SAMSON
TECHNICAL
BULLETIN

Surface Preparation for Synthetic Ropes

Overview The following recommendations can be applied at the shipyard or during vessel operations. Lab testing has shown that many coatings work quite well and adequate surface preparation before the coating is applied has a large impact on the rope service. The surface should have a roughness of 300 micro inches or less. If this roughness cannot be achieved, other means to smooth the surface must be employed. Once that is accomplished, the following steps apply.

Check Ambient Conditions

Verify that hardware idle time and weather conditions will allow adequate curing prior to beginning installation work. Details of time required for curing should be available from the coating manufacturer. If conditions are favorable, follow these steps:

STEP 1 SURFACE PREPARATION Proper surface preparation is the most critical step in this process. Many standards and publications exist that specify both the smoothness and cleanliness of steel surfaces. These should be referenced if the person doing this work is not an expert in common surface preparation practices. Prepare hardware for application of treatment by removing rough edges, rust and debris by sandblasting, and/or use of a pneumatically operated wire bristle brush or needle-scaler (shown bottom right). Rust will prevent proper adhesion of the coating and result in premature wear of the repaired area, so removal is imperative.

STEP 2 COATING PREPARATION Prepare coating per manufacturer instructions (see label and instructions that came with product). Use appropriate personal protective equipment — typically at least safety glasses and rubber gloves.

2 part coating mixture (Intershield 300V shown)

STEP 3 COATING APPLICATION Apply the coating liberally to the hardware (brush or spray on). Where possible, extend the coating 2–4 inches beyond the area of probable contact to ensure complete coverage of the affected area.

STEP 4 CURING After complete curing (24+ hours depending on thickness and product), hardware can be used.

Rust damaged chock typical of crude tankers.

Rough finish as coating wears away.

Coating removal using a needle scaler

SURFACE PREPARATION—APPENDIX

Introduction

Proper surface preparation is essential for the success of any protective coating scheme. The importance of removing oil, grease, old coatings and surface contaminants (such as mill-scale and rust on steel) cannot be over emphasized.

The performance of any paint coating is directly dependent upon the correct and thorough preparation of the surface prior to coating. The most expensive and technologically advanced coating system will fail if the surface preparation is incorrect or incomplete.

The adhesion and longevity of any paint coating is dependent upon the surface preparation prior to coating.

Steel Preparation Standards

Some of the various methods of surface preparation of steel are briefly described below. For more explicit details and recommendations please refer to full specifications, such as:

1. International Standard ISO 8504:1992(E).
   Preparation of steel substrates before application of paints and related products – Surface preparation methods.
2. Steel Structures Painting Council (SSPC)
   Pittsburg, PA, USA. Full range of surface preparation standards.
3. International Standards ISO 8501-1:2007(E) and ISO 8501-2:1994.
   Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.
4. Swedish Standard SIS 05 59 00 (1967)
   Pictorial Surface Preparation Standards for Painting Steel Surfaces.
5. Shipbuilding Research Association of Japan
   Standard for the preparation of steel surface prior to painting ("JSRA" Standard).
6. International Protective Coatings Hydro-blasting Standards.
7. International Protective Coatings Slurry Blasting Standards.
8. International Protective Coatings Abrasive Sweep Blasting Standards.

Removal of Contaminants

The performance of protective coatings applied to steel is significantly affected by the condition of the steel substrate immediately prior to painting. The principal factors affecting performance are:

a) surface contamination including salts, oils, grease, drilling and cutting compounds,
b) rust and mill-scale,
c) surface profile.

The main objective of surface preparation is to ensure that all such contamination is removed to reduce the possibility of initiating corrosion so that a surface profile is created that allows satisfactory adhesion of the coating to be applied.

Recommended procedures are outlined in International Standard ISO 8504:1992(E) and SSPC SP Specifications.

Removing contamination improves the surface profile for subsequent coating adhesion.

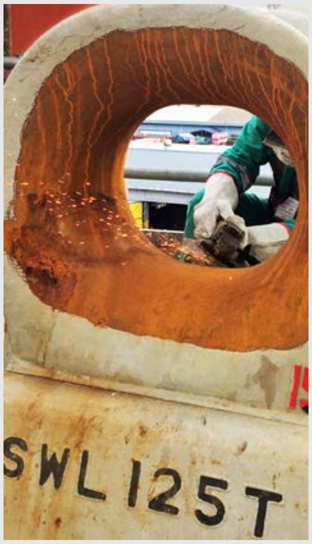
Degreasing

It is essential to remove all soluble salts, oil, grease, drilling and cutting compounds and other surface contaminants prior to further surface preparation or painting of the steel. Perhaps the most common method is by solvent washing, followed by wiping the surface dry with clean rags. Cleaning the surface is critical; if cleaning is not carried out thoroughly, the result of solvent washing will simply spread the contamination over a wider area. Proprietary emulsions, degreasing compounds and steam cleaning are also commonly used. Recommended procedures are described in International Standard ISO 8504:1992(E) and SSPC-SP1.

It is essential to remove all soluble salts, oil, grease, and other surface contaminants prior to further surface preparation or paint application.

Hand and Power Tool Cleaning

Loosely adhering millscale, rust and old paint coatings may be removed from steel by hand wire brushing, sanding, scraping and chipping. However, these methods are incomplete, and always leave a layer of tightly adhering rust on the steel surface. Methods for hand tool cleaning are described in SSPC-SP2 and should be to ISO 8501-1:1988 grade St2-B, C or D. Power cleaning is generally more effective and less laborious than hand tool cleaning for the removal of loosely adhering millscale, paint and rust. However, power tool cleaning will not remove tightly adhering rust and millscale. Power wire brushes and impact tools such as needle guns, grinders and sanders are all commonly used. Care should be taken, particularly with power wire brushes, not to polish the metal surface as this will reduce the key for the subsequent paint coating. Methods are described in SSPC-SP3 and SSPC-SP11 and should be to ISO 8501-1:1988 grade St3-B, C or D. SSPC-SP11 describes a degree of surface profile which can be achieved by power tool cleaning.



Care should be taken when using power tools to remove rust and debris from steel surfaces to not polish the surface—this can cause bonding issues for the subsequent coating product.

Blast Cleaning

By far, the most effective method for removal of millscale, rust, and old coatings, is the use of abrasives such as sand, grit, or shot under high pressure.

The grade of blasting suitable for a particular coating specification depends on a number of factors, the most important of which is the type of coating system selected.

The primary standard used in the product data sheets in this manual is ISO 8501-1:1988(E), preparation of steel substrate before application of paints and related products—visual assessment of surface cleanliness. This standard represents a slight extension of the Swedish Standard (SIS 05 59 00), which was developed by the Swedish Corrosion Institute, in co-operation with the American Society for Testing &Materials (ASTM), and the Steel Structures Painting Council (SSPC), USA, and is already used on a world-wide scale.

By far, the most effective method for removal of millscale, rust, and old coatings, is the use of abrasives such as sand, grit, or shot under high pressure.

Where appropriate, the nearest equivalent SSPC specification has been quoted on individual product data sheets. It is recognized that the SSPC and ISO standards are not identical, and as a consequence certain product data sheets may show grade Sa2½ (ISO 8501-1:1988) as equivalent to SSPC-SP6, (commercial blast cleaning), whilst others will be equivalent to SSPC-SP10 (near white metal). The selection of these blast cleaning grades has been assessed using a number of factors including coating type, performance expectation, and in-service conditions.

As a general principle, where products are recommended for immersion or aggressive atmospheric conditions, the blasting standard required will be to Sa2½ (ISO 8501-1:1988) or SSPC-SP10; however, when products are recommended for general atmospheric exposure, the blasting standard required will be Sa2½ (ISO 8501-1:1988) or SSPC-SP6.

Prior to blasting, steelwork should be degreased and removed of all weld spatter. If salts, grease or oil are present on the surface they will appear to be removed by the blasting process, but this is not the case. Although not visible, the contamination will still be present as a thin layer, and will affect the adhesion of subsequent coatings. Weld seams, metal slivers and sharp edges revealed by the blasting process should be ground down, as paint coatings tend to run away from sharp edges, resulting in thin coatings and reduced protection. Weld spatter is almost impossible to coat evenly, in addition to often being loosely adherent, it is a common cause of premature coating failure.

The surface profile obtained during blasting is important, and will depend on the abrasive used, the air pressure and the technique of blasting. Too low a profile may not provide a sufficient key for coating, while too high a profile may result in uneven coverage of high, sharp peaks possibly leading to premature coating failure, particularly for thin film coatings such as blast primers. The table (right) gives a brief guide to typical roughness profiles obtained using various types of abrasive.

Abrasive	Mesh Size	Max. Height of Profile
Very fine sand	**80**	37 μ *(1.5 mils)*
Coarse sand	**12**	70 μ *(2.8 mils)*
Iron shot	**14**	90 μ *(3.6 mils)*
Typical non-metallic "copper slag" 1.5–2.0 mm grain size	**–**	75–100 μ *(3–4 mils)*
Abrasive	**Mesh Size**	**Max. Height of Profile**
Iron grit No. G16	**12**	200 μ *(8.0 mils)*

Wet Abrasive Blasting/Slurry Blasting

Wet abrasive blasting uses a slurry of water and abrasive as opposed to dry abrasive alone. The advantage of this method is the virtual elimination of hazards and health problems that are associated with dust.

A further important advantage is that when wet blasting old, well rusted surfaces, many of the soluble corrosion products in the pits of the steel will be washed out, which will greatly improve the performance of the applied coating system. However, a disadvantage of this technique is that the cleaned steel begins to rust rapidly after blasting. It is therefore common practice to include proprietary inhibitors in the blast water which will prevent this rusting for a sufficient time to allow painting to be carried out. In general, the use of very low levels of such inhibitors does not affect the performance of subsequent paint coatings for non-immersed steelwork. The use of a moisture tolerant primer, which can be applied to wet blasted steel while it is still damp, can make the use of inhibitors unnecessary, but International Protective Coatings should be consulted for specific advice. If wet-blasted surfaces have been allowed to corrode, they should be mechanically cleaned or preferably sweep blasted, to remove the corrosion prior to painting.

The advantage of wet abrasive blasting methods is the virtual elimination of dust-related hazards.

Hydroblasting

Hydroblasting is a technique for cleaning surfaces, which relies entirely on the energy of water striking a surface to achieve its cleaning effect. Abrasives are NOT used in hydroblasting systems. Consequently the problems caused by dust pollution and by the disposal of spent abrasives are eliminated. Two different hydroblasting operating pressures are commonly encountered.

> *High pressure hydroblasting, operating at pressures between 680 bar (10,000 p.s.i.) and 1,700 bar (25,000 p.s.i.).*

> *Ultra-high pressure hydroblasting, operating at pressures above 1,700 bar (25,000 p.s.i.).*

The terms hydroblasting, hydrojetting and water jetting essentially mean the same thing, with all being used to describe the same process. There can be confusion however over the difference between simple water washing and hydroblasting. To clarify the situation, International Protective Coatings have adopted the following commonly accepted definitions.

Low Pressure Water Washing:
Operates at pressures less than 68 bar (1,000 p.s.i.).

High Pressure Water Washing:
Operates at pressures between 68-680 bar (1,000–10,000 p.s.i.).

High Pressure Hydroblasting:
Operates at pressures between 680–1,700 bar (10,000–25,000 p.s.i.).

Ultra High Pressure Hydroblasting:
Operates at pressures above 1,700 bar (25,000 p.s.i.) with most machines operating in the 2,000–2,500 bar range (30,000–36,000 p.s.i.).

The International Protective Coatings Hydroblasting Standards have been prepared using ultra high pressure hydroblasting equipment. This standard however is also applicable to surfaces produced by a whole range of hydroblasting pressures, providing the equipment used is capable of cleaning to the visual standard depicted.

The steel surfaces produced by hydroblasting do NOT look the same as those produced by dry abrasive blasting, or slurry blasting. This is because water on its own cannot cut, or deform steel in the same way as abrasives. Hydroblasted surfaces therefore tend to look dull, even before they "flash rust." In addition steel, with active corrosion pitting, shows a mottled appearance after hydroblasting. Mottling occurs when the corrosion products are washed out of the pits, leaving a bright patch, and the surrounding areas are left a dull grey, brown to black color. This pattern is the reverse of that left by abrasive blasting, where anodic pits are often dark, due to corrosion products not being entirely removed, and the surrounding areas are bright. "Flash rusting," i.e. light oxidation of the steel, which occurs as hydroblasted steel dries off, will quickly change this initial appearance.

When flash rusting is too heavy for a coating application, it may be removed or reduced by brushing with a hard bristle brush, or by washing down with high pressure fresh water. High pressure washing, at pressures above 68 bar (1,000 p.s.i.) using either the rotational nozzles, or fan jet lances of the hydroblasting equipment itself is the preferred method. It will cause the area to re-rust, but it is possible to reduce the degree of flash rusting from heavy to light using this method. Hand wire or bristle brushing to remove heavy flash rusting may be acceptable for small areas, but will generally produce an inadequate surface. Mechanical rotary wire brushing can however produce acceptable surfaces for large areas.

When large areas are hydroblasted, flash rusting, which obscures the original blast standard, may occur, before an inspection can be carried out. Establishing the required standard by blasting a small test area prior to the main blast may help, providing the rest of the job is blasted to the same standard. Methods for ensuring the rest of the job is blasted to the same standard will vary from project to project.

Flash rusting can be prevented by the use of water soluble chemical corrosion inhibitors. These inhibitors may leave a crystalline layer on the steel surface as the water evaporates, which can then lead to a loss of adhesion and osmotic blistering, if coatings are applied over this type of surface. International Protective Coatings do not recommend the use of corrosion inhibitors to hold wet blasted surfaces. If inhibitors are used, they must be thoroughly washed off with fresh water before International Protective Coatings products are applied.

Hydroblasting, hydrojetting, and water jetting are essentially the same process under different pressures.

International standards are applicable to surfaces produced by a range of hydroblasting equipment, providing it is capable of cleaning to the visual standard depicted.

Surface Preparation for Synthetic Ropes

The temperature of steel substrates can rise during the hydroblasting process.

There are two reasons for this:

a) *Compression of the water to reach hydroblasting pressure will create a temperature rise in the water itself,*

b) *The velocity of the water striking the steel will impart energy to it as heat.*

This temperature rise can be substantial and may help hydroblasted surfaces dry off more quickly, with a corresponding reduction in the severity of flash rusting.

An important property of the hydroblasting process is that it can emulsify and remove oil and grease from a surface as it is blasted. However, this does not preclude the need for proper degreasing procedures as specified in SSPC-SP1, prior to hydroblasting. Hydroblasting will not produce a surface profile, although the process can eventually erode steel and result in metal loss. The surface profile exposed after hydroblasting will have been produced by earlier surface preparation work, or by corrosion. For most coating schemes, International Protective Coatings will accept a profile in the 50 to 100 microns range.

For additional information and other available Technical Bulletins, please contact your Samson representative or visit our website: *SamsonRope.com*

SEVERAL EXAMPLES OF GOOD AND BAD SURFACE PREPARATION / COATING APPLICATION

BEFORE REPAIR

DURING REPAIR

AFTER REPAIR

STAINLESS ROLLER INSTALLATION

PROS

- > *Smooth finish of material and durable material*

CONS

- > *Inadequate support under material*
- > *Roller not entirely covered and weld*
- > *Not adequately smoothed following installation*

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