

Lubker DISTRIBUTION

Hydrogen Embrittlement

Hydrogen embrittlement is a condition in steel fasteners where the presence of hydrogen causes high-hardness metal (above Rockwell C 36) to fail when put under a load. Electroplating is a common source for the introduction, absorption and entrapment of hydrogen.

If the hydrogen is not removed, it migrates to high stress points when put under a load. Typically, this occurs just under the fastener head or in the first few load-bearing threads. Micro-stresses become small cracks then big cracks and then the fastener fails. The amount of time for this to occur is anywhere from a few hours to a few days. (Note: Hydrogen embrittlement failures do not occur immediately, but only after being under high stress for a period of time. Failures occurring immediately during or post assembly are not hydrogen embrittlement failures). The delayed failure timing is the primary, tell-tale symptom of hydrogen embrittlement.

Preventing hydrogen embrittlement during electroplating is a matter of baking the parts immediately after plating (375° – 425°F). This temperature will not impact the metallurgical properties, but will drive the hydrogen out through the electroplated coating. Baking time is very important; the higher the hardness, the longer the bake (See ASTM B 850 specs.) The time requirement runs from eight hours (Rockwell C 38) to 22 hours for parts above Rockwell C49. Some other specifications require baking for 24 – 48 hours.

Testing for Hydrogen Embrittlement is recommended for all high alloy (above Rockwell 36) electro plated fasteners. Testing the parts requires putting the parts through a stress durability test, where a sample (10 pcs or more depending on the plating 'lot') from the processed lot are screwed into a test block with a wedge interference under load and left for 48 hours. If hydrogen embrittlement is present, one or more of the fasteners will fail catastrophically under the head, or perhaps in the first few load bearing threads. If no fasteners fail, loosen and re-tightened them. If no failure occurs the second time, you can be confident that the tested fasteners are embrittlement-free

Although customers are encouraged NOT to plate high strength / high alloy products, there are times that they deem it necessary to offset application corrosion concerns. When this is the case, product is contracted for processing to quality approved suppliers who have demonstrated processes that meet industry quality standards. Testing post plating / baking is conducted by Lubker Distribution, or in some cases contracted directly to the approved plating facility or an outside independent laboratory.

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