

A CASE HISTORY: LINING WATER BOX CONDENSERS

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ABSTRACT

An energy company hired a contractor to remove and replace the linings of a condenser and water boxes during a maintenance shut down. This case history will give a summary of the scope of work, a review of the specification, a description of the work performed, an accounting of the in-process inspection, and a summary of lessons learned during the project.

Key words: Coatings, Lining, Power, Energy, Inspection

INTRODUCTION

An energy company hired a contractor to remove and replace the linings of water box condensers during a maintenance shut down. This case history will give a summary of the scope of work, a review of the specification, a description of the work performed, an accounting of the in-process inspection, and a summary of lessons learned during the project.

The project consisted of maintenance cleaning and painting of a steel condenser with 8 steel water boxes. The condenser and water boxes were first put into service in 2018. The original factory applied coating system consisted of a coal tar epoxy applied at approximately 12 -16 mils (305 – 406 μm) dry film thickness (DFT). Evidentially, this was not the optimum system choice for this service environment. After approximately three years of service, 2018-2021, extensive rust and pitting were observed throughout the condenser and water boxes, predominantly on the water box floors and walls near the floor. These conditions would require full removal of the remaining, existing lining and abrasive blasting to meet the requirements of NACE No. 2, Near White Blast Cleaning, weld repair of pits greater than 0.5" (1.27 cm) in depth, ceramic putty repair of pits less than 0.5" (1.27 cm) in depth, caulking, and then application of the lining system.

To reduce the risk of repeating a premature failure, the owner tasked a manufacturer to recommend a coating system more applicable to the service environment and to develop a comprehensive specification for the work. The owner also engaged a SSPC QP5 certified Coatings and Linings Inspection firm to perform third party inspection.

SPECIFICATION

Scope

Surface preparation consisted of pressurized water washing followed by a NACE No. 2, Near White Blast (minimum 4 mil (102 μm) angular profile). Pits greater than 0.5" (1.27 cm) in depth were repaired by welding and pits less than 0.5" (1.27 cm) in depth were repaired with ceramic putty. A 100% solids multifunctional epoxy (3 coats, 55-60 mil (1400-1524 μm) total dry film thickness (DFT)). The specification included requirements known to be proactive in preventing issues arising from difficulties with lining projects, especially condenser and water box lining projects. These requirements are discussed below.

Environmental Conditions

Maintaining suitable environmental conditions inside the condenser and water boxes during surface preparation and lining is critical, especially when applying epoxy linings. High humidity results in amine blush and high carbon dioxide levels effect the cure. The specification required all means necessary (e.g., forced ventilation, dehumidification) to maintain the relative humidity below 70%, the air temperature and surface temperature above 60°F (16°C), and the carbon dioxide level below 750 ppm. Lastly, the surface temperature was required to be 5°F (3°C) above the dew point.

Soluble Salts

Soluble salt contamination causes premature rusting and osmotic blistering. The specification required soluble salt levels to be below 3 ppm for chlorides, 7 ppm for sulfates, and 15 ppm for nitrates in accordance with SSPC Guide 15, Field Methods for Extraction and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

Dust

Before application of ceramic putty or lining, surfaces had to pass ISO 8502-3 tape test for dust with a rating of 2 or better.

Amine Blush Testing

The specification required amine blush testing of each coat of lining. A sample area was swabbed, the swab was inserted into a test tube with reagent and compared to a control test tube. Amine blush is indicated when the sample is less yellow than the control sample.