean and dry.