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Dealing with *Flash Rust*

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We were standing on the dry dock in a small, very progressive shipyard in Baltimore harbor. The vessel on dock, a tugboat, was the pride and joy of the owner and the core of the family owned towing business. It was more than just a possession; it was his whole livelihood. We had waterjetted areas of the underwater hull to NACE 5/SSPC 12 standard, WJ-2. There was a significant amount of flash rusting, and he was concerned. He was now unsure how to proceed.

"Paint it!" I said.

The look on the owner's face showed he was clearly distraught. "What about all of the rust?" he questioned.

With a deadpan face, I said, "I think you should paint that too!" He saw I was serious and trying to relieve some of his tension. It helped a bit, but he was still alarmed. So, we went and had a cup of coffee and chatted about waterjetting and what was happening to "his baby."

Overcoming Objections

Dry docking the vessel was a necessity for maintenance and inspection purposes. Typically, we would abrasive blast the underwater hull, but, because of environmental issues, ship-



Fig. 1

Photo courtesy of John Tanner

yards were doing more work with UHP waterjetting. This transition raised concerns with the owner who, traditionally, was only familiar with abrasive blasting or power tool cleaning. Flash rusting was and still is a big issue with clients.

We chatted about rusting and how it is actually an electrochemical process. I explained that steel that has been abrasive blasted to "near white metal" and is nice and bright and seems like the perfect thing to paint may have some hidden problems. The bright, recently blasted surface is actually

slightly electrically unstable. The metal wants to "turn" or begin the oxidation process. This is a natural event. If there is an electrolyte or liquid that has available electrons in it, and, it is in contact with the metal surface, the "turning" process will accelerate. Therefore, steel that has completed this transformation and shows a light reddish brown patina is actually very stable. This flash rusting may not be a bad thing!

Studies have shown that when properly formulated coatings are

Continued on Page 22

Dealing with Flash Rust. . .

Continued from Page 20

applied to surfaces, the surfaces will perform in accordance with their design criteria. Simply stated, they work fine! Waterjetting has been used in Europe for many years and is not really new technology. However, there have been incredible advances in equipment that now make the process much more viable in both marine and industrial coating markets. Production rates are faster, and the degree of cleanliness is much better.

"But," he insisted, "I have been in this business for over twenty years, and we try to never paint over rust!"

Quite often, the biggest controversy that erupts on a waterjetting job relates to the acceptable degree of flash rusting.

"It's true," I replied, "but we are painting over 'tight rust.' We are going to check to make sure that it will be an acceptable surface for painting." I know he wanted to believe me, but doubts continued to surface.

"We tried painting the forepeak tank with one of those 'surface tolerant' epoxies after we pressure washed it, and half of it fell off the next year!" he exclaimed. He was obviously still worried.

The Process

Waterjetting is relatively new in some areas, and, until people become familiar with it, it does raise concerns. Many of today's modern epoxies perform very well over waterjetted surfaces. What is important, in addition to having the correct coating material, is that the surface preparation specification be properly written. In this case, the shipyard knew they were going to waterjet certain areas to condition "WJ-2, light flash rusting." This is a NACE/ SSPC

standard that is well known to all reputable coating contractors who offer waterjetting services. By specifying a WJ-2 surface, the contractor is required to remove 95% of the existing coating material.

Additionally, all rust scale will be removed. The degree of acceptable flash rusting can be verified by wiping the surface with a clean rag to determine what residue is left. A surface showing "light" flash rusting will not discolor a clean rag when it is lightly wiped on the surface. It's primitive, but it works!

In an effort to address his concerns and put him at ease, I went to my van and produced a sample of material.

(See Fig 1.) I explained that the major cause of failure when coating over supposedly "tight rust" was going over rust scale, which is rust that forms

in layers as the steel breaks down. The coating adheres to the scale, but when the scale falls off, so does the coating!

This was probably what happened in his forepeak tank. He admitted that there was rust on the backside of the coatings that came off. We didn't have to contend with this possibility on this job because we had written a good specification, which called for the removal of all rust scale. I pointed out that what he was seeing was flash rusting or what some people term "rust back." It can be coated with every expectation of success.

Quite often, the biggest controversy that erupts on a waterjetting job relates to the acceptable degree of flash rusting. There are several ways of dealing with this issue. Depending on the equipment that is being utilized, flash rusting may or may not be present. Most open lance units will allow for the formation of flash rust. As

mentioned earlier, this is a natural occurrence. There are also UHP waterjet units on the market that vacuum the water off of the surface, along with paint chips, dirt, and rust particles, as the unit works its way across the surface. The friction, generated by these "closed loop" systems, heats the surface of the steel and causes very rapid evaporation of the water. Consequently, there is little or no flash rusting. The US Navy and the Coast Guard have accepted these types of units. They are used on their vessels when recoating flight decks, freeboard, and underwater areas. These systems produce a surface that is much easier to accept as being "ready" for painting!

"But, we can't paint now!" he remarked. "The shift is changing and machinery repairs have to be made before we can paint! What will happen if more flash rust forms before we get to paint it?"

I explained that we actually had a couple of options. If the amount of flash rusting did indeed increase to an unacceptable level, we could wash it off with a low pressure fresh water wash at about 3,000-5000 psi. It would darken the steel, but it would also remove the powdery flash rust. Another option would be to brush it off with brooms, making certain to remove all of the dry powdered rust. I explained that, unlike abrasive blasting, the timing to actually get coating material on the surface was not that critical. We didn't have to keep the steel bright and shiny! As it turned out, it rained for the next two days, and he felt better that we didn't have to reblast the hull!

A Final Check

I returned to the shipyard a couple of days later. The outside machinists were finishing up the installation of the wheel, and the painters were rigging a pressure washer to give the hull a final cleaning. As expected, the once "tight rust" was now covered with a powdery layer of reddish brown iron oxide. Rubbing my hand over the surface produced a vivid

red stain on my palm. "Too much," I said. "After they pressure wash it and it dries, we should be good to go."

The washing procedure took a little over an hour, and, after it was dry, which was helped by a stiff breeze, I checked it by wiping it with a clean white rag. This time there was no discoloration; we were ready to apply the first coat of epoxy primer.

I knew he was still a bit apprehensive. As a final check on quality, I measured the amount of chlorides on the hull. Recent studies have shown that salts, from roadside de-icing procedures or from marine exposure, can have an extremely detrimental effect on coating performance. In this case, the amount of soluble salts was, as expected, almost nothing. Traditionally, waterjetting produces a surface with exceptionally low chloride readings. Also a factor in this case was the fact that the shipyard had washed the hull to remove higher levels of flash rusting. After properly mixing the epoxy primer and waiting the required induction time, the underwater hull was painted as per specification.

I could see relief written on the owner's face, as he no longer had to look at the bottom of "his baby" rusting away! The job was finished in a couple of days. The vessel was soon put back in the water and off he went!

A few months later, I was back in the same shipyard, and I saw the owner in the parking lot. "Everything OK?" I asked. My friend had a smile on his face as he explained things were good. They were planning to put a new winch on the tugboat's main deck and give the whole main deck a major facelift at the same time. What method of surface preparation was chosen for the job—why waterjetting of course!

John Tanner has been part of the marine coatings industry for 20 years. He is the chairman of the NPCA Marine Coatings Committee and is involved with NACE and SSPC in the development of waterjetting standards for industry.

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