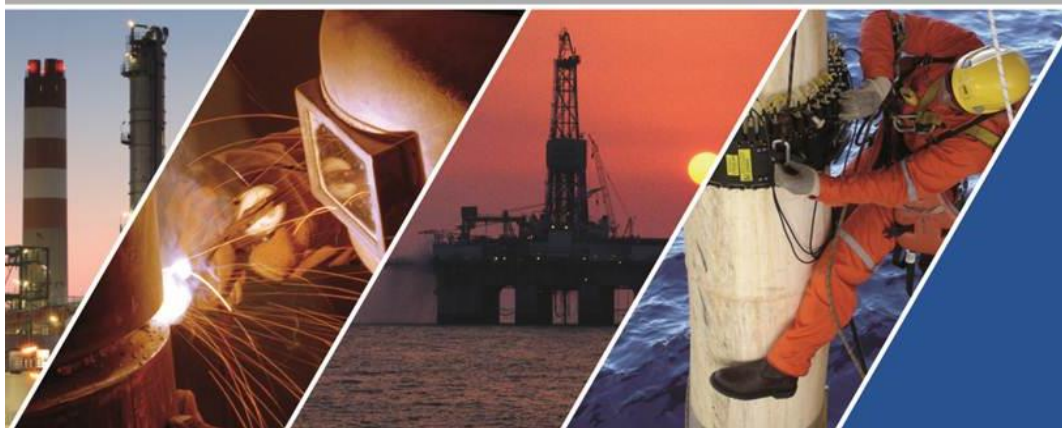


Industry Standardisation of SENT Testing



**PUBLISHABLE
SUMMARY**

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Background

The single edge notched tension (SENT) fracture toughness specimen is rapidly gaining acceptance and being more widely used as a substitute for the single edge notched bend (SENB) specimen for assessing the integrity of pipeline girth welds subjected to plastic strains. Generally, SENT tests result in higher fracture toughness being measured than with SENB tests and they are more representative of pipe behaviour. It is therefore important to standardise fracture toughness testing of SENT specimens testing parent material but also for weld metal and heat affected zones which often exhibit the lowest fracture toughness.

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Objectives

- Develop an industry standard for fracture toughness testing of SENT specimens in particular for weld metal and HAZ.
- Perform SENT testing and carry out work to fill in gaps in existing practices.
- Critically review existing literature, experience and practices associated with SENT testing.

Benefits

This project provided the following benefits:

- Relevant SENT testing data and improved standardised fracture toughness testing guidance.
- Minimise the risk of obtaining inconsistent results between different testing laboratories.
- Increased confidence in using results for SENT tests leading to improved safety, reliability and reduced costs.

Participants

The Project was funded by the following Sponsors:

- BP Exploration Operating Co Ltd
- Saipem S.p.A.
- Subsea 7 Limited

Scope of Work

The programme of work was divided into four phases: (1) review existing knowledge, (2) testing and analysis, (3) round-robin testing, (4) defining a SENT industry standard.

- Phase 1 critically reviewed existing knowledge, experience and practices associated with SENT testing. This involved a review of TWI's internal research and SENT data, a comparison of current existing SENT test procedures, and a collation of literature published on various aspects of SENT testing. Phase 1 identified factors which have been well reviewed and need limited further attention, and also highlighted factors which required further research for general application of SENT testing. The results of the review enabled a draft testing procedure to be developed for Phase 2 of the work programme.
- The objective of Phase 2 was to fill in the gaps of knowledge and validated research on various aspects of SENT testing. A programme of fracture mechanics testing systematically considered the specimen (BxB or 2BxB), notching orientation, the need for local compression and/or side grooves, and testing at low temperature. The programme included testing SENT specimens notched into parent pipe, weld metal and HAZ. Numerical modelling and analysis contributed to the understanding of the constraint comparison with service conditions for typical industrial applications. It also helped validate the equations for J and CTOD with the amount of tearing and/or path deviation. At the end of Phase 2 a set of draft amendments to the new British standard procedure were written.
- In Phase 3 reference specimens were produced and seven laboratories asked to carry out tests according to the draft procedure. The round-robin confirmed that the new procedure is straightforward to perform and good consistency of results was obtained between the participants.
- In the final Phase 4, following the round-robin, a set of recommendations was agreed with the sponsors before being submitted to the BS 8571 committee of BSI.

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Price and Duration

The project had a duration of 2 years and a budget of £240,000. 3 Sponsors each made a contribution of £80,000

Further Information

For further information on how a Joint Industry Project (JIP) runs please visit:

<http://www.twi.co.uk/services/research-and-consultancy/joint-industry-projects/>

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