Analysis of the Causes of Degradation of Surface-Treated Sheet Metal of Part the Lift

Kuśmierczak Sylvia†, Kraus Pavel

Abstract: This paper analyzes the causes of degradation of the coated sheet lift construction that worked in real conditions. Coated sheets were analyzed macroscopically and microscopically using standard methods. Results of the analysis will be used to create recommendations so that the degradation and shortening of life not occurred.

Keywords: analysis, degradation, surface-treated sheet

1 INTRODUCTION

Corrosion of materials is an actual problem in of many industries. Corrosion covers most of the materials with which we meet, whether they are metal, plastic, glass, concrete or other materials. Many of these materials are subject to corrosion due to the elements of nature, but also due to technological and aggressive environment in which the materials are exposed [1, 2, 8]. Corrosion is the interaction between the environment and the material, which leads to loss of functional properties and degradation of the material. Corrosion attacks, the type of corrosion and its location described in standard ČSN 03 8137. The process of corrosion is not only dependent on the chemical composition of the environment and the type of material. Corrosion is accelerated by other factors, which are mainly: mechanical stress, fatigue, improper heat treatment, improper construction and the like [1, 2, 3, 4, 8]. Therefore, it is important to create a surface treatment on material. With surface treatment and reduce corrosion aggressive environment can slow down or prevent it. Surface treatments contribute to savings in material and from economically in most industries pay to use it, despite the fact that using safe surface treatments also contribute to environmental protection, which is now also widely watched topic in any industry. Best variant corrosion protection is a combination of the above mentioned surface treatments and adjustments aggressive environment with other ways to protect the surface, such as the choice of suitable materials, structural design, production technology and electrochemical protection [3-7].

The aim of this paper is to analyse the quality of surface-treated sheets for construction of elevator. It will be evaluated the corrosion resistance of the surface layer and the degradation of components and subsequently examined analysis of quality of surface-treated steel sheet. For solving the issue was chosen following procedure: description of the sample, measuring the thickness of protective layer, macroscopic evaluation, evaluation of coating degradation by CSN, microscopic analysis. As an experimental sample was used sheet elevator part, which has been in operation, Fig.1.

2 EXPERIMENTAL MATERIALS

The aim of this paper is to analyse the quality of surface-treated sheets for construction of elevator. It will be evaluated the corrosion resistance of the surface layer and the degradation of components and subsequently examined analysis of quality of surface-treated steel sheet. For solving the issue was chosen following procedure: description of the sample, measuring the thickness of protective layer, macroscopic evaluation, evaluation of coating degradation by CSN, microscopic analysis. As an experimental sample was used sheet elevator part, which has been in operation, Fig.1.

Elevator was not directly exposed to the outdoor environment. Age of sheet is approximately 15 years. Plate was most likely painted over at least once due to maintenance. Plate length is 500 mm; width 250 mm, thickness is 5 mm. As a surface pre-treatment method was applied hand brushing with steel wire brushes. The plate itself was welded circular start only after the coating on one side. Application of paint on the surface of the plate was sprayed - pneumatic coatings. At the very surface of the part has been used synthetic cover spray mass of metal, glossy, grey hue. Drying coatings was carried out in air.
3 THE ANALYZES

Measuring the thickness of the coating layer: barrier protection is one of the basic factors of quality surface protection part, then is necessary correct and regular thickness of the coated layer. According to the recommendations of EN ISO 2808 and EN ISO 3882 has been chosen method of measuring the thickness of the surface layer using a digital thickness gauge. Measuring the thickness of the surface layer was carried out in the laboratory using a digital thickness gauge POSITECTOR 6000.

Macroscopic analysis revealed the following surface defects [10, 11]: Dripping (Fig.2) - dripping paint from the part. The cause of defects: uneven application of paint, too much pressure in the gun, bad paint viscosity, short drying time, low ambient temperature, oily surface.

![Fig. 2. Dripping](image1)

Bubbles and peeling paint: small raised points in the paint and peeling paint (Fig. 3). The cause of defects: wet the surface before painting parts, large ambient humidity painted parts, a lot of tension in the surface layer, low temperature painted parts, poor pre-treatment surface of the component.

![Fig. 3. Bubbles and peeling paint](image2)

Impurities in the paint: small solid particles that emerge from the paint. The cause of defects: unadjusted surface prior to coating, dusty environment in which paint is applied and in which dries, bad filters for painting cabins or spray gun.

Corrosion resistance and degradation of surface treatment was carried out according to the applicable standards: ČSN EN ISO 2409 Cross-cut test, ČSN EN ISO 4628 – 2 Evaluation of degree of blistering.

Cross-cut test was carried out on surfaces that macroscopic evaluation showed defects such as sagging, cracks and bubbles, and clean flat surface free of defects. Area free of macroscopic defects: grid is formed almost completely peeled off. The area with bubbles and cracks: peeled area is greater than 5% but less than 15%. This area, even though it had visible defects in the form of cracks and bubbles fared better than the area clean, Fig.3.

![Fig. 3. Cross-cut test](image3)

The degree of blistering was evaluated according to ČSN EN ISO 4628 - 2. The number and size blisters is evaluated according to visual standards and approximate dimensions of area. To evaluate the degree of blistering five sites were selected on the sheet. The results of both tests show a high degree of corrosion and degradation plate surface. Microscopic evaluation was performed on a confocal laser microscope Lext OLS 3100. Samples were prepared by conventional metallographic procedure. Metallographic analysis showed that the part has two layers of paint. The first layer was probably older data, applied during the initial assembly of components into operation. The second layer was deposited on the first layer without removing the original, Fig. 4.

![Fig. 4 Two layers of paint g](image4)
The original coating layer was applied without proper surface treatment; the part is cleaned at least. As a result, the coating formed pitting corrosion, which eventually progressed under the coating, which is also in many places lifted, peeled and damaged top layer, see Fig. 5.

4 CONCLUSION

Macroscopic analysis showed the occurrence of recurrent defects, namely: dripping paint, bubbles and peeling paint, impurities in the paint. All causes of these defects are related to insufficient surface preparation before painting. In the next part of contribution surface quality was evaluated in terms of corrosion resistance and degradation. Tests confirmed the unsuitable condition the surface layer. The test results show a considerable degree of corrosion and degradation of the sheet surface. More by microscopic analysis of the surface layers at a location between the occurrence and without the occurrence of defects in the paint. Measured thickness of the surface layer was not uniform and not fulfilled the conditions for barrier protection. Microscopic analysis revealed that the surface of the sheet were applied two coats of paint, with an interval of several years. Microscopic examination also confirmed that the surface was not sufficiently prepared before application of coating layers. Pitting and corroded layers confirmed that the part before painting has been wet or stored in a humid environment. The analysis of quality surface-treated sheet for elevator construction showed that the coating application even to its pre-treatment was not taken great into consideration and quality of the surface layer it corresponds. Based on the analyses can be recommended before any application of paints comply with at least the general principles of pre-surface treatment and respect the manufacturer’s instructions for application layer of lacquer.

REFERENCES