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Corrosion Control by Soda Blasting:

Maintenance Painting on Structural, Mechanical, and Architectural Metals

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Soda blasting is often described as a "non-destructive method of paint stripping and cleaning." Soda blasting is a variation on sand blasting, but instead of using sand (or other abrasives such as slag), this process uses baking soda — sodium bicarbonate. When the baking soda hits the substrate, it "explodes" into fine particles, removing rust and surface contaminants. While the process can be done on many surfaces we will focus on soda blasting as it relates to steel, specifically in preparation for maintenance painting.

Since the process of soda blasting began in the 1980s, many people who are associated with coatings and surface preparation have had a tendency to interrelate soda blasting with conventional blast processes. The blasting results of conventional abrasive blasting, (i.e. surface profile, visual specifications, etc.) have been misapplied to soda blasting. Understandably, this has led to confusion of abrasive blasting with soda (sodium bicarbonate) and to direct comparisons to the generally accepted methods of abrasive blasting. The consensus has been "Why soda blast when it does not achieve conventional specification results?" This is a logical conclusion if soda blasting is superimposed over most other types of abrasive blasting. Separation and analysis between soda blasting and abrasive blasting, however, present a totally different prospective on soda blasting.

To Blast or Soda Blast?

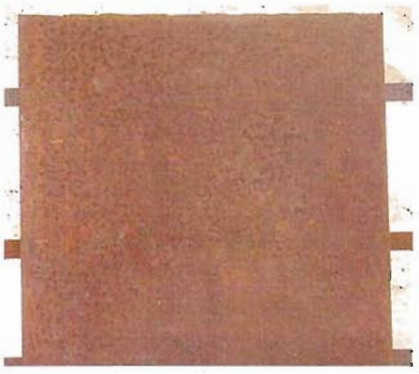
Remember, the topic here concerns preparation for maintenance painting. Maintenance painting surface prep calls for a situation in which a protective coating system is applied to a previously blasted surface.

Let's look at a typical situation involving prematurely failing coatings on a steel tank. In our scenario, after a reasonable period of time, some of the tank's original topcoat as well as the primer begins to fail. In some areas, primer is exposed while other areas are beginning to rust. The owners decide to repaint the tank in order to inhibit the corrosion process and address the aesthetics as well. There are several options for determining just how the coatings job will be accomplished. The coatings contractor can: completely strip all paint and rust by abrasive blasting, or spot blast the worst areas, or sweep blast and spot blast, or blast to NACE #3/SSPC-SP 6 standard for Commercial Blast, or blast to NACE #2/SSPC-SP 10 standard for Near-White Blast, then establish the coatings specification, and so on.

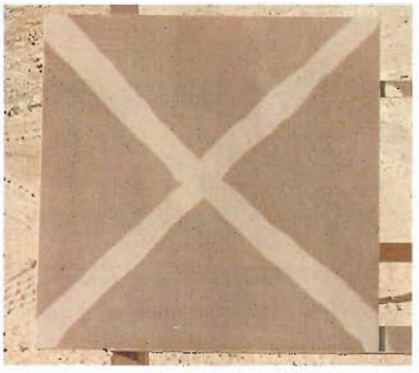
The above options are common in a typical maintenance painting project with all known factors taken into consideration. Since we are talking about the basics here for our scenario, let's select the complete stripping and repainting option with the application of a complete coating system. Our abbreviated specification calls for a NACE #2/SSPC-SP 10 Near White Metal surface preparation followed by the application of a primer, intermediate coat, and a topcoat or two.

A common saying in the coatings industry is "a coating is only as good as the surface preparation." Metaphorically, this may be considered accurate; however, it should be stated, "a coating's performance is seriously affected by the surface preparation."

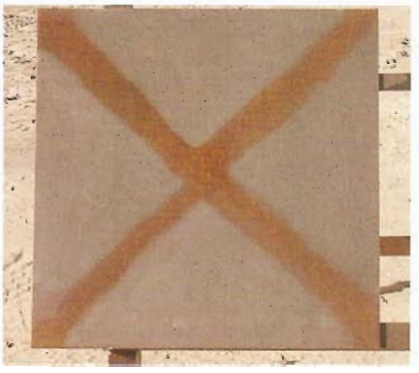
O.K. So, the specification calls for a "Near-White Metal finish" and our contractor's prep work, using abrasive blasting with steel slag, resulted in a



ABOVE ▲ Figure A. The base plate with moderate to heavy rusting.

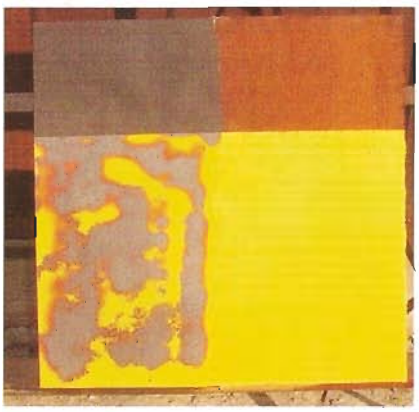


ABOVE ▲ Figure B. The entire plate was sodablasted removing all rust. An "X" mark was sandblasted across the plate as noted in the picture.



ABOVE ▲ Figure C. Photo was taken about three weeks after figure B. Note that the sodablasted area outside of the "X" has not rusted but the "X" itself is showing light to moderate rusting.

ABOVE ▲ Figure D. Plate was sandblasted on the top half and sodablasted on the bottom half. After two months the upper sandblasted area has considerable rusting while the lower sodablasted surface shows little rusting.



ABOVE ▲ Figure E. Top third of the rusted plate was not blasted and left completely rusted.

ABOVE ▲ Figure F. Left top of plate was sodablasted and left untouched. Upper right was originally sandblasted. Bottom was sandblasted then painted with a primer, intermediate layer and topcoat. It was later spot sodablasted down to previously sandblasted metal exposing original anchor profile.

"quality appearance" consistent with NACE #2/SSPC-SP 10. He then applies the coating system, which looks great — no blisters, no pinholes, etc. We should be good for at least 10 years. Right?

Wrong! Three years later rust is again breaking through the coating. The owners are furious and ready to sue the coatings company. Corrosion consultants are brought out and determine that chlorides are present beneath the primer. How did that happen? The metal was blasted and that should have removed the contaminants. Right? Unfortunately, there were chlorides that were not completely blasted off — in fact, during the abrasive blasting process, some chlorides were actually blasted into the metal. Also, the abrasive blasting process reconfigured the surface steel molecules by moving the anodic and cathodic molecules (activating the steel surface) in conjunction with the impingement of chlorides. And, if our contractor used recycled abrasives, we have another potentially damaging situation. Occasionally, recycled abrasives can become contaminated and during the blasting process can re-introduce the contaminants into the blasted surface. In that case, we now have a perfectly functioning iron oxide factory.

So what does soda blasting have to do with this typical scenario? Remember in this case we are dealing with maintenance painting. The surface profile was already established during the original coating process. Soda blasting will not etch steel but what it will do is etch and/or remove old paint and rust.

Soda Blasting: Options and More Options

Paint removal in the early days by soda blasting was reasonably accomplished but rust removal was a different story. However, it was recently discovered that increasing the velocity of soda blasting by virtue of higher pressure, could effectively remove rust. The odd thing is that when the rust is removed, the cleaned surface doesn't look like a NACE #2/SSPC-SP 10 or any other abrasive blast found on the visual determination charts. What is left is undisturbed steel — natural in color (dark grey) and pitted.

Going back to our original scenario, we can determine that several factors led to the steel tank's premature coating failure. Chlorides were impinged into the metal during the conventional blasting process. Also, the surface metal was activated by translocation of anode and cathode molecules. This disturbance is often observed in a matter of seconds during conventional blasting in a humid, chloride-rich environment and is commonly referred to as "flash rusting."

Soda blasting offers many options; chief among them is the option of reducing the scope of the recoating project. It has been observed that a tightly adhering coating can serve as an excellent primer or sub-primer. A soda blast sweep with a water rinse will remove chlorides and other contaminants such as oil and acids, while adequatcly preparing the previously painted surface for recoating. If an anchor pattern is recommended on the old coating, a longer soda blast dwell period will provide the desired painted surface etch. In areas where the paint is determined to be loose it can be completely removed using soda blasting to expose the original anchor pattern. This will allow for a neat "feather-edge" into tightly adhering paint. Also, there is no flash rusting to the bare metal because the surface is "passivated" from the soda blast process and can be left uncoated for extended periods due to the absence of sufficient electrolytes that contribute to rusting. Additionally, soda blasting can be done in the rain for extended periods (days/weeks) when the duration of a job is time sensitive. Given all of this, the contractor in our scenario could easily have used soda blasting to achieve a sufficient surface prep and to scour away chlorides and surface contaminants.

A Reduction in Time and Money

Unlike other abrasives such as sand and slag, soda blasting causes little or no collateral damage to nearby surface areas. The baking soda granules do not ricochet or over-blast like hard abrasives. Most machinery is not affected because baking soda is water soluble and friable. This

ABOVE ▲ Left side of photo shows store-bought (in the box) baking soda powder. Right side shows blasting soda, which is coarse in size with minimal fines. Original magnification 30X.

usually eliminates the masking and blast prep required with conventional blasting.

In our steel tank scenario, a comparative abrasive cost analysis would favor soda blasting. Sand and slag materials cost about $60 per hour as compared to $50 for soda blasting. The production time required for soda blasting would be significantly less when the entire scope of the job is considered, ie. from job prep to spent abrasive remediation — 1,800 lbs. per hour of hard abrasive vs. 0 lbs. to 100 lbs. per hour using baking soda. Remember baking soda is water soluble and can be disposed of in a number of ways. Always follow local disposal regulations, especially depending on the removed contaminants. However, the spent soda can often be disposed of in common wastewater treatment systems.

Some projects require repainting of thin gauge steel. Soda blasting is ideal for these types of projects as it is a less harsh process than conventional blasting. Using hard abrasives will etch the steel surface and cause the metal to be "stress relieved," which will cause the metal to become warped and disfigured. Besides being unsightly, proper fit-up may be disturbed affecting the integrity of the structure. So, in these "delicate" situations, soda blasting is a good alternative to conventional blasting.

In summary, it is reasonable to present the soda blasting process to corrosion artisans so it can be considered as a viable alternative in many maintenance projects that exist in various industries including marine, offshore, petro-chemical processing, food processing, and transportation industries just to name a few. Soda blasting is an environmental- and user-friendly alternative to conventional blasting. CP