

Title: Monotonic Fracture Tests on Full Scale Notched Pipe Welds to Study the Effect of Thermal Ageing on its Fracture Behaviour [SSP 36141]

Duration: September 2023 to February 2025

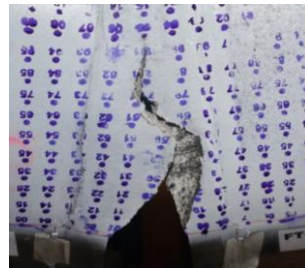
Deliverables: To study the monotonic fracture toughness on nine thermally aged similar and dissimilar metal pipe weld joints at room temperature.

Significant Achievements:

In order to study the effect of fracture behaviour of thermally aged pipes, monotonic fracture tests carried out on eight numbers of pipe welded joints of 324 mm nominal outer diameter having circumferential through-wall notch in the centre of the weld. The pipe weld specimens were of 324 mm OD made of SA312 Type 304LN stainless steel / SA508 Grade 3 Class 1 carbon steel. Five pipe specimens were thermally aged at 400 °C for 10000 and 20000 hours for 600 mm length in the middle portion. Subsequent to fatigue pre-cracking, the pipe weld specimens were subjected to monotonic static loading. During the fracture tests, load, load-line displacement, deflection of the pipes (at five locations), circumferential deformation, surface crack growth along circumferential direction was monitored using Image Processing Technique (IPT), Crack Mouth Opening Displacement (CMOD) and angular rotation of the pipes were continuously monitored. The maximum load values obtained varied between 601.09 kN and 820.41 kN; the load-line displacement values corresponding to maximum load varied between 26.8 mm and 90.9 mm respectively. The CMOD values corresponding to maximum load varied from 8.10 mm to 28.1 mm. The circumferential through-wall crack length (measured by IPT) varied from 376 mm and 472 mm at the end of fracture tests; the corresponding crack angles varied between 132.57° and 166.42°.



Deflected shape of the pipe weld joint after fracture test



Close-up view of crack location after the fracture test on the pipe weld joint

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