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Guidance on the methods used for removing surface rust from Grade 8 or higher, steel chains and components.

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1.0 Introduction

The environment in which high tensile steel chains (grade 8 or higher (8+)) and components are commonly used will cause corrosion of the material. As a part of a good inspection/maintenance regime it is beneficial to remove this surface rust. However, it is important to ensure that the correct method is selected as some techniques can damage the equipment or reduce its life span. This guidance document identifies and provides guidance on some of the common de-rusting methods available on the market.

2.0 Rust removal methods

Surface rust can be removed in two ways:

- By mechanical means or;
- By chemical means.

The following sections describe some of the various forms of these rust removal methods and provide information to enable the duty holder to understand the potential risks associated with each.

2.1 Mechanical rust removal.

The removal of surface rust by mechanical means is by far the safest method available to the duty holder. The various forms of mechanical rust removal mean that it can be used to remove surface rust on wide range of products. The following sections identify the main forms of mechanical rust removal and any limitations associated with them.

2.1.1 Shot blasting.

In this method a stream of abrasive material is forcibly propelled against the surface of the component under high pressure to remove the surface rust.

To determine the suitability of this method consideration shall be made to the following limitations associated with it;

1. The surface rust will only be removed from surfaces that are exposed to the abrasive blast media.
2. The abrasive nature of the process means that the metal beneath the surface rust can also be affected.

2.1.2 Tumbling

As the name suggests, chain or components are placed in a rotating container, which causes them to continually ‘tumble’ down a slope created by the containers rotation. As the components or chain tumble, they rub and knock against each other, which effectively removes surface rust.

The disadvantage of this technique is that the tumbled parts will suffer additional wear and tear. It shall also be noted that this technique is inherently noisy, requiring protective measures. One such measure is to enclose and ‘dampen’ the noise, but this can generate additional heat to the extent where it would be advisable to have adequate firefighting materials nearby.

2.1.3 Vibrating

In this process the components are placed in a container with an abrasive media. The container vibrates, which causes the media to rub against the components and remove the surface rust.

Again the abrasive nature of this method means that the components will suffer additional wear and tear.

2.2 Chemical rust removal.

The use of chemicals with grade 8+ steel chain and components is generally not recommended as they can cause hydrogen embrittlement. This phenomenon has been attributed to the failure of many grade 8+ steel chains and components, as it causes a loss in ductility or load carrying ability or cracking (usually as sub-microscopic cracks), or catastrophic brittle failures at applied stresses well below the yield strength or even the normal design strength of the material. The following sections identify the main forms of chemical rust removal and any limitations associated with them.

2.2.1 Acid and Alkaline based rust removers.

Although affective in the removal of rust these products should not be used with grade 8+ steel chains and components as they are known to cause hydrogen embrittlement.

2.2.2 Electrolysis for rust removal.
Electrolysis is a method of removing iron oxide by passing a small electrical charge through the oxidised metal to stimulate an exchange of ions whilst the component is submerged in an electrolyte solution, typically water mixed with Sodium Carbonate.

Again this method should not be used with grade 8+ steel chains as it is known to cause hydrogen embrittlement.

2.2.3 Rust Converters
Rust converters chemically convert rust into iron tannate, a dark coloured stable material which also serves as a protective coating to the material. Unfortunately, they are acidic and as such they may cause hydrogen embrittlement and, therefore, their use is not recommended.

2.2.4 Chelation
Chelation is a phenomenon that removes rust through a chemical reaction between the rust molecules and the chelating agent. It is claimed that this process is PH neutral and, therefore, there is no risk of hydrogen embrittlement, although LEEA recommends that assurances of this are sought from the supplier. However, if the rust has penetrated deep into the metal, for whatever reason, this too will be removed and the structural strength of the component could possibly be reduced.

The submersion time of the component is critical and it is equally important that the chelating agent is thoroughly cleaned off the product, as prolonged exposure can corrode the metal, as shown figure 1.

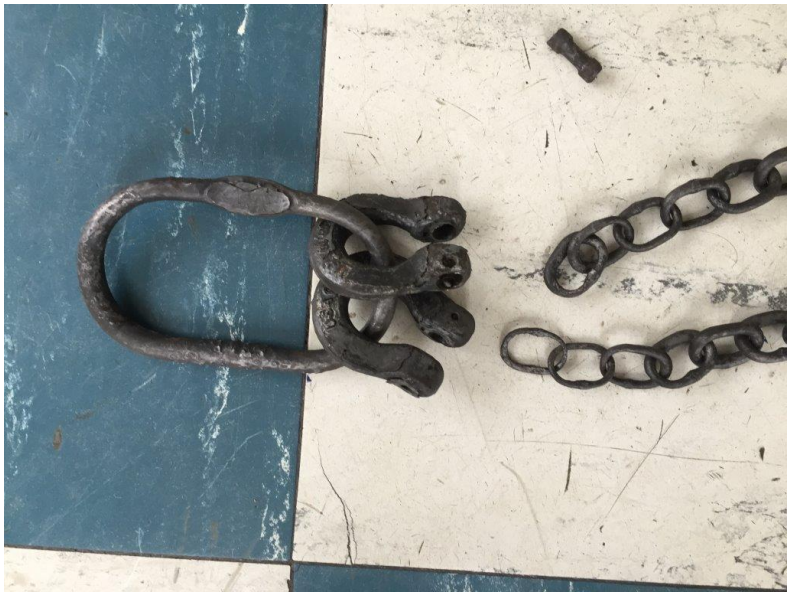

Figure 1: the effect of prolonged exposure to a chelating agent on a chain sling.

Chains will inevitably pick up contamination which may affect the strength of the solution and its ability to clean. There is also the additional issue of disposing of the solution once it has reached saturation point. Although technically Ph neutral the potential for other contaminating substance coming off the chains means that it would have to be removed by a controlled/licensed carrier

3.0 Conclusion and Recommendation.
It is clear that most chemical surface rust removers can cause hydrogen embrittlement and therefore their use is not recommended. PH neutral chemical rust removers offer a solution to this issue, but the effects of prolonged exposure cannot be ignored. It is, therefore, vital that measures are put in place to ensure that prolonged exposure is prevented. It is also recommended that following the process, the slings and components are thoroughly examined.

Although the abrasive nature of the mechanical rust removal processes does cause additional wear, this problem is tolerated, as it can easily be monitored and controlled. Therefore, it is LEEA's recommendation that these methods are selected to remove surface rust from grade 8+ steel chain and components. It is also recommended that they are thoroughly examined following the process.