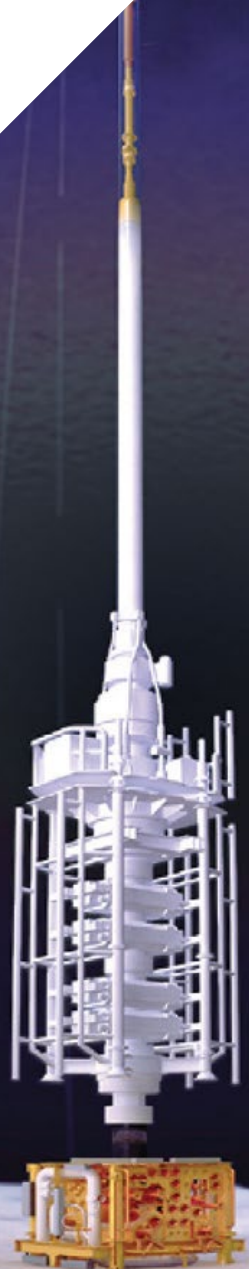


Landing String system

A primary well control barrier during a range of subsea operations





TechnipFMC Well Access Landing String system is the primary well control barrier during a range of subsea operations.

This can be during a development well test, a well completion, or when conducting any subsequent well intervention operations on subsea trees. It is configurable for TechnipFMC's Enhanced Horizontal and Vertical subsea tree systems in addition to legacy and other suppliers' equipment.

TechnipFMC provides full system integration of the Landing String (LS) with the subsea equipment and vessel to reduce complexity of interface management and therefore minimize operational risk.

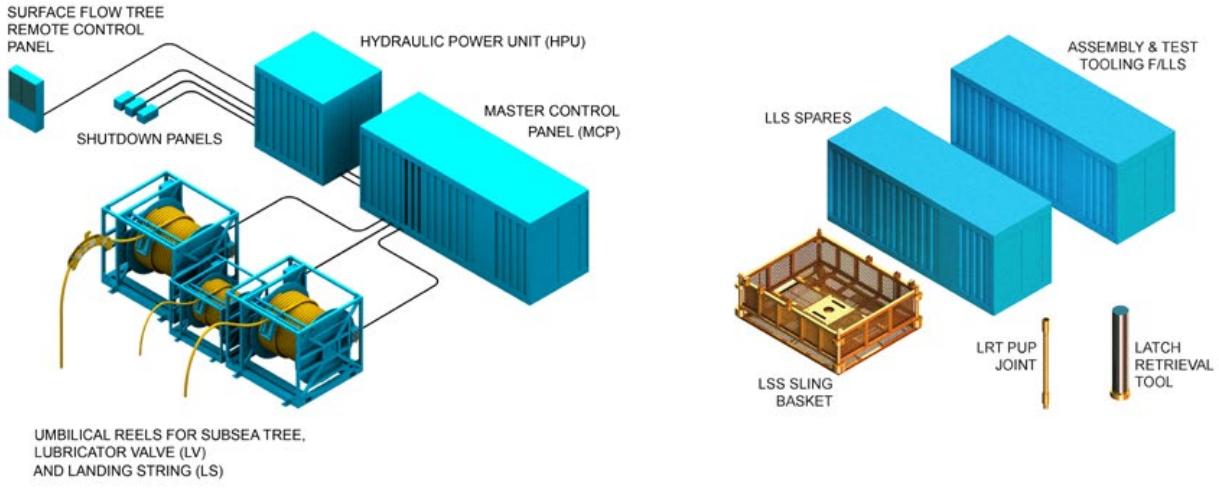
Technical description

TechnipFMC's LS is a 10,000 psi rated system with a nominal bore of 7 1/16". The system complies with ISO13628-7, has the capability for Safety Integrity Level 2 (SIL-2) control of Production Shut-down (PSD), Emergency Shut-down (ESD) and Emergency Quick Disconnect (EQD), while delivering accelerated response times. It is configurable to suit Anchored, Dynamically Positioned and Jack-up Vessels.

With our LS system, operators can benefit from:

- ▶ Minimal operational costs with less offshore personnel
- ▶ Minimal third party equipment on the vessel
- ▶ Minimal operational risk through system integration
- ▶ Minimal operational risk through SIL-2 rated fast response control system
- ▶ Minimal risk and maximum operating envelope through use of optional Riser Monitoring and Management system

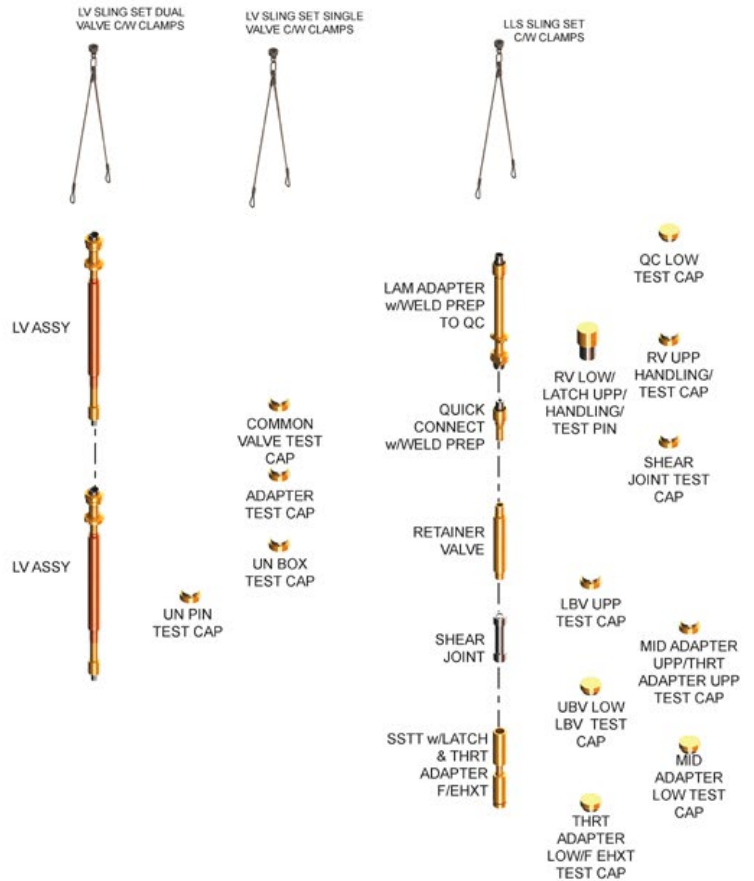
Landing String system overview



System specifications

Installation Workover Control System:

- ▶ Multimode Hydraulic Power Unit/ Master Control Panel rated for SIL-2 PSD, ESD and EQD
- ▶ XT umbilical and reel system with umbilical disconnect system
- ▶ LS umbilical and reel system
- ▶ Lubricator Valve umbilical and reel system
- ▶ Surface Flow Tree umbilical
- ▶ Umbilical Deck Jumpers and Emergency Shutdown Panels
- ▶ Electro Hydraulic Riser Control Module (RCM) - optional
- ▶ Riser Monitoring and Management system - optional



Surface equipment (ISO13628-7 rated):

- ▶ 7 1/16" 10,000 psi SIL-2 rated Surface Flow Tree (SFT) for ESD
- ▶ Wireline / Coil Tubing adapter
- ▶ Swivel
- ▶ Riser Slick Joint - also called Cased Wear Joint
- ▶ Upper Tension and Stress Joints
- ▶ Tension Frame - optional

Riser system (ISO13628-7 rated):

- ▶ 7 1/16" 10,000 psi non-rotating union nut adapter joints for the Riser Slick Joint, Lubricator Valves, Landing String Accumulator Module and the Retainer Valve
- ▶ Casing Riser Joints - optional
- ▶ Union Nut Riser Joints - optional

Landing String equipment (ISO13628-7 rated):

- ▶ 7 1/16" 10,000 psi Single or Dual Lubricator Valves, configurable (dual high set or 1 high/1 low)
- ▶ 7 1/16" 10,000 psi Retainer Valve
- ▶ 7 1/16" 10,000 psi Subsea Test Tree rated to cut and seal Coil Tubing
- ▶ Vessel BOP specific Shear Sub and Slick Joint

In riser system

Functions:

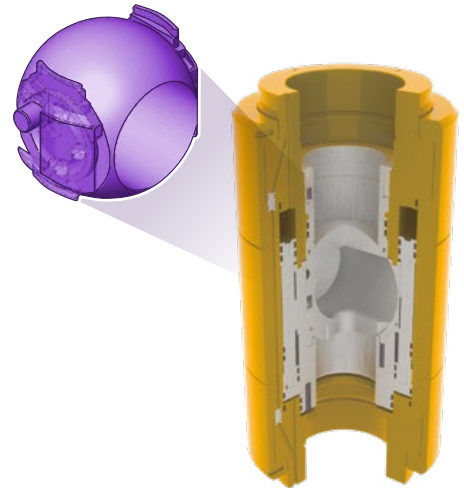
- ▶ The Lubricator Valve (LV) is a ball valve controlled by a separate control umbilical which can be configured as single or dual assemblies
- ▶ It is a working valve which allows long wireline or perforating assemblies to be rigged up and run into the well
- ▶ The LV therefore allows the Landing String to be used in lieu of very long wireline lubricator assemblies above the surface flowhead. It therefore saves time and improves job safety
- ▶ Designed to withstand dropped object impact from above (i.e. tools)
- ▶ Chemical injection porting is also provided both between and below the valves if required



Retainer valve

Functions:

- ▶ The Retainer Valve (RV) sits above the Subsea Test Tree (SSTT) in the LS assembly, immediately above the Shear Sub
- ▶ It closes (cuts and seals wireline and/or coil tubing) just prior to unlatching the SSTT, preventing hydrocarbons from migrating directly to the drill floor
- ▶ It also vents the pressure between the closed SSTT and the closed RV. This prevents 'lift-off' of the LS assembly when the SSTT latch is released



Subsea test tree

Functions:

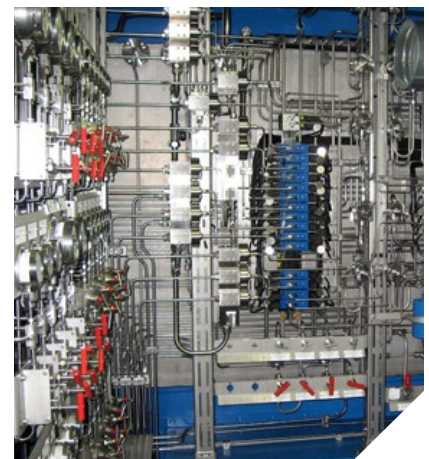
- ▶ The SSTT acts as the main safety barrier towards the well.
- ▶ Provides cutting capability for coiled tubing, wireline & slickline
- ▶ Two fail safe close ball valves, each able to isolate & contain maximum well bore pressure from below (and above)
- ▶ Annular and production bore well control below closed BOP pipe ram
- ▶ Pump through capability from above
- ▶ Provides a safe mechanism for disconnection & reconnection of the LS, with full hydraulic & electric communication, while within the BOP stack
- ▶ Chemical injection port supplied between the valves



IWOCS HPU/MCP

Functions:

- ▶ No single failure in the IWOCS will cause an unintended system shut-down, unacceptable risk for personnel safety, environment or loss of financial assets
- ▶ HPU/HDU/MCP can be one or several containers, typical 12-35ft. They are DNV 2.7-1 certified and A60 fire rated containers, with a control room section and a hydraulic section.
- ▶ Shutdown, PSD/ESD/EQD panels are included in system
- ▶ Remote control panel for installation in driller cabin will show the same information as HMI in MCP control room
- ▶ SIL-2 rated safety system



Landing String Accumulator Module

Functions:

- ▶ The Landing String Module (LAM) is a SIL-2 rated Electro Hydraulic control module for both ESD and EQD of the LS
- ▶ It facilitates a high speed response with large flow control valves providing EQD operation in less than 15 seconds (inclusive of wire and coil tubing cutting)
- ▶ Redundancy is included to ensure that no single failure will compromise the system safety
- ▶ The LAM system is optional and can be omitted to operate direct hydraulic only for selective operations



Umbilicals and reels

Functions:

- ▶ 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 for FMC Technologies and other suppliers' subsea tree production control systems
- ▶ Umbilical reels can be delivered electrically or pneumatically, and driven by a local and remote control panel
- ▶ They can all be run manually or have a constant tension



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