Tie-in Systems Development
Quick & Easy Installation

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Introduction

As subsea developments are going deeper with higher pressure and increased temperatures, the cost increases accordingly. In the past few years Aker Solutions has developed connection systems to meet market expectations in terms of cost as well as safety and reliability for any conditions.
Aker Solutions Tie-in Systems Developments

Tie-in Systems Development:

- Vertical Connection System (VCS) - 2008/2009
- Horizontal Connection System (HCS) - 2010

Main benefits:

- Reduce overall cost during installation
- Minimum requirement of installation tooling
- Minimum offshore service hands
- Quick & Easy installation
- Less mobilization time for tooling
Vertical Connection System (VCS)

- Seal retained in upper hub/connector well protected
- Seal Replacement and Hub cleaning without retrieving the jumper
- No Large Running tool required
- Minimum requirement of ROV tools
- Fast Installation
- Multiple jumper installations can be performed with connection tools remaining subsea
- No guide rail on structures required
- High Load capacity
- Applicable for Rigid, Flexible & Umbilical lines
- ± 8 deg alignment capacity for rigid jumpers and up to ± 15 deg for flexible/umbilical

Quick & Easy Installation
VCS Qualification Testing

- Qualification testing according API 6A/17D + additional requirements from customers
- Witnessed and approved by ExxonMobil, Anadarko & Installation Contractor

Full 8 deg misalignment
VCS Tooling

Stroke Tool (Contingency)

Torque Tool – Make-up tool

Seal Replacement Tool (Contingency)
VCS Installation Sequence

1

2

3

Link to VCS Animation
VCS Installation Sequence (contingency pull-down)

- Contingency: If friction lock occurs during landing, the stroke tool is installed in any of the 6 slots to pull the connector completely onto the porch.
VCS Installation Sequence

- ROV picks up Torque tool from subsea Tooling Basket
- Back seal testing is performed to verify the connection
- Connection completed
Reference projects - Vertical Connections

- Jubilee, Ghana, Anadarko (2009)
- Oyo, Nigeria, ENI (2009)
- Longhorn, GOM, ENI (2008)
- MA-D6, India, Reliance (2007)
- KG-D6, India, Reliance (2006)
- Kikeh, Malaysia, Murphy (2005)
- Marimba, Brasil, Petrobras (1998)
Horizontal Connection systems

- Big Brother RTS (BBRTS)
- ROV operated Tie-in System (RTS)
- Guide & Hinge-Over (GHO)
- Horizontal Connection System (HCS)
Guide & Hinge Over (GHO)
Guide & Hinge Over (GHO)

- Allow retrieval of XT/ manifold without removal of the spool/jumper
- Seal Replacement and Hub cleaning without retrieving the jumper
- No Large Running tool required
- Utilizing Lightweight ROV Carried Tools
- Fast Installation; 3-4 hours per jumper, both connectors (landing + connecting + back seal test)
- Multiple jumper installations can be performed with connection tools remaining subsea
- Guideline less connection system
- High Load capacity
- Applicable for Rigid, Flexible or Umbilical lines

Quick & Easy Installation
First Jumper installation on Dalia
GHO Tooling

Stroke Tool

Torque Tool

Hub Cleaning Tool (Contingency)

Seal Replacement Tool (Contingency)
Reference projects – Guide & Hinge Over

- USAN, Nigeria, Saipem/Total (2010)
- Montanazo/Lubina, Spain, Repsol (2009)
- OYO, Nigeria, ENI (2009)
- Gimboa, Angola, Sonagol (2007-2008)
- Dalia, Angola, Total (2004-2008)
Horizontal Connection System (HCS)
Horizontal Connection System (HCS)

- High degree of re-use from field-proven GHO (Dalia) design.
- Designed for installation with guidewire to accommodate for harsh weather conditions
- Applicable for guidewire-less installation
- Quick, easy changes to switch between guidewire and guidewire-less
- Applicable for Shallow Water and Deep Water
- High load capacity compared to RTS
- Applicable for Rigid, Flexible or Umbilical lines
- Allow retrieval of XT/ manifold without removal of the spool/jumper
- Seal Replacement and Hub cleaning without retrieving the jumper
- Only using lightweight ROV carried tools
GHO vs HCS Comparison

Guide & Hinge Over
- C-C distance 2500mm
- Designed for calm weather conditions in Africa
- Guidelineless installation
- Utilize low weight ROV operated tools

Horizontal Connection System
- C-C distance 1300mm
- Designed for harsh weather conditions (NCS or similar)
- Can be installed with or without guide wires
- Utilize the same lightweight ROV tools as GHO
- 1st and 2nd connections are identical
HCS Rigid Spool – System Components
HCS Rigid Spool Installation Sequence

1. Attach spreader beam. Lift off and lower jumper to seabed. If required attach guide wires.
2. 1st end entry (alternative landing 1st & 2nd at same time)
3. 2nd end entry.
HCS Rigid Spool Installation

4. Lower termination until landed on porch
5. Disconnect spreader beam
6. Stroke termination towards IB hub using ROV carried stroke tool
7. Close clamp with ROV carried torque tool
8. Perform back-seal test – connection completed
HCS Flexible/Umbilical – System Components

Outboard Termination

- Flexible flowline
- Guide Frame (retrievable)
- Lifting spread

Inboard Porch

- Guide Rails
- Inboard Reaction Plate
- Alignment Rods
HCS Flexible / Umbilical Installation

1. Lower termination until landed on porch
2. Disconnect guiding frame
3. Stroke termination towards IB hub using ROV carried stroke tool
4. Close clamp with ROV carried torque tool
5. Perform back-seal test – Connection completed
HCS Tooling

Stroke Tool

Torque Tool

Hub Cleaning Tool (Contingency)

Seal Replacement Tool (Contingency)
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