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Technical Tips
The Art of Powerful Cleaning...

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Title: Hydroblasting Standards (7 pages)

1. Introduction

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 above 680 bar (10000 psi)

Ultra high pressure hydroblasting,
operating at pressures above 1700 bar (25000 psi)

See note 5.1.

This visual standard has been prepared by the use of ultra high pressure hydroblasting equipment. The standard however is 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 like abrasives. Hydroblasted surfaces therefore tend to look dull, even before they "flash rust". In addition Grade D 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 colour. See note 5.10. 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. This standard has been produced to give advise on the recommended standard of hydroblasting and the acceptable level of flash rusting allowed prior to the application of coatings.

2. Format

The standard consists of a series of colour photographs, which depict the condition of unpainted steel surfaces prior to and immediately after surface preparation by hydroblasting. See note 5.2. It then shows these surfaces with varying degrees of flash rusting.

3. Explanatory Text

3.1. Initial Rust Grades

The standard illustrates two initial rust grades of steel, which have had the mill scale removed by abrasive blasting and which have been allowed to rust to the relevant standard. See note 5.8. They are designated as Grades C and D, and are comparable to the rust grades C and D described in the ISO 8501-1:1988 surface preparation standard, and the SSPC VIS-1-89 surface preparation standard of the Steel Structures Painting Council. The definitions are:

Rust Grade C Steel surface completely covered with rust but with little, or slight pitting under normal vision.

Rust Grade D Steel surface completely covered with rust, on which general pitting is visible under normal vision.

3.2. Blast Standards

The standard illustrates grade C and D surfaces prepared by hydroblasting to two different degrees of cleanliness. They are designated HB2 and HB2 1/2 and are comparable to Sa2 and Sa2 1/2 described in the ISO 8501-1:1988 surface preparation standard and to SSPC-SP6 and SSPC-SP10 of the Steel Structures Painting Council surface preparation standards.

The definitions are :

HB2 Thorough Hydroblast Cleaning

When viewed without magnification, the surface shall be free from visible oil, grease, dirt and from most of the rust, paint coatings and foreign matter. Any remaining contamination and staining shall be firmly adherent. See notes 5.9 and 5.10.

HB2 1/2 Very Thorough Hydroblast Cleaning

When viewed without magnification, the surface shall be free from visible oil, grease, dirt, loose rust, paint coatings and foreign matter except for staining. A brown-black discoloration of ferric oxide may remain as a tightly adherent thin film on corroded and pitted steel. See notes 5.9 and 5.10.

3.3. Degrees of Flash Rusting

The standard illustrates three grades of flash rusting. Light flash rusting designated L; moderate flash rusting, designated M; and heavy flash rusting, designated H. The definitions are:

L. Light Flash Rusting

When viewed without magnification, small quantities of light tan-brown rust will partially discolour the original metallic surface. This discoloration may be evenly distributed, or in patches, but it will be tightly adherent and will not be heavy enough to easily mark objects brushed against it.

M. Moderate Flash Rusting

When viewed without magnification, a layer of light tan-brown rust will obscure the original metallic surface. This layer may be evenly distributed or patchy in appearance, but it will be heavy enough to mark objects brushed against it.

H. Heavy Flash Rusting

When viewed without magnification, a heavy layer of dark tan-brown rust will completely obscure the original metallic surface. This layer of rust will be loosely adherent and will easily mark objects brushed against it.

4. Procedure for using the standard

- a. Select the photograph of rust grade that most closely resembles the rust grade of steel to be cleaned. Previously painted steel can be classed as either C or D grade, depending upon the degree of pitting. See note 5.1.
- b. Select the photograph depicting the degree of cleaning that has been specified. For example, if the initial rust grade is D and thorough hydroblast cleaning is specified (HB2) use photograph D HB2.
- c. Compare the prepared surface with the photograph selected immediately after hydroblasting but before the surface has flash rusted, to evaluate the degree of cleaning, see note 5.3.
- d. Prior to painting, compare the flash rusted surface with the flash rusting photographs. For example, D HB2 L, D HB2 M, D HB2 H to evaluate the degree of flash rusting that has occurred.
- e. Check that the paint product specified is suitable for overcoating the degree of flash rusting that has occurred. See note 5.7.

5. Notes

5.1. Definition of Terms

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, please use the following commonly accepted definitions.

Low Pressure Water Washing:

Operates at pressures less than 68 bar (1,000 psi)

High Pressure Water Washing:

Operates at pressures between 68-680 bar (1,000 - 10,000 psi) See note 5.12

High Pressure Hydroblasting:

Operates at pressures between 680-1700 bar (10,000 - 25,000 psi)

Ultra High Pressure Hydroblasting:

Operates at pressures above 1700 bar (25,000 psi) with most machines operating in the 2000-2500 bar range (30,000 - 36,000 psi)

5.2. Painted Steel

The photographs in this standard were prepared from unpainted steel but they are also suitable for depicting the appearance of painted steel after hydroblasting.

5.3. Inspecting Hydroblasted Surfaces Prior to Flash Rusting

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.

5.4. Inspecting Areas of Difficult Access

It is difficult to clean areas of difficult access such as the backs of stiffening bars, without the use of specially designed angled nozzles. This is because it is impossible to ricochet water into these areas in the same manner as abrasives. Special attention must therefore be given to these areas during inspections.

5.5. Temperature Rise of Substrate

The temperature of steel substrates can rise during the hydroblasting process. There are two reasons for this. Compression of the water to reach hydroblasting pressure will create a temperature rise in the water itself, and 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.

5.6. Chemical Corrosion Inhibition

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 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 coatings are applied.

5.7. Removal of Flash Rusting

When flash rusting is too heavy for coating application, it may be removed or reduced by brushing with a hard bristle or wire brush, or by washing down with high pressure fresh water. High pressure washing, at pressures above 68 bar (1000 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.

5.8. Surface Profile

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 paint schemes, paint manufacturers will accept a profile in the 50 to 100 micron range.

5.9 Removal of Oil and Grease

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.

5.10 Discoloration of Corroded and Pitted Steel

The grey, brown to black discoloration seen on corroded and pitted steel after hydroblasting cannot be removed by further hydroblasting. Analysis shows that this thin film consists mainly of ferric oxide, which is an inert material. As it is tightly adherent, it does not present a serious contamination problem.

5.11 Soluble Salt Removal

This standard makes no attempt to define levels of soluble salts remaining on hydroblasted surfaces, or to relate degrees of flash rusting to remaining soluble salts. However, the ability to remove salt, particularly from badly pitted and corroded steel is a major advantage of the hydroblasting process.

5.12 High Pressure Washing

Although the accepted definition of high pressure washing ranges from 68-680 bar (1000-10000 p.s.i.) International recommend that for vessels in drydock, the outside hulls are high pressure washed with fresh water at 200 bar (300 p.s.i.)

6. References

6.1 Steel Structures Painting Council. SSPC-VIS 1-89

"Visual Standard for Abrasive Blast Cleaned Steel".

6.2 International Standards Organisation ISO 8501-1 : 1988

"Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness".

7. Visual Standards

Rust Grade Standards



Rust Grade C



Rust Grade D

Preparation Standard C HB2



Rust Grade C



C HB2 Rust Grade C
Hydroblasted to an Sa2 equivalent

Degree of Flash Rusting



C HB2 L Light Flash Rusting



C HB2 M Moderate Flash Rusting



C HB2 H Heavy Flash Rusting

Preparation Standard C HB2½



Rust Grade C



C HB2½ Rust Grade C Hydroblasted to an Sa2½ equivalent

Degree of Flash Rusting



C HB2½ L Light Flash Rusting



C HB2½ M Medium Flash Rusting



C HB2½ M Heavy Flash Rusting

Preparation Standard D HB2



Rust Grade D



D HB2 Rust Grade D Hydroblasted to an Sa2 equivalent

Degree of Flash Rusting



D HB2 L Light Flash Rusting



D HB2 M Medium Flash Rusting

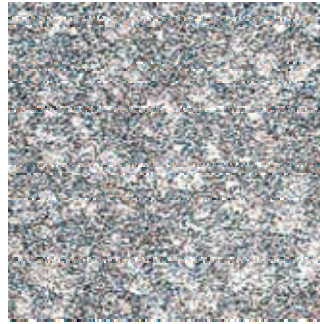


D HB2 H Heavy Flash Rusting

Preparation Standard D HB2½



Rust Grade D



D HB2½ Rust Grade D Hydroblasted to an Sa2½ equivalent

Degree of Flash Rusting



D HB2½ L Light Flash Rusting



D HB2½ M Medium Flash Rusting



D HB2½ H Heavy Flash Rusting