

# HYDROGEN EMBRITTLEMENT

REDUCING RISK AND  
AVOIDANCE

Presentation by  
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# HIGH TENSILE STEELS ARE SUSCEPTIBLE TO HYDROGEN EMBRITTLEMENT IF CLEANED WITH ACIDIC MATERIALS OR ELECTROPLATED

PARTS ARE CONSIDERED TO BE AT RISK IF THEY HAVE:-

- A tensile strength  $\geq 1050\text{MPa}$ ,  $1000\text{N/mm}^2$  or  $65\text{ tons/sq. in.}$  (T class Imperial fasteners and above)
- A hardness  $> 320\text{ v.p.n.}$  (10.9 grade fasteners or above)

# TO *REDUCE* THE RISK OF H-EMBRITTELEMENT

- Reduce any time in acid media to a minimum.
- Bake parts as soon as possible after processing in an oven at temperatures between 190-210°C.
- As susceptibility increases with higher strength, time at temperature needs to increase to reduce the risk.
- See Table of recommended times.

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USUAL REQUIREMENTS TO LIMIT HYDROGEN EMBRITTLEMENT		
Parts heat treated or cold worked to a surface hardness of	TENSILE STRENGTH OF PART	
	320HV to 390HV	390HV and above
Fasteners property classes	9.8, 10.9	12.9 and above
<b>Process Requirements</b> Clean parts to remove phosphate coating prior to hardening heat treatment	Advisory	Mandatory
Use special wet cleaning methods	Advisory	Forbidden
Use abrasive cleaning methods	-	Mandatory
Electroplate	Allowed	Only allowed under special circumstances
Use non-electroplated coatings	Advised	Very strongly advised. Mandatory with Auto. Manufacturers.
Baking times (at 180-210°C) if electroplated	4-12 hours	12-24 hours (or longer)

**Note:** Phosphating can cause hydrogen embrittlement but it is generally considered that this disappears if the components are not used for 48 hours after processing otherwise a de-embrittlement baking of a minimum of 2 hours at 115°C is recommended.

# TO AVOID THE RISK USE NON-EMBRITTLING COATING:-

- Mechanical plating
- Zinc Flake type Coatings i.e.  
Delta-Protekt  
Geomet  
Magni 565
- Organic Coatings i.e.  
Xylan  
Delta-seal

The above Coatings are covered in more detail in the following Presentation on Hex Chromium free coatings

Further information is available from  
FERA Data File 1 – Hydrogen  
Embrittlement and from  
[www.anochrome-group.co.uk](http://www.anochrome-group.co.uk)

