Procurement Risk Management of Flexible Pipes and Umbilicals

Presented by
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• Who are BPP-TECH?
• SURF Procurement – What is it about.
• How and where do we control quality?
• Why do we need to control quality?
• Lessons-learnt and how we deal with it...
**BPP-TECH** provides specialist engineering, research and product development services to the offshore hydrocarbon and marine industries.

- Company formed in 1981
- Offices in London, Houston and Aberdeen
- Staffed by experienced, highly qualified engineers
- Operating worldwide
Company Overview

- Analysis & review of subsea architecture: flexible pipes, risers, umbilicals, power cables, flowlines and moorings
- Product development & joint industry projects (JIP)
- Procurement support, production advice & client representation
- Concept and feasibility studies for floating offshore systems
- Offshore monitoring and instrumentation
- Insured risk and failure analysis
SURF Procurement

• SURF – Subsea Umbilical, Risers & Flowlines

• The reliability of the subsea production system from the mudline to the sea surface is critical to production in terms of control and flow assurance

• Subsea system components are often safety critical
There is a history of defects and incorrect designs leading to significant losses.

The majority of field failures relate to manufacturing defects passing through inadequate QA/QC systems.

Ready acceptance of manufacturer’s non-conformance reports in the face of schedule and cost pressures.

FAT - Factory acceptance testing does not ensure long term reliability.

Use of inappropriate procedures and equipment encountered during installation.
Quality Control

• How and where do we control quality?
  • Specification
  • Design & analysis
  • Material procurement
  • Manufacturing
  • Packing and loading
  • Mobilisation & offshore installation
Design and Analysis

- Prediction of strength, internal strains and service lives
- Global hydro-elastic structural response calculations
- Local nonlinear structural analysis
- Analysis of designed and as-built structures

Deepwater optical fibre cable

Finite element mesh
Analysis of Flawed Design

Finite element analysis of the deepwater optical fibre cable
Laborious but often necessary qualification testing
– Rotational and Reel Loading Tests
Failure of separators in a deepwater umbilical due to crush loads from bending on a reel
Rejected tensile armouring wires from the sub-suppliers
Wire defects found on “Approved” wire stock from the sub-suppliers
In-service umbilical thermoplastic hydraulic hose rupture
Kidney-shaped hose cross-section at failure location
Damage during production – inadequate setup quality control
Flexible Pipe Manufacture

Extrusion problem due to inadequate QA/QC procedures
Flexible Pipe Manufacture

Resulting extrusion defect – irregular sheath thickness
Remedial Procedure

Permanent change in underlying tape securing procedure
Outer Surface

Inner Surface

Crack notch in pressure sheath

~ 5mm
Close-up of notch
In-Service Crack
End fitting dissection to determine root cause of failure
Incorrect dimensional control on critical components
Creep under pressure into un-supported sheath location
Inadequate packing procedure at factory leading to a near-miss offshore
Improper weld during sea-fastening operation during mobilisation
Inadequate loadout planning – Last-minute welding of deck covers to main deck on the transport vessel during mobilisation!
Mobilisation Issues

Inadequate mobilisation planning that could have led to over-bending of riser during loadout
Mobilisation Issues

Requiring “on-the-ground” intervention to rectify problem
Panoramic view of “on-the-ground” solution to over-bending problem
Detailed planning required for mobilisation of SURF components
All set and ready to go...
Inappropriate installation planning leading to “on-the-ground” improvisation to make things work!
Installation Issues

Pipe alignment issues – Mid-line connection the brute force way...
Notice the vessel main crane on the starboard side?
Installation Issues

... or use the laws of physics to make life simpler!
Inadequate installation planning leading to...
Offshore Failures

Buckled pipe

Kinked cable
Some failure modes are totally unforeseen!
• What do we do with all the lessons-learnt?
  • Feed lessons-learnt back into new SURF programmes
  • Apply lessons-learnt into other forms of procurement processes
Lessons-Learnt

• Make use of lessons-learnt to enhance the development of new technologies...
  
  • Cryogenic transfer hoses for the LNG market
  
  • High capacity dynamic power cables for very long and deepwater offshore applications
10-year development programme for the Lloyds Type-Approved Dynamic Cryogenic Offshore Transfer Hose
High capacity dynamic power cable development programme currently undergoing strenuous testing for qualification
Thank You
For
Your Attention!