WOODS & HUGHES
BOLTS & SCREWS LTD

UNIT 9, HILL TOP IND EST
SHAW STREET
WEST BROMWICH, B70 0TX
T : +44 (0) 121 505 7551
F : +44 (0) 121 505 7652
E : sales@socketscrews.co.uk
W: www.socketscrews.co.uk

Important Information

Hydrogen Embrittlement

Hydrogen embrittlement is a globally recognised problem (BSI, ISO, ASME, MOD) associated with high tensile bolts and screws 10.9 / 12.9 grades (hardness 35.0HRc and above / 1000N/mm² tensile strength) that are electro-plated.

When atomic hydrogen enters steels and certain other metals, it can cause loss of ductility or load carrying ability, cracking (usually as sub-microscopic cracks) or catastrophic brittle failures at applied stresses well below the yield strength, or even the normal design strength for the alloys.

This phenomenon often occurs in alloys that show no significant loss in ductility, when measured by conventional tensile tests, and is frequently referred to as hydrogen induced delayed brittle failure, hydrogen stress cracking or hydrogen embrittlement.

De-embrittlement is a heat treatment process which is carried out after electroplating on high tensile fasteners, where hydrogen embrittlement is likely to take place. The beneficial effect of a heat treatment process is a reduction of hydrogen by effusion. Although baking after coating will minimise the risk of failure, the process can never be guaranteed to be completely effective.

De-embrittlement after plating is performed at between 190° – 230° centigrade for a minimum of 8 hours.
The de-embrittlement shall commence as soon as possible, preferably within 1 hour but not later than 4 hours after plating has been performed.

The following points should be considered when specifying electroplated finishes on high tensile fasteners:

1. Complete elimination of hydrogen embrittlement cannot be assured. If a reduced probability of encountering hydrogen embrittlement is desired, alternative procedures should be evaluated. – ISO 4042.
2. There is no known test procedure which can satisfactorily guarantee that the heat treatment process has successfully eliminated all traces of hydrogen embrittlement from all parts in a processed batch. If the risk of failure is unacceptable, cleaning and coating specifications which do not involve electrolysis from aqueous solutions should be used. – BS 7371
3. The risk of embrittlement increases with increasing tensile strength.
4. The risk of failure increases with the use of higher tensile loads.
5. With increasing coating thickness, the difficulty of removing hydrogen increases.
6. The use of non-embrittling processes such as mechanical plating, zinc flake or organic coatings should be considered for susceptible work.

Due to the continued and unpredictable risk of failure, customers should be aware of the risk of subjecting high tensile fasteners to an electrolytic process, and to avoid this risk wherever possible.

We take all recommended precautions to minimise the risk by ensuring that all electroplated fasteners are processed in accordance with the specification requirements and are correctly de-embrittled after plating. As a minimum, this will meet the requirements of ISO 4042 / BS 7371.

The responsibility for assessing whether electro-zinc plated high tensile fasteners should be used in a particular application remains with the end-user, in liaison with the design authority.

In line with our Terms and Conditions, we cannot accept any liability for failures caused by hydrogen embrittlement.

FM 53805
COMPANY REG NO. 640361
VAT REG NO. 110161344