Technical Bulletin

Technical Bulletins on the Internet: www.vecom-group.com

Number: 2004/16 September 2004

PHOSPHATING OF CARBON STEEL WITH COLD PHOS / ARO

Introduction

Protective coatings, grease, oil, mill scale, annealing skin and oxides are the most common contaminants found on carbon steel. If before installation prefab pipespools are treated by specialized metal surface treatment companies, there are reasonable good facilities and inspection possibilities. A problem arises when such conservations have to be removed from a complete installation in situ.

Present deposition for treatment

The deposition has been removed and a phosphate layer has been applied

The reasons for a chemical pre-commission surface treatment of a carbon steel installation are:

- prevention of product contamination.
- prevention of damage to machinery (blockage of filters, damaging of turbines, explosion danger in pure oxygen systems).
- prevention of corrosion in specific environments.
- reduction of flow.

A surface treatment (internal) of carbon steel generally consists of the removal of protective coatings and grease, in a hot alkaline solution, the removal of oxides and mill scale with inhibited acids and a passivation.
Passivation is often chosen as a way to apply a metal conversion layer by means of phosphating. With this we can kill two birds with one stone: the pickled carbon steel is passivated (after all, a film of rust may immediately develop after pickling and rinsing with water) and a solid priming for organic finish coats such as paints or coatings is created at once.

This Technical Bulletin will investigate the application of metal conversion layer through phosphating on carbon steel.

Metal conversion layers

A conversion treatment is the chemical or electrochemical process that is applied to obtain a cover layer (conversion layer) consisting of a compound of the surface material itself. Conversion layers consist of oxides, chromates, phosphates or sulphides. They are therefore inorganic cover layers. The fluid in which the process takes place consists of constituents that initially dissolve a part of the metal surface. The solved metal ions react immediately with constituents from the fluid itself and form the precipitation or conversion layer.

Phosphating

Phosphating is applied on iron and steel, zinc, aluminium, magnesium, cadmium and their alloys, with the aim to:

- Improve the corrosion resistance.
- Improve the bond of organic cover layers.
- Facilitate the cold deformation.
- Reduce friction.
- Increase electrical resistance (zinc phosphate layers).

Applying phosphate layers can take place:

- In immersion baths (usually for smaller productions).
- In spray tunnels.
- With a brush.

Cold Phos / ARO

Cold Phos/ARO is applied when sand-blasting, warm phosphating or pickling in baths is not possible. It is the best product in the Vecom range of products for the cold phosphating of carbon steel. Cold Phos/ARO is a product on the basis of phosphoric acid, zinc salts and moistening agents. As a result a strong penetration and a good moistening are guaranteed. The formed phosphate layer offers a sound temporary corrosion protection and an excellent paint adhesion.

Phosphating

First remove any loose rust with a steel brush. After this, dilute according to Cold Phos / ARO in a proportion of 1 litre on 2 litres of water (solution of about 35 %). For the preparations it is necessary to use a plastic bucket or plastic bowl. This solution must be applied with an acid-proof brush or spray gun. Do not rinse it afterwards.
After it has been completely dried (approx. 6 hours), a protective phosphate layer has been formed, which offers a sound corrosion protection to the underlying metal and is responsible for a good pain adhesion.

Intermezzo

The electrolytes that are used with phosphatising have the following basis: phosphoric acid and zinc phosphate, zinc/calcium phosphate, manganese phosphate or zinc/nickel/manganese phosphate. When applied, the pH lies between 1.8 and 3.5.

Phosphate baths also contain oxidation agents such as nitrites, nitrates, hydrogen peroxide or organic nitro-compounds. Sometimes metal compounds, polyphosphates, fluorides and borates are also added.

During the process of phosphatising Fe(II)-phosphate is dissolved, which is partly oxidised to Fe(III)-phosphate and precipitates as so-called phosphoric sludge.

Auteur: ing. J.P. Lange (Research & Development)
Reactions and/or questions: e-mail: tb@vecom.nl