Developing solutions for deepwater HPHT applications

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What are the biggest challenges faced by HPHT Operators?

HPHT wells summit

- Personnel and workforce: 14%
- Material issues: 13%
- Equipment selection: 10%

HPHT wells 2015 survey
www.hphtwells.com
Challenges for the UK supply chain

- High Pressures > 10,000psi
- Underwater life greater than 20 years
- High H2S, CO2 and Methane > 17%
- High Temperatures > 121 deg. c
- Stringent Fugitive Emissions Criteria
- Lighter weight & space savings
- Water Depths > 4,500m
- High Pressures > 20,000psi
- Underwater life greater than 50 years
- High Temperatures > 177 deg. c
- High H2S, CO2 and Methane > 17%
Challenges and Risks of HPHT

- BP, Mad Dog
- Shell, Stones
- Chevron, Jack and St Malo
- Maersk, Culzean
- Petrobras, Lula
Subsea equipment

Where do the knowledge gaps lie?

- Polymers and metallurgy: 19%
- Seals: 18%
- Testing: 11%
Bigger doesn’t mean better.

Higher Strength Steels

Cost Effective Base Material Cladding

Higher Speed Offshore Welding

Installation Vessels with Higher Tension Capabilities

Lightness, Strength, Corrosion Resistance

Composite Materials

Qualification of HPHT Interface Items

Source: Oilfield Metallurgy – Lloyd-Thomas Consultancy
Working example

- ASTM F22 forged body and bonnet
- Fully clad alloy 625
- Alloy 718 trim
- HVOF Tungsten Carbide
Material Qualification and Extra Data to Support Design

Slow Strain Rate Test, Fracture Toughness Testing, Cyclic Fatigue Crack Growth

- API 579-1
- ASME Section VIII Div 3
- API PER15K & 17D TR8
- API 6A & ISO 10423
Considerations for high pressures and high temperatures

- Elastomers & Thermoplastics
- Reinforced/filled PTFE
- Poly Ether Ketone

Upper limits
15,000 psi
177°C

High Temperature vs Low Temperature
Thermal/Chemical History
Mechanical Loading History
Chemical Environment
Mechanical Wear
Potential size of the prize

North America
Projects: 11
Value: $22500m

South America
Projects: 5
Value: $16800m

Europe
Projects: 18
Value: $15925m

Caspian
Projects: 3
Value: $53250m

Asia
Projects: 4
Value: $3970m

Africa
Projects: 2
Value: $3000m

45 HPHT Projects
Combined value $116,195m

298 HPHT wells since 2000
Extra 39 expected from 2014 - 2019

Excellence in Valve Engineering
Risks and challenges

- Choice and availability of materials
- Sealing technologies for HP
- Large bore hyperbaric capabilities
- Lack of material data
- Seal selection for HT
- Coating technologies at HP
- Material stability, deflection and set

Excellence in Valve Engineering
Hyperbaric Test Centres

- Newcastle University and BEL Valves joint venture investment
- Multiple hyperbaric chambers with testing down to 4500m
- Centre of excellence for research and development in the North East of England
Skills gap

Personnel and workforce

Developing a North East of England Engineering Hub

Creating a training school for apprentices from across the region

In house apprentice and graduate training program

Maintaining strong links with local schools and universities