William Hackett

ZINC-TOUGH™ TECHNOLOGY

A new concept of corrosion resistance ideal for lifting operations in the offshore environment used in:

- ***DNV Welded Chain Slings***
- ***DNV Mechanically Assembled Chain Slings***
- ***HA Master Links***
- ***HA Master Links with Handles***
- ***Grade 8 Marine Chain***

McKinnon Chain

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

ENVIRONMENTAL SYSTEM CERTIFICATION DNV·GL ISO 14001

SAFETY SYSTEM CERTIFICATION DNV·GL ISO 45001

July 2020

ZINC-TOUGH™ TECHNOLOGY

Zinc-Tough™ Technology provides superior corrosion protection offering resistance to Hydrogen Embrittlement/Stress Corrosion Cracking — making these products ideal for lifting operations in the offshore environment.

William Hackett and McKinnon Chain have combined their technical knowledge and worked alongside a wide range of stakeholders, including several major oil and gas operators, to develop ***ZINC-TOUGH™ TECHNOLOGY.***

Zinc-Tough™ Technology is a first for:

- DNV Welded Chain Slings
- DNV Mechanically Assembled Chain Slings
- HA Master Links
- HA Master Links with Handles
- Grade 8 Marine Chain

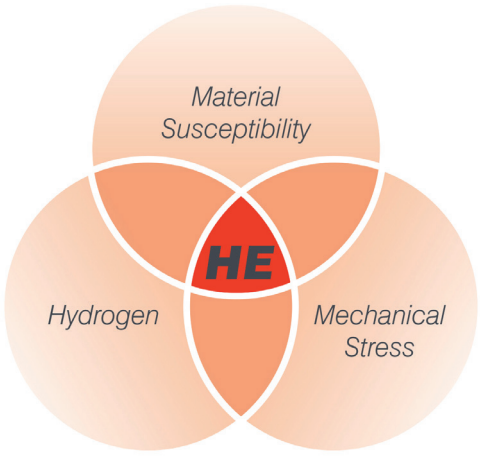
All products are manufactured from a high quality fine grained steel with very specific processing parameters in order to achieve an optimum balance between strength and toughness.

The combination of these properties will deliver exceptional durablility offshore.

Hydrogen Embrittlement

Hydrogen Embrittlement/Stress Corrosion Cracking can occur in a marine environment when favourable conditions for hydrogen formation are created within a metal pit. The anodic layers of ***ZINC-TOUGH™ TECHNOLOGY*** as well as the excellent inherent material properties reduce the risk of pitting and subsequent embrittlement of the steel.

Root causes of Hydrogen Embrittlement (HE)



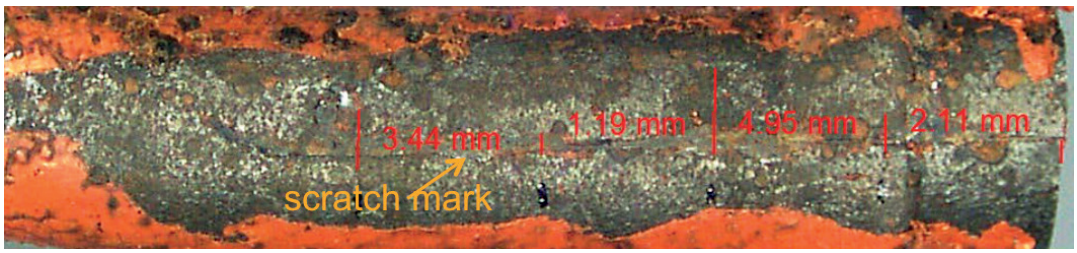
For Hydrogen Embrittlement to take place, three elements are required: a source of hydrogen, material susceptibility and mechanical stress.

ZINC-TOUGH™ TECHNOLOGY

Comparison between a standard link and a link treated with Zinc-Tough™ Technology subjected to a 600 hours standard salt spray test

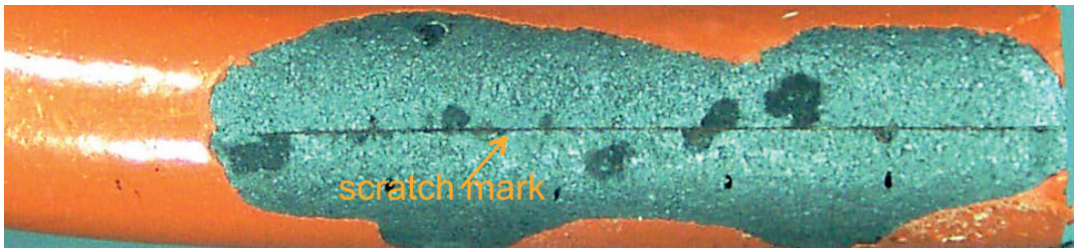
Powder coated surface

Corrosion creepage beneath the powder coated layer. The powder coating flakes off easily.



Zinc Thermal Diffusion using Zinc-Tough™ Technology plus powder coated surface

No corrosion creepage. The powder coated layer remains intact.



Benefits of ZINC-TOUGH™ TECHNOLOGY

Non-interference with metallurgical properties

The low temperature application of the coating process does not have any effect on the hardness and toughness of the steel.

Zero risk to Hydrogen Embrittlement

Many coating processes such as galvanizing and electroplating bring with them the risk of embrittlement. This process poses a zero risk of Hydrogen Embrittlement.

Corrosion protection

The Zinc-iron alloy coating provides galvanic protection and resistance to pitting.

Excellent bonding surface and spark free

The zinc layers are spark free and provide an excellent bonding surface and is ideal for powder coating.

Abrasion resistance

The coating is typically 45μ in thickness is highly abrasion resistant.

Environmentally friendly process

Zinc thermal diffusion is an environmental friendly process (a non-toxic, heavy metal free process with minimum waste).

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