Installation of the world's first subsea Thermoplastic Composite Flowline for hydrocarbon service

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Presentation Overview

• Introduction:
  o Thermoplastic Composite Pipe (TCP)
  o TCP End fitting & Termination
  o Qualification approach

• Installation:
  o General installation methods - overview
  o Installation of the world’s first TCP hydrocarbon flowline

• Conclusions:
  o Lessons learned
Thermoplastic Composite Pipe (TCP)

- Solid pipe structure: bonded
- Fit for purpose polymer: liner, matrix & coating
- Glass or carbon fibres fully embedded (true composite)
- Optional weight coating for on-bottom stability
  - No corrosion
  - Flexible
  - Light weight

Coating
Laminate
Liner

Weight coating (optional)

Glass-PE
Carbon-PA12
Carbon-PVDF

65°C
80°C
121°C
TCP End fitting & Termination

- Terminated within hours
- Can be terminated in the field
- Allows for cutting pipe to length offshore
- Fully qualified and field proven
- Various flange and material options available

Termination onsite allows for flexibility in tie-in as well as pulling through I/J-tubes without end-fitting

The liner is reamed prior to stem insert, maximising bore dimensions to enable pigging
TCP Qualification

DNV Qualifications

Product & Client qualification

Jumper Spools

Flowlines

Dynamic jumpers

Downlines

Project Specific Design

Materials

Design method

Production

MCE Deepwater Development 2018
A qualification and testing approach that benefits future users

Qualification testing
Start: 2012
Duration: 5 years
- Regression testing internal pressure
- Fatigue testing
- External pressure testing
- Tensile testing
- Material qualification testing

Installation trials & in use testing
Start: 2014
Duration: 2 years
- Impact testing
- Fire resistance testing
- Erosion testing
- On Bottom Stability Testing

Full scale installation trials in South China Sea

Engineering & installation
Start: 2017
Duration: 1 year

First time right installation
Installation methods

**Horizontal lay**

**Main characteristics**
- TCP spooled on drum, unspooling by Reel Drive System
- No need for tensioner
- On-Bottom Stability integrated in pipe design or added on-deck during installation
- Pull through I/J-tubes

**Advantages**
- Low transport cost for TCP
- Enables use of small vessels
- No need for divers, no connections on the seabed (<3 km)
- Fast installation

**Tow out method**

**Main characteristics**
- TCP prepared onshore/near shore in river
- TCP towed to location and laid down
- I/J-tube / riser preparation separately
- Connections on seabed

**Advantages**
- Low transport cost for TCP
- Cheapest vessel option
- Enables low cost on-bottom stability methods such as chains
- Fully proven in South China Sea
TCP installation using tow-out method

- Successful installation of the first TCP hydrocarbon flowline
- Preparation low cost & controlled environment
- Installation short & cost effective
- TCP Flowline & I tube separately installed
Riser I-tube preparation

- TCP pull through I-tube onshore
  - I-tube marginally larger than TCP OD
  - Controlled environment
- TCP terminated on-site
Riser l-tube installation

- Riser assembly installed by DP2 vessel
- Assembly pulled-in behind riser guards
TCP Flowline preparation

• Lightweight TCP Flowline on reel
• Preparation on low-cost barge
• On bottom stability through chain
• Controlled environment
TCP Flowline tow-out, lay-down & tie-in

- Total flowline prepared in river
- Tow-out to location using low-cost tug boats
- Lay-down on seabed including buoyancy recovery
Conclusions

- TCP provides a fully qualified corrosion free solution
- A proper qualification approach de-risks first application
- Installation trials provide key-learning opportunities
- Different methods of installation for different applications and locations
- Collaborative approach & joint teams involving client, installation contractor and material supplier yield best results