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## TO PICKLE OR NOT TO PICKLE? MEASURE AND FIND OUT!

When welding stainless steel, oxidation occurs on and beside the weld seam, both internally and externally. The oxidation is visible as a coloured zone and results in a decrease in resistance to local corrosion. For the inside of a pipe, for example, a correct backing procedure during welding is essential to minimise oxidation and colouration. In many cases, a finishing treatment, such as pickling is required to remove the colouration and restore the corrosion resistance. Currently, colour charts are often used to determine the degree of colouration, and as such to determine whether the weld seam must be pickled or not.

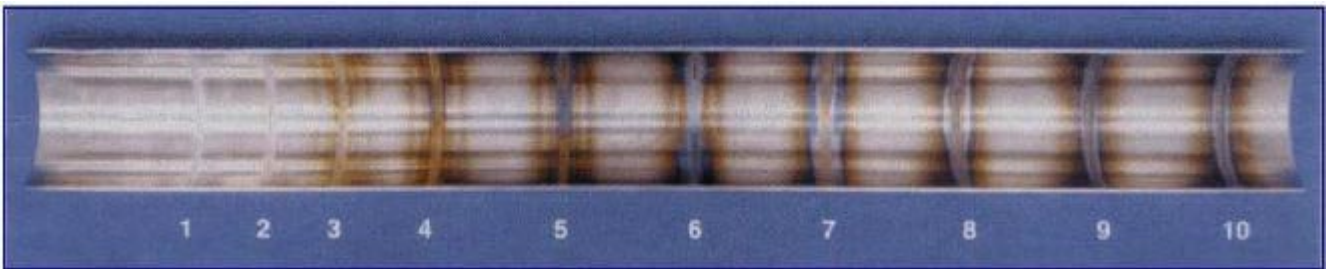


Figure 1: AWSO colour chart with weld 1 at 10 ppm oxygen and weld 10 at 25,000 ppm oxygen

However, this way of determining the degree of colouration is very subjective, and in principle any level of colouration indicates oxidation with the resultant decrease in resistance to corrosion. Hence, quantification of the sensitivity to corrosion at weld colouration or other damage to the surface is desirable. Sensitivity to corrosion is mainly studied in laboratories with electrochemistry. However, standard electrochemical measurement equipment, such as potentiostats, are not suitable for field applications because of their large size and the high costs associated. Recently, the **test.clinox** was developed. This is a unique, handy and inexpensive potentiostat and pen-shaped measurement electrode, with a built-in reference for determining the current flow at every point on the tested product.



Figure 2-3: Test.clinox and measurement

The current measured at a specific applied potential is directly related to the level of corrosion sensitivity. As shown in figure 4, the surface with unpickled weld seams (left) is more susceptible to corrosion and the test.clinox measures high current levels on and beside the weld. If the surface is well pickled and passivated (figure 4 right), the test.clinox does not measure high current peaks.

With the aid of digital electronics and a set limit for the measured current, the test.clinox indicates by means of a red or green LED whether pickling is necessary or not. The test is non-destructive, which means that the material does not need to be damaged. The ease-of-use, the short preparation time and the possibility of measuring practically every type of object make this instrument a usable piece of equipment for quality control within the industry.

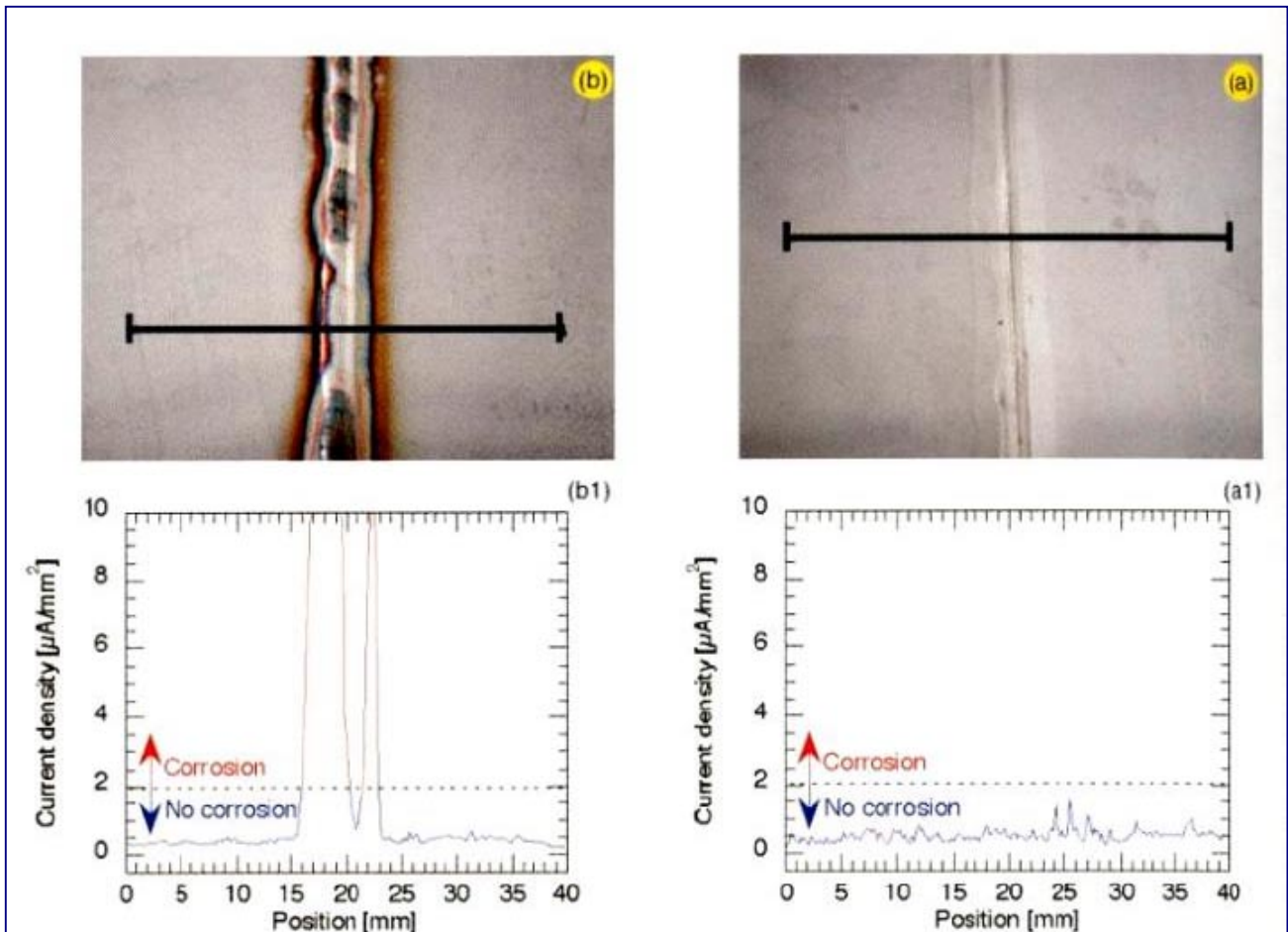


Figure 4: Current measured as a function of the location before (left) and after pickling (right)

### Pickling and passivating

A pickling treatment is the only type of post-treatment capable to restore the corrosion resistance of the stainless steel at the weld and other surface damage, to what it was prior to welding. This is true irrespective of the type of stainless steel and there is no difference in effectiveness between immersion in a pickling bath or application of a pickling paste [Practical recommendation No. LM.94.04 NIL (Dutch Institute for Welding Technology), TNO (Applied Scientific Research)– metal institute]. The corrosion resistance is restored during the pickling treatment because iron dissolves quicker during pickling than other metals, whereby the surface is enriched with chromium (see figure 5) and the corrosion resistance of the stainless steel increases.

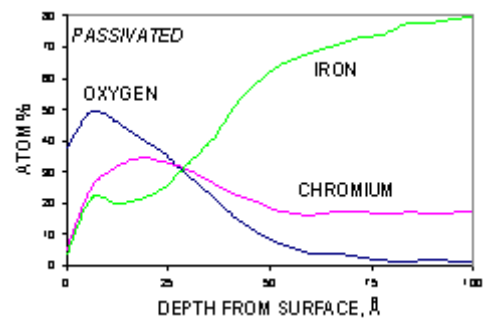


Figure 5: Concentration profile after pickling and passivating

VECOM has been treating a variety of materials, including stainless steel, for over 50 years. Pickling and passivating this material after processing restores the corrosion-protective oxide layer. We cannot stress the importance of this post-treatment of stainless steel often enough when it comes to preventing various types of corrosion, with all the associated consequences.