Deembrittlement Verification Test

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DEEMBRITTLEMENT VERIFICATION TEST

1. SCOPE:

This standard outlines test methods and practices which can detect embrittlement of steel parts. It is a process control or referee verification test. The risk of embrittlement of steel is minimized by using best practices in the finishing/coating process. One such practice is described in SAE/USCAR-5, Avoidance of Hydrogen Embrittlement of Steel.

2. REFERENCES:

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE/USCAR-5, Avoidance of Hydrogen Embrittlement of Steel

3. DEEMBRITTLEMENT TEST

A torque/tension test is used for threaded parts and a tensile test is used for non-threaded parts. The test consists of three steps: 1) Determine the ultimate torque or tensile stress to failure for threaded and non-threaded parts respectively; 2) Load the parts to some percentage of the ultimate torque or tensile stress; 3) Maintain the torque or tensile stress for some determined length of time. Whenever possible, the test fixture should simulate the intended application. Section 3.5 discusses alternatives to test fixtures.

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3.1 Test Load Determination

3.1.1 Threaded Parts

a. Randomly select a minimum of 5 parts from the lot being evaluated to establish the test torque for the stress test. Note that the five part sample is only to establish the test torque used for the deembrittlement tests. The deembrittlement test sample size is discussed in section 3.2.

b. Apply torque to the test part, or the mating part of the text fixture until ultimate failure of the test part occurs. Some ideas of fixturing methods are discussed in Section 3.5. Hand or power tool tightening is acceptable, however, the selected tightening method must also be used in performing the deembrittlement test (section 3.3). Record the maximum torque for each of the five fasteners. The average maximum torque for all five test parts is the ultimate failure torque which completes step 1 referred to in section 3.

c. The test torque to be used in step 2, referred to in section 3., is 80% of the ultimate failure torque. This test torque value does not necessarily correspond to the actual application installation torque for the part.

3.1.2 Non-Threaded Parts

a. Randomly select a minimum of 5 parts from the lot being evaluated. (Note that the five part sample is only to establish the test load used for deembrittlement tests.) The deembrittlement test sample size is discussed in section 3.2.

b. Determine an acceptable tensile test method for the geometry and configuration of the part. The test fixture and test procedure must be agreed upon by the supplier and the purchaser. Some ideas on fixturing methods are discussed in section 3.5. Apply a tensile load to the part until failure of the test part occurs. Record the maximum tensile load for each of the five parts. The average maximum load for all five test parts is the ultimate load which completes step 1. The fixture and test method used for step 1 must be duplicated for steps 2 and 3. Steps 1, 2, and 3 are described in section 3.

c. The tensile load used in step 2, referred to in section 3., is to be some percentage of the ultimate load. Typical test loads are between 70 to 80 percent of the ultimate load. The supplier must determine a test load sufficient to detect embrittlement susceptibility. At a minimum, the test load should exceed the tensile load applied during assembly of the part into it's actual application.