

# Hydrogen cracking of grade T and grade 8 chain and components

Guidance Note PM39

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This Guidance Note gives advice to users of grade T and grade 8 chain and components on their susceptibility to hydrogen cracking.

Incidents reported to the Health and Safety Executive indicate that grade T and grade 8 chain and components are still being used in corrosive environments, despite advice from manufacturers.

## Introduction

- 1 Grade T and grade 8 alloy steel chain and components (hooks, shackles, links etc) are used for lifting purposes in many different lifting environments. However, such chains and their components are not suitable for use where acid or strongly alkaline conditions are prevalent. This is because the steel from which grade T and grade 8 chain and components are made is susceptible to hydrogen cracking under these conditions. For this reason the manufacturers do not recommend the use of their products in conditions where the chain or components are immersed in acid or strongly alkaline solutions, or used in atmospheres in which corrosive fumes are present, eg chemical works, plating shops etc.
- 2 Where grade T or grade 8 chain and components have been surface-coated they may have been subjected to an acid pickling process which in itself may lead to hydrogen cracking. Therefore, users of surface-coated grade T and grade 8 chain and components should take particular care before deciding on their suitability.
- 3 As much of this equipment will be used in lifting operations, it will be subject to the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER). Where this is the case you should inform the competent person carrying out the thorough examination if the equipment has been used in environments which have the potential to have caused damage, including hydrogen cracking.

## Hydrogen cracking

- 4 The phenomenon known as hydrogen cracking requires both a corrosive environment and tensile stresses to be present.
- 5 Cracking can occur in two ways:
  - The hydrogen generated at the surface of a tensile-loaded, high-strength steel can enter the material lattice and embrittle the steel, increasing its susceptibility to failure by dynamic loading (shock loading). This is known as hydrogen embrittlement (HE).
  - The hydrogen can migrate and congregate in tensile-stressed regions and cause cracks to grow progressively. This is sometimes referred to as hydrogen-assisted cracking (HAC).
- 6 Both of these actions can take place in high-strength steel without any appreciable visual change to the material's surface.
- 7 To reduce HAC, some manufacturers of chain hoists supply grade T and grade 8 case-hardened chain and slings. The case-hardening process produces residual surface compressive stresses in the link and these, coupled with relatively low operating tensile stresses, mean the links are less susceptible to hydrogen embrittlement. It should be noted, however, that case-hardened chain is still susceptible to hydrogen embrittlement but to a lesser extent. An effective inspection regime will be necessary to detect surface defects.

## Grade T and grade 8 chain and components

8 Newly supplied grade T and grade 8 alloy steel chain, chain slings and components such as self-locking hooks and latches are generally manufactured in accordance with the BS EN 818 series of standards. Existing chain and components may have been manufactured in accordance with older British or International Standards.

9 The quality grade marking for grade T and grade 8 chain is the letter 'T' or number '8' marked on every 20th link or at intervals of 1 metre, whichever is the lesser distance. 'T' is the preferred marking for fine tolerance hoist chains made to BS EN 818-7.<sup>1</sup>

## Recommendations

10 Grade T and grade 8 alloy steel chain and components should not be used in acidic or strongly alkaline environments, whether immersed in these corrosive solutions or used in atmospheres in which the fumes are present.

10 No surface treatments of grade T or grade 8 chain and components should be undertaken without the approval of the chain manufacturer.

12 All grade T and grade 8 chain and components should be inspected for corrosion and surface defects. If there is any doubt as to the suitability of their continued use following the inspection then users should seek advice from suppliers or a competent person before putting the equipment back into service.

13 Where users have doubts about the chain's suitability, or need advice on alternative lifting equipment, they should seek the advice of their suppliers or a competent person.

14 If the regular use of lifting equipment in corrosive environments is unavoidable, a lower tensile grade should be used, eg grade 4 to BS EN 818-3<sup>2</sup> or BS EN 818-5.<sup>3</sup> Its use should be accompanied by a comprehensive risk assessment which should establish an effective inspection regime. There should be advice about the inspections in the hoist block manufacturer's servicing instruction manual.

## References

1 BS EN 818-7:2002+A1:2008 *Short link chain for lifting purposes. Fine tolerance hoist chain. Grade T (Types T, DAT and DT)* ISBN 978 0 580 64249 8  
British Standards Institution

2 BS EN 818-3:1999+A1:2008 *Short link chain for lifting purposes. Medium tolerance chain for chain slings. Grade 4* ISBN 978 0 580 64079 7  
British Standards Institution

3 BS EN 818-5:1999+A1:2008 *Short link chain for lifting purposes. Chain slings. Grade 4* ISBN 978 0 580 64081 0 British Standards Institution

## Further reading

*Safe use of lifting equipment. Lifting Operations and Lifting Equipment Regulations 1998. Approved Code of Practice and guidance L113* HSE Books 1998  
ISBN 0 7176 1628 2 [www.hse.gov.uk/pubns/books/l113.htm](http://www.hse.gov.uk/pubns/books/l113.htm)

BS EN 818-1:1996+A1:2008 *Short link chain for lifting purposes. Safety. General conditions of acceptance* ISBN 978 0 580 64211 1 British Standards Institution

BS EN 818-2:1996+A1:2008 *Short link chain for lifting purposes. Safety. Medium tolerance chain for chain slings. Grade 8* ISBN 978 0 580 64140 4 British Standards Institution

BS EN 818-4:1996+A1:2008 *Short link chain for lifting purposes. Chain slings. Grade 8* ISBN 978 0 580 64080 3 British Standards Institution

## Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit [www.hse.gov.uk/](http://www.hse.gov.uk/). You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

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