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Courtesy of International—Courtaulds Coatings, Ltd

New Hydroblasting and Slurryblasting Standards Issued

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International, part of the Courtaulds Coatings Group (Felling Gateshead, UK), recently issued 2 separate visual standards for wet blasted steel. The Slurryblasting Standards depict surfaces before and after blast cleaning with a mixture of water and abrasive. The Hydroblasting Standards depict surfaces before and after blast cleaning with ultra high pressure water.

This article will explain why a coatings supplier decided to produce independent visual standards for wet blasting, how it created the standards, and how the standards were designed for use in the field.

Fig. 1 - Rust grades C and D
Courtesy of International—Courtaulds Coatings, Ltd

Developing the Standards

Our company operates in a very competitive marine coatings market where paint manufacturers normally accept some degree of liability for the finished paint system. The new standards for wet blasting steel were developed and produced to meet the company's customer requirements as well as its own internal requirements. To better understand the reasoning behind a supplier's need to develop its own set of standards, it is probably worthwhile to look at how visual standards are used for surface preparation in the marine industry.

Generally, a coatings supplier will put together a paint specification when bidding for work. The document will include the surface preparation requirements for the paint system specified (e.g., grit blast to ISO 8501-1-1988 Sa2 1/2 or SSPC-SP 10, Near White Blast Cleaning). The customer will usually (but not always) incorporate the surface preparation requirements into the contract for the work performed.

For coatings work in shipyards, it is common to have a technical service rep from the coating supplier available on site to offer advice on whether the standards are being achieved. Evaluating the surface to be coated is generally not a problem when hand tool cleaning, power tool cleaning, or dry abrasive blasting is performed

because internationally recognized standards specify these types of work. However, problems can arise when wet blasting is performed. Because there are no standards for wet blasting steel, it is difficult to know what standards to specify or to accept on site. A coatings supplier does not always know if its products will perform over an "unknown" surface (i.e., one that does not meet specified standards).

The lack of specification standards for wet blasting has become more obvious in recent years. Environmental restrictions on dry blasting and resulting economic pressures have led to an increase in wet blasting operations worldwide. In addition, many ship owners are using wet blasting for on-board maintenance. Questions from our customers about wet blasting standards and coating wet blasted surfaces have increased. Among the most frequently asked questions are the following.

- Can we paint over wet blasted surfaces?
- What is an acceptable wet blast standard?
- Should the surface be wet or dry when painted?

Fig. 2 - Rust grades C and C HB2 1/2

Fig. 3 - C HB2 1/2L, light flash rusting; C HB2 1/2M, moderate flash rusting; and C HB2 1/2 H, heavy flash rusting

• Will your paint tolerate flash rusting? If so, by how much?
• Can we use salt water for wet blasting?
• Are your products approved to go over wet blasted surfaces?
• Will you accept liability or offer guarantees?

Fig. 4 - Rust grades C and C SB2 1/2

To answer these questions and to quantify paint performance on wet blasted surfaces, our company initiated a program to look closely at all types of wet blasting. This program, started several years ago and still in progress, led to the development of visual standards for wet blasting. It also enabled the company to produce a range of approved products for hydroblasted and slurryblasted surfaces.

The wet blasting standards for steel were developed to meet 2 requirements. First, they had to define 2 standards of wet blasting that showed varying degrees of flash rusting. These standards could then be used to test products over "known" surfaces and link the standards to product approval. For example, a product could be tested over a surface prepared to the HB2

Fig. 5 - Rust grades C and C SB2 1/2L, light flash rusting; C SB2 1/2M, moderate flash rusting; and C SB2 1/2H, heavy flash rusting

1/2 L (Very Thorough Hydroblast Cleaning with Light Flash Rusting) standard in the laboratory. It could then be tested over the same standard of preparation in field trials on actual ships. If it performs effectively in both laboratory and field trials, it will perform well over that standard cleaning in normal shipyard and onboard maintenance situations. Thus, specifiers can confidently specify the product and the preparation standard.

Second, the standards had to serve as a practical inspection tool to help customers and technical service personnel judge acceptable levels of blasting and degrees of flash rusting before painting. In this respect, the explanatory text of the standard is as important as the visual standards themselves.

Other wet blasting standards that were already developed were not able to meet these requirements. Of course, it would have been easier to wait until SSPC, NACE International, or ISO had produced internationally recognized wet blasting standards; but our company needed to respond quickly to the increased use of wet blasting for surface preparation in the marine industry.

Structure of the Standards

Our company developed 2 standards to accommodate the 2 methods of wet blasting commonly used in the marine industry: slurryblasting and hydroblasting.

Slurryblasting involves cleaning with a mixture of water and abrasive. The 2 types of systems commonly used are pressurized water abrasive blasting, which uses water to propel the abrasive, and air abrasive water blasting, which uses compressed air to propel the abrasive. Initially, the surfaces produced by slurryblasting are identical to those produced by dry abrasive blasting because the abrasive cuts and deforms the steel surface, producing a bright appearance. However, this bright appearance quickly changes when flash rusting occurs as the surface dries.

Hydroblasting relies entirely on the energy of water striking a surface to achieve its cleaning effect. The 2 different operating pressures commonly used are high pressure hydroblasting at pressures above 69 MPa (10,000 psi) and ultra high pressure hydroblasting (or waterjetting, the preferred term in the U.S.) above 172 MPa (25,000 psi). Abrasives are not used in hydroblasting systems. By itself, water does not cut or deform steel in the way that abrasives can. Hydroblasted surfaces do not look like those produced by dry abrasive blasting or slurryblasting. Instead, the surfaces look dull or "matte" even before they flash rust.

Because the 2 blasting techniques produce surfaces with different appearances, we decided to introduce 2 separate standards. It would have been possible to combine the 2, but the company wanted to keep the standards simple and practical so that they can be used as on-site inspection tools.

Both of the standards follow the same format. We selected 2 initial rust grades of bare steel, grades C and D (Fig. 1), which are comparable to grades C and D of ISO 8501-1:1988 and SSPC Vis 1-89. Both grades were blasted to different standards comparable to ISO Sa2 and Sa2 1/2 and to SSPC-SP 6 (Commercial Blast Cleaning) and SSPC-SP 10. For simplicity, HB2 (Thorough Hydroblast Cleaning) and HB2 1/2 (Very Thorough Hydroblast Cleaning with Light Flash Rusting) were designated for hydroblasting; and SB2 (Thorough Slurryblast Cleaning) and SB2 1/2 (Very Thorough Slurryblast Cleaning) were designated for slurryblasting. The standards were then allowed to flash rust to degrees that were classified as either light, moderate, or heavy. Surface salt con-

Photographs and definitions should be subordinate to the inspector's judgment.

tamination levels were not linked to the standards for reasons that will be explained later in this article.

Figure 2 shows rust grades C and C HB2 1/2, rust grade C when hydroblasted to an SSPC-SP 10 equivalent. Figure 3 shows 3 degrees of flash rusting after hydroblasting to C HB2 1/2:C HB2 1/2L, light flash rusting; C HB2 1/2M, moderate flash rusting; and C HB2 1/2H, heavy flash rusting.

Figure 4 shows rust grades C and C SB2 1/2, rust grade C slurryblasted to an SSPC-SP 10 equivalent. Figure 5 shows 3 degrees of flash rusting after slurryblasting rust grade C to an SB2 1/2: C SB2 1/2L, light flash rusting; C SB2 1/2M, moderate flash rusting; and C SB2 1/2H, heavy flash rusting.

Initial Rust Grades

To develop the standards, we started with bare steel. Rust grades C and D were appropriate because most wet blasting during maintenance and repair operations is done on old or previously coated steel. Typically, steel with mill scale (grades A and B) is not prepared by wet blasting. In the marine coatings industry, steel with mill scale is usually prepared by centrifugal blasting in painting shops. In any case, hydroblasting at commercially available pressures will not remove mill scale.

Previously painted steel was not used because the company was more interested in full blasting than sweep blasting, where some of the paint is left in place. However, in the real world, many lower pressure hydroblasting machines are unable to remove all of the paint because the paint threshold removal energy is greater than the energy produced by the hydroblasting waterjet. Our company prefers that its technical personnel deal with the problem of intact islands of paint on a case-by-case basis rather than to try to cover every eventuality with a standard. An acceptable preparation standard for 1 coating may be totally unacceptable for another.

Blast Standards

The 2 standards selected for blasting are equivalent to Sa2 (SSPC-SP 6) and Sa2 1/2 (SSPC-SP 10) because virtually all full blasting in the industry is carried out to 1 of these standards.

Flash Rusting

All wet blasted steel will flash rust at a threshold humidity as the surface dries unless chemical corrosion inhibitors are added to the water. Our company does not recommend using inhibitors because, in many circumstances, inhibitors may lead to loss of adhesion and osmotic blistering. Without inhibitors, contractors and specifiers have the choice of overcoating flash rusting or removing it. Complete removal is expensive and impractical, so flash rusting is typically overcoated. Fortunately, the rust itself consists mainly of ferric oxide, an inert material that is not detrimental to the paint or the steel. If it is light and tightly adherent, ferric oxide does not affect coating performance. However, if it is heavy and loose, it may cause loss of coating adhesion.

For this reason, flash rusting is quantified as light, moderate, or heavy (Figs. 3 and 5). The visual standards are reinforced by written definitions, and these definitions are probably more useful to the inspector than the photographs.

Salt Contamination Levels

Wet blasting, particularly ultra high pressure hydroblasting, is a very effective method for removing soluble salts from substrates. Salt removal is perhaps the greatest advantage that hydroblasting has over dry abrasive blasting. However, we did not want to link our standards to salt contamination levels. This would have required our technical personnel to take

time consuming on-site measurements for surface salt levels in situations where measurements of this type had not previously been necessary. However, the company does measure surface salt levels for coating work on ballast or cargo tanks. If potable water is used for hydroblasting, surface salt levels below the level proposed by SSPC and NACE of 7 micrograms per sq cm are achievable on old rusted and pitted steel. (SSPC and NACE have proposed this level in their draft joint standard, "Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultra High Pressure Waterjetting Prior to Recoating.")

For this reason, we recommend that potable quality water be used for blasting whenever possible, although we recognize that in some locations, fresh water is in short supply, and brackish or salt water will be used for blasting. Where this is the case, we always advise that the blast be followed by a high pressure fresh water wash to remove residual salts.

Using the Standards

The standards are used by the company and its customers at the specification stage of a coating project to set acceptable levels of surface preparation. They are also designed for on-site inspections. The standards follow the general format of other visual standards used for on-site inspections; they include photographs, written definitions, procedures, and notes for the inspector.

The procedure for using the standards is designed to follow a logical pattern. The inspector selects the rust grades of steel to be cleaned (either C or D), and then selects the photograph depicting the degree of cleaning that has been specified. The prepared surfaces are compared with the photograph immediately after blasting and before flash rusting has occurred. This comparison ensures that the surface has been prepared to the required standard.

At this point, my company's procedures differ slightly from those used in other standards. Immediately before painting begins, the inspector must carry out a second inspection to assess the degree of flash rusting that has occurred. He or she must also check the paint product specification to ensure that it is suitable for overcoating that particular degree of flash rusting. If flash rust is too heavy, the notes in the standard say that it can be reduced to an acceptable level by high pressure waterjetting.

Some visual standards make the photographs subordinate to the written definitions, while others make the written definitions subordinate to the photographs. This is fine where rigid adherence to a specification is required. However, in most instances, our inspectors or technical service representatives are on site to offer advice. Actual decisions about accepting or rejecting blasts are made by the owner's representatives. In these instances, both the photographs and definitions should be subordinate to our inspectors' judgment, common sense, training, and experience. In reality, this is how all good paint inspectors work.

However, there may be a problem with wet blasting. Obviously, large scale hydroblasting and slurryblasting jobs are still fairly rare compared to open abrasive blasting work, and it is difficult for inspectors to gain the required experience necessary to evaluate surface preparation. This is why the company is following up its standards with worldwide training courses that cover both the theoretical and practical aspects of wet blasting steel. The courses are designed to give inspectors hands-on experience handling wet blasting equipment and carrying out inspections on flash rusted steel. **JPCL**

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