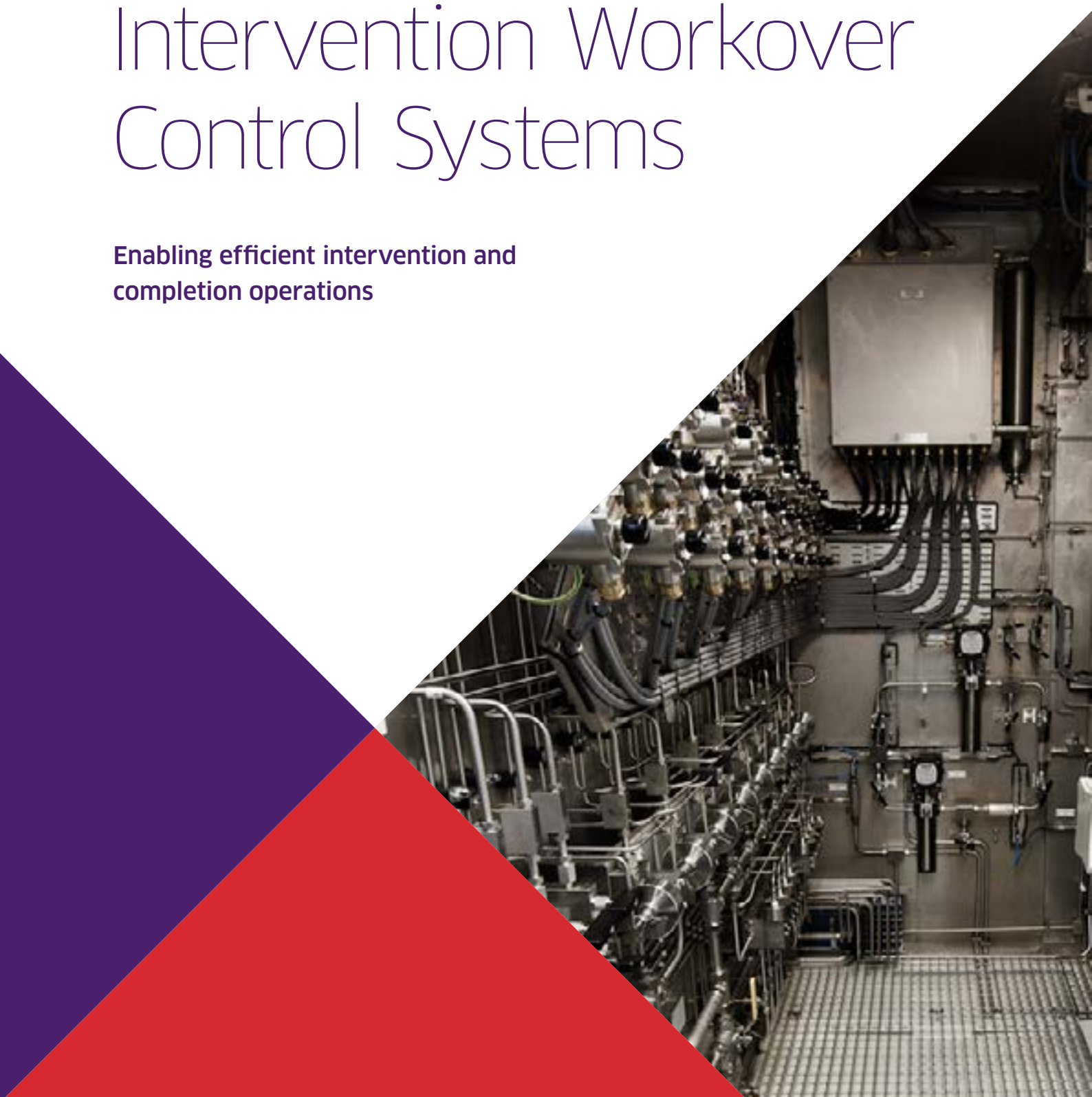
TechnipFMC

Intervention Workover Control Systems

Enabling efficient intervention and completion operations



Intervention Workover Control Systems

The purpose of the Intervention Workover Control Systems (IWOCS) is to enable safe and efficient installation, intervention and completion work on subsea wells.

Applications, functions and components

System description:

IWOCS can be configured to control one or more of the following operational modes:

Installations and Test:

- Control of downole functionality and subsea tree/ manifolds

Simplified Landing String (SLS):

- Control of downhole functions, subsea tree and Simplified Landing String

Full Landing String (LS):

- Control of downhole functions, subsea tree, Landing String, Subsea Test Tree, High Set Lubrication Valve (HSLV) and Surface Flow Tree

Open Water (Emergency Disconnect Package [EDP]/ Well Control Package (WCP):

- Control of downhole functions, subsea tree, Open Water Stack, High Set Lubrication Valve and Surface Flow Tree

Well Start-up:

- Control of downhole functions, subsea tree and opening of pump open valves

P&A:

- Downhole functions, subsea tree and other necessary tools

Functions:

- The IWOCS system can monitor and control all function in the vertical axis, from downhole valve to surface flow tree as required, except BOP
- All sensors data, signatures and command are logged and can be monitored in the HMI. DH sensor data can be provided to 3rd party
- All logged data can be provided to onshore live or after operation, for operational planning and maintenance purposes
- Live onshore HMI monitoring and onshore remote control can also be provided

Safety features:

- Production Shutdown (PSD)
- Emergency Shutdown (ESD)
- Emergency Quick Disconnect (EQD)
- Dead Man Function

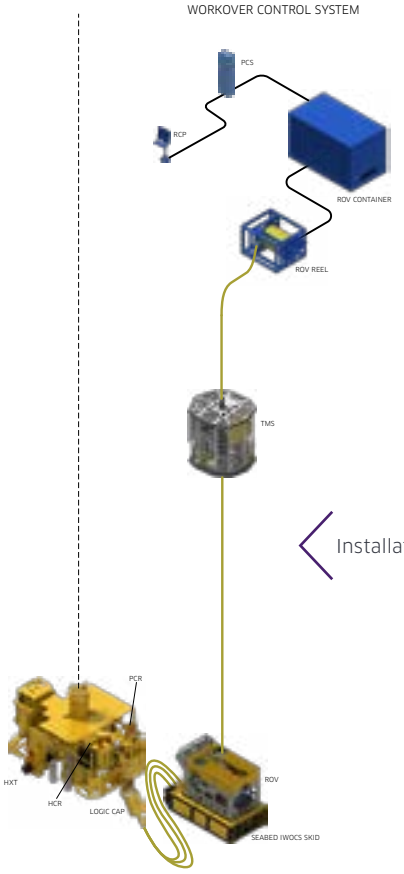
Main components:

- Master Control Panel (MCP)
- Master Control Station (MCS)
- Hydraulic Power Unit (HPU)
- Hydraulic Distribution Unit (HDU)
- Remote Control Panel (RCP)
- Portable Control System (PCS)
- Subsea tree umbilical and reel system
- LS umbilical and reel system
- SLS umbilical and reel system
- HSLV umbilical and reel system
- SFT Control Panel and jumpers
- Annulus hose and reel system
- RLWI Cables and reel system
- FlyWOCS (ROV skid solutions)
- Work Over Control Module (WOCM)
- Jumpers and sensors
- Test equipment
- Well Access Management System (WAMS)

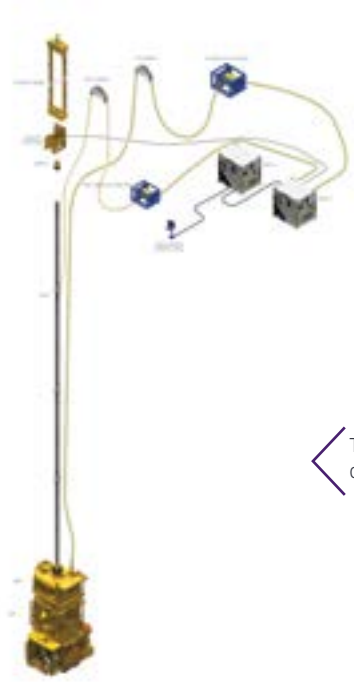
Master control station

Hydraulic distribution unit

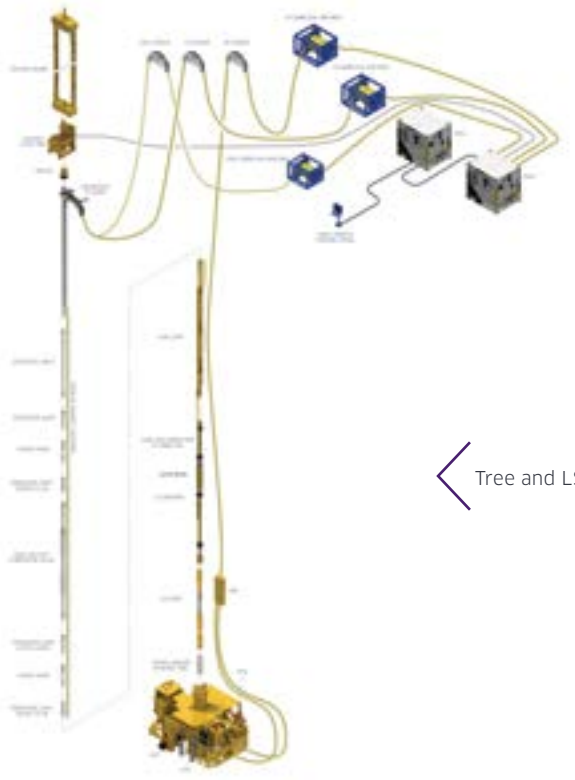
Intervention Workover Control Systems overview



Installation control system



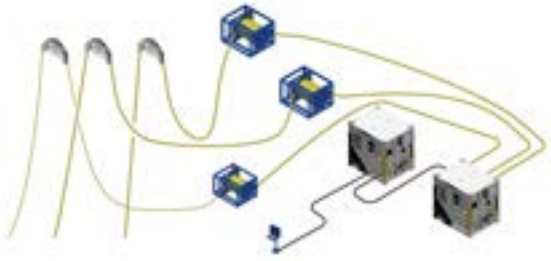
Tree and EDP/LRP control system



Tree and LS control system

IWOCS

- No single failure in the IWOCS will cause an unintended system shut-down, unacceptable risk for personnel safety, environment or loss of financial assets
- Standardized and modularized design reduces project engineering cost and time, improves reliability and flexibility

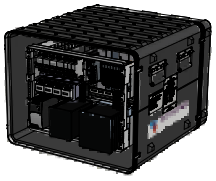


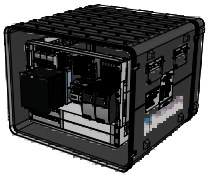
Topside Control System

- A typical solution is two 10 feet containers (SACU) equipped with necessary functionality for the planned operation, such as HMI, control room, HPU/HDU and subsea communication
- Remote control panel for installation in drillers cabin
- EX zone 1, T3, gas group IIB (ATEX and IECEx)
- NORSOK compliant and DNV 2.7-1 lift certified
- Operating temperature -20–+50°C
- Optional 3rd party XT control
- Optional SIL rated safety system (PSD, ESD, EQD)

Portable Control System (PCS)

- A low weight hand carried (max 40kg) modular control system option for use when no hydraulic system is required
- Consists of the following modules:
  - SCADA module (PCU)
  - Subsea interface module (PTM)
  - Uninterruptible Power Supply (UPS)
  - Portable Safety Module (PSM)
  - Portable Remote Control (PRM)
  - Portable Communication Module (PCM)





Umbilicals and reels

- In riser Landing String (electro hydraulic comms) and Lubricator Valve (hydraulic comms) umbilicals are optimized for size to minimize risk of damage
- Open water umbilicals (Electro Hydraulic and Optic comms) are multifunction standardized designs that maximize flexibility towards TechnipFMC and other suppliers' subsea tree production control systems
- Umbilical reels can be delivered electrical or pneumatic driven with a local and remote control panel

FlyWOCS

- The FlyWOCS is a ROV carried subsea tree and manifold installation and test skid, also with the possibility of opening pump open valves.
- Communicates to the topside control system (PCS) through the ROV system
- Hydraulic 5K LP and 15K HP supply and 120 liters reservoir
- Power and communication for SCM interface
- LP and HP chemical supply
- Space for 3rd party XT interface canister
- Qualified for 3000 meters water depth

Subsea tree and EDP/LRP control pod

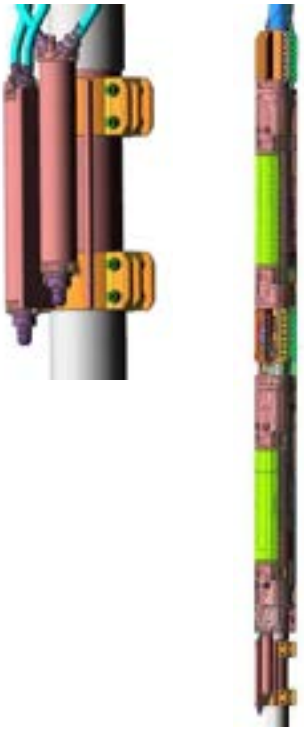
The Workover Control Module (WOCM) will be installed on the EDP and used for the following functions:

- Operation of valves and connectors on the EDP and LRP
- Operation of the direct hydraulic operated Tree valves
- Operation of connectors on the choke module
- Monitoring of PT/TT in main and annulus bores
- Close the defined barrier envelopes required for ESD and EQD
- Includes redundant electronic modules and a manifold block for solenoid valves
- A dedicated safety system is included that can be SIL rated if required

TH and LS control pod

The Riser Control Module (RCM) and the Landing String Accumulator Module (LAM) will sit within the vessel marine riser system and be used for the following functions:

- Operation of valves and connectors on the LS and Tubing Hanger Running Tool (THRT)
- Operation of the tubing hanger latch and pressure test functions
- Operation of TH soft land piston and integral valves where applicable
- Operation of the downhole completion valves in the main bore of the completion below the TH
- Monitoring of the downhole PT/TT in the main bore of the completion below the TH



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