

SUCCESS STORY 97

BAKING OF ELECTROPLATED METAL FASTENERS TO PREVENT HYDROGEN EMBRITTLEMENT FAILURE DURING OPERATING LIFE



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How can I prove that my post baking process of electro plated fasteners is being performed correctly to avoid product failure due to hydrogen embrittlement?

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Situation and background

After electroplating metal fasteners, hydrogen atoms can diffuse easily through the metal. Formation of hydrogen molecules in voids within the metal creates pressure build-up, which can lead to internal cracks and field failure. If the metal has not started to crack, the condition can be reversed by baking out the entrapped hydrogen, if this is done within 1 hour after acid-treating the parts. The fasteners must be heated to a target metal temperature of 200°C/392°F and held at that temperature for 4 hours within the product basket to remove (diffuse) the harmful hydrogen.

The winning solution

- Datapac® Oven Tracker® system travels through the bake oven within the product basket, monitoring product and air temperature without difficult to use trailing thermocouples.
- Up to 10 thermocouple channels; allowing both air and product temperature to be monitored at different depths within the product mass located in the product basket(s).
- Traceable certified profile report allows verification to CQI-9 Automotive standards that product achieved the necessary 4 hours at 200°C/392°F.

Savings made

- Profile identified that product temperature ramp up was too slow, explaining the 3-4% rejection rate due to insufficient bake at temperature.
- Data available to allow process correction/optimization necessary to achieve peak metal temperature of 200 °C/392 °F for 4 hours.
- Certified validation report proves that product met required specs, eliminating risk of costly long term construction repair costs*

**Example Costs: Eastern span replacement of the San Francisco Oakland Bay Bridge – Failure of 30 of the first 90, 9 to 17 feet bolts due to hydrogen embrittlement – repair cost estimate \$5,000,000*

KEY FACTS

Customer's End Product
Electro-plated metal fasteners

Max Temperature Reached
Heat treatment
200-250°C/392-482°F

Duration of Process
4-6 hours

PRODUCT AND BENEFITS



- Datalogger Tpaq21 provides 10 points of measurement and possible RF operation.
- TB0081 barrier is capable of protecting 9 hours at 200°C/392°F, yet small in size at 182x236x370mm (7.2x9.3x14.6in).
- Mineral-insulated thermocouples for easy positioning within product mass at monitoring depths without risk of damage.
- Insight™ software provides certified and traceable validation reports, clearly indicating temperature uniformity within the product basket(s).