

Case study

Project: Root Cause Analysis

Client: Global industrial equipment manufacturer

Project objectives:

Determining the root cause for the early failure of an electronic circuit module, with implications for the operational safety of a complex machine.

Initial situation:

The studied electronic circuit board allows for the optimization of the operation of the machine and its shutdown in case of danger. The board was failing well before the MTBF guaranteed by the manufacturer. The failure of the board/module led to the unwanted shutdown of the machine.

Main activities:

Tests were carried out with the electronic module under real operating conditions. Through Ishikawa, 5 Why and Shainin type analyses, it was demonstrated that the electronic board was failing as a result of the failure of a relay in its composition. The relay was failing prematurely due to the overloading of its contacts as a result of vibrations combined with the accelerations occurring during the operation of the machine. This probable cause was verified by high-speed camera filming. The filming showed a special form of oscillation of the contacts, likely to generate their premature breakage due to material fatigue.

Results:

The root cause of the premature contact breakage was demonstrated to be the improper shape of the blades supporting the relay contacts. These blades, thin at the bottom, favored a complex oscillation mode that led to premature blade breakage due to material fatigue. It was recommended to change the blade profile by thickening the bottom, which eliminated the problem, according to subsequent testing. The root cause found was thus confirmed and the project was completed.