Subsea Pipeline Technology

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Materials:
- Mechanically Lined Pipe
- High strength steels
- SCR Welding

Flow Assurance:
- PIP systems
- Active Heating

Summary/Discussion
Reeling of Mechanically lined pipe

Phased development with extensive input from Buttings including:

• Reeling tests
• Material test
• FE analysis
• Fatigue testing
• Pressurisation and pigging procedure
• Seven Oceans Reeling Trial
• Range of Diameters and Liners
• DnV Qualification
• On-going development of optimized pipe
High Strength Steel

- High strength steels enable reduced top tension for installation or reduced air can size for riser towers

Comparison of 2000mtr. riser with different steel grades

- Particularly suited to deep water/high pressure applications
High Strength Steel

- Challenge is to develop welding procedures that result in appropriate weld mechanical properties
- Welding using the GTAW/PGMAW process based on existing procedures and filler wire
- Welding procedures developed for X80 pipe
- Good mechanical properties including strength, hardness and fracture toughness
- Scope of testing completed: Mechanical testing, fracture toughness testing, HIC and SSC testing and testing in strain aged condition
- Qualification to DNV and full scale bending trials underway
High Performance Pipe-in-Pipe

• PIP systems are used where a high level of insulation is required, typically below a U-value of 1.5 – 2.0 W/m²K

• Conventional PIP system is qualified for reeling and will be installed next year for Statoil

• Good track record in the industry for reeling conventional PIP systems

• Challenge is to further improve the efficiency of the insulation to reduce cost and improve installability
High Performance Pipe-in-Pipe

- Development undertaken with ITP
- Based on field proven ITP system with Swaged field joint
- No centralisers to improve thermal efficiency
- Reduced pressure annulus to take advantage of Knudsen effect and further improve efficiency of Izoflex
High Performance Pipe-in-Pipe

- Significant improvement in cool down times, verified by full scale testing
High Performance Pipe-in-Pipe

- Extensive FE work undertaken on Swage weld under reeling conditions
- Drag through without centralisers tested and confirmed
- Full scale bend testing undertaken
- Technology is fully developed and qualified by DNV as ‘Fit for Service’ (DNV RP A203)
Trace Heated Pipe-in-Pipe

- Maintain temperature above HAT during shutdown, assist with restart, reduce chemical injection requirements
- Alternative to DEH – lower power consumption
- Extensive FE and full scale bend testing undertaken
- Fully qualified for reeling as per DNV RP A203
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