

HyFI line pipe

HFI welded line pipe for hydrogen transportation

Hydrogen has been identified and adopted globally as a key component of future energy networks for its ability to provide security and reliability as part of a greener, more diverse energy solution. Tata Steel's UK manufactured H₂-ready line pipe, named HyFI, has undergone testing via an external laboratory to confirm suitability for hydrogen applications up to 100 bar.



The applications of hydrogen being explored are both industrial and domestic ranging from power generation to transportation and beyond.

Pipelines, being the preferred method of transportation, are inherently linked with hydrogen as a development. However, not all pipes are made the same and capability is not a given.

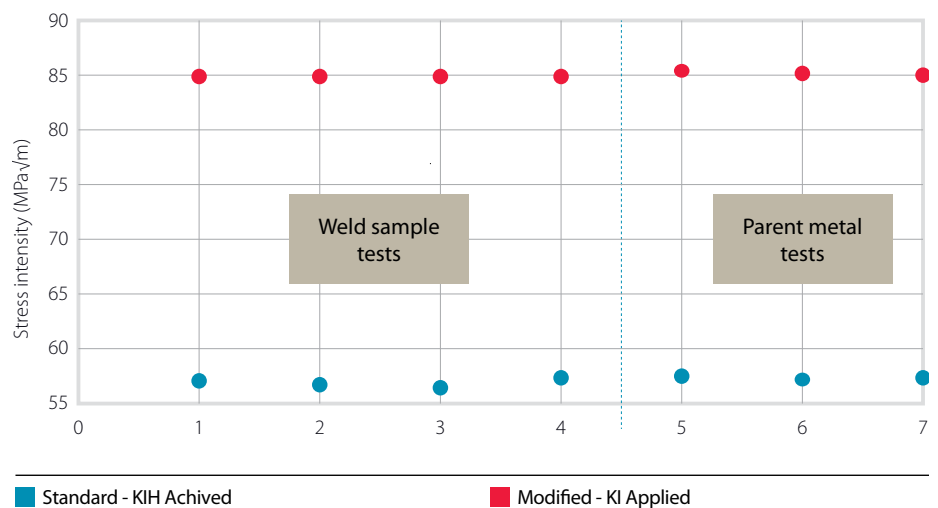
HyFI fracture resistance (K_{IH}) assessment

To ensure the technical requirements of material for hydrogen transportation are met, external validation testing was performed by specialists Element Materials Technology in line with ASME B31.12 (2019) option B in 100% Hydrogen. Samples were loaded to double the specified stress intensity as set out in ASME B31.12, in the body and weld, under conditions of 100 bar hydrogen for 1000 hours, with no crack growth observed.

HyFI supplementary testing

In addition to the standard testing, a second, modified approach, developed by Element, involving the use of more representative elastic-plastic fracture mechanics (ASTM E1820) further confirmed capability in excess of the minimum required stress intensity threshold in hydrogen.

Stress intensities by sample for weld and parent material tests



Results

A total of 14 tests were completed. Seven were applied straight to standard demonstrating an achieved K_{IH} in excess of the required minimum of 55 MPa√m (K_I applied ~115 MPa√m).

Seven applied a modified approach where the K_I applied was based on established fracture mechanics testing of the same material. This is deemed to be more representative of the actual capability of the material, exceeding the minimum K_{IH} comfortably.

Familiar Territory

Tata Steel UK already has a long history of manufacturing line pipe for deployment across the UK gas networks, for use in power generation and offshore installations. Our links to the existing infrastructure, and our development alongside it, means we are uniquely placed to engage with and understand you and your product's needs.

Bespoke product range for hydrogen transportation

We are capable of supplying material at both ends of the spectrum - from low pressure L245 applications through to the more demanding distribution and transmission projects where for hydrogen ASME B31.12 type material qualifications are often specified.

The material tested by Tata Steel to ASME B31.12 met the requirements of both an X65 and X70 pipe grade. This material was chosen as higher strength grades are known to pose more of a challenge while grades X52 and below are largely accepted as compatible with hydrogen. Final capability and offering is based on a Technical assessment of customer and/or project requirements. Minimum order quantities may apply.

High level view of ASME B31.12 testing approach's based on SMYS

ISO 3183	API 5L	High level view	Qualification
L245	B	Generally accepted as suitable.	Where Specified Only
L290	X42	Reduced risk of hydrogen embrittlement.	
L360	X52		
L415	X60	Higher susceptibility to hydrogen embrittlement. Significantly restrict design factor / test accordingly.	Expected / necessary
L450	X65		
L485	X70		

Susceptibility of grades to hydrogen embrittlement & material qualification is subject to overall design considerations including operating conditions and requires proper engineering assessment & specification.

Dimensional capability

Our 20" pipe mill in Hartlepool is capable of manufacturing welded line pipe for gas and hydrogen specifications ranging from 219.1mm – 508mm (8" – 20") OD. Thicknesses are available range from 6.4mm – 16.3mm.

Due to the unrivaled consistency achieved via our process and the tight tolerances we are able to apply, including offering non-standard wall thicknesses, HFI presents the potential for significant material and cost savings when compared to other methods of pipe manufacture.

Coated and delivered

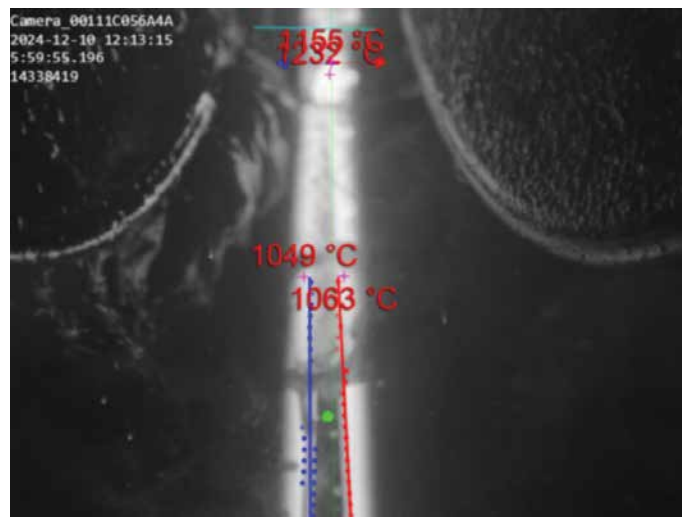
The Hartlepool works is home to global coating applicator Wasco. As the only operating facility of its kind in the UK the proximity to our 20" pipe mill allows customers to minimize project complexity and logistics reducing costs and time deliverables.

Wasco as a company has coated over 22,000 km of pipelines across 25 countries since inception with the Hartlepool site regularly fulfilling orders specified to gas industry standards CW6, CM1 and CM2 as well as multi-layer systems for demanding environments.

Tata Steel's 20" pipe mill in Hartlepool, UK is among only a handful of mills capable of supplying H2-ready line pipe worldwide.

Performance & integrity

Enhanced mechanical properties are achieved through our steel grades and our ability to apply a secondary offline heat treatment (full body). Combining this with our continuous weld monitoring, multi-site through process NDT evaluations, digital metrology and wealth of experience means the 20" mill is capable of delivering line pipe to the highest standards and into safety critical applications, such as gas & hydrogen.



Certified and accredited

Tata Steel holds accreditations with API, DNV, Lloyds register and LRQA for the manufacture of line pipe, casing and structural hollow sections. No hydrogen specific line pipe accreditation exists as yet in the UK, though testing to ASME B31.12 has been completed.

Technical Support

With a dedicated project team for energy business, our technical engineers and trained sales staff are able assist with your line pipe enquiries and project delivery. Participation in front end engineering & design (FEED), specification review & development and post contract support are all offered. In addition we have access to leading Research & Development, both in-house and via strategic collaboration with partner universities

Please contact your Tata Steel representative or email us on technicalmarketing@tatasteeleurope.com to discuss your requirements and how we can help make hydrogen happen.

www.tatasteeluk.com

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