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Best Practices for Handling Completion Tubulars to Ensure Design Life Well Integrity in HPHT Wells

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Abstract

In the search for attractive hydrocarbon resources, geological targets are often encountered that are designated as high-pressure, high-temperature (HPHT). To ensure an HPHT well meets or exceeds design life, a very thorough design review is needed for all aspects of the well architecture to ensure integrity is maintained throughout. Often overlooked, improper handling and installation through lack of knowledge, equipment selection, or technology have led to many well integrity issues in HPHT wells.

The presence of certain corrosive downhole species, combined with the high temperatures and pressures of these wells can accelerate corrosion mechanisms on well bore tubulars at an early stage of the well's life. To address this challenge, corrosion resistant alloy (CRA) tubulars, along with temperature and pressure monitoring equipment, are often designed into the well architecture to ensure well integrity is preserved. These elements must be handled and installed carefully as impressions, marks, and cuts from make-up and handling operations can further accelerate corrosion failures on the tubular, such as stress corrosion cracking, while compromising the integrity of the downhole measuring equipment.

To ensure these wells have the best chance of meeting target design life, special consideration should be given to the control line and tubing handling equipment. Specialized equipment, such as control line manipulation systems, offer extra protection to lines as they are manipulated for clamp installation, as well as increased safety and efficiency within the operations. Compensation systems prevent damage to threaded connections during stabbing and make-up while intelligent connection analyzed make-up systems use artificial intelligence and machine learning to provide real-time accurate, consistent, and reliable connection integrity assessments.

And lastly, specialized reduced penetration or non-marking technologies can be utilized for make-up and handling of CRA tubulars to minimize or eliminate iron transfer and impressions imparted into the tubular body. By eliminating these, the potential for corrosion cracking due to stress concentrations and other risks of corrosion are also eliminated. One industry sponsored study examined the condition of 406 injection and production wells on the Norwegian shelf. Of these wells, 18% of the wells suffered from well integrity incidents, while nearly 40% of these incidents were due to the tubular string, emphasizing the need for specialized attention and equipment selections for HPHT wells.