AGENDA

- 13 5/8” Wellhead System
  - System Advantages
  - Installation History
  - 13 5/8” Wellhead System Components and Tools
  - In-Wellhead Completion
  - Installation videos
13 5/8” Slimbore Wellhead System
Advantages of a Slimbore Wellhead System

- Designed to be used with Surface BOPs
- Allows for lighter drilling packages on TLP and Spars
- Designed with smaller and lighter casing programs
- Reduces mud costs due to smaller drilling risers
- Can be used in shallow and deepwater applications
Installation Information

North Sea
- 1 Exploration Wellhead

Congo, Africa
- FDPSO – allows drilling and completion from the same ship
- 1500 m water depth
- 10 wells
  - 1 FMC Tubing Head on existing exploration well
  - 4 FMC Wellheads and Tubing Hangers installed
  - Currently installing 4th Tree
  - Will begin 5 well batch set in July
FMC Scope of Supply

- Ten (10) Enhanced Vertica Deepwater Trees (EVDT)
- Nine (9) UWD-SB 13 5/8 Slimbore Wellheads
- Control Systems
- One (1) 10-slot Manifold
- Gooseneck connectors
IRLSD System Components
30”/ 36” IRLSA Low Pressure Housing

30”/ 36” Integral Rigid Lock Low Pressure Housing
- Drifts 26” bit
- Four 3” diameter ports for passing drilling and cement returns

30”/ 36” IRLSA CAM Tool
- Tool has two 2” diameter ports for additional 6.28 in² flowby

30”/ 36” IRLSA Drill Ahead Tool
- Will pass a 10” tool joint in DA mode
- Six 3.0” diameter ports with 42.4 in² of flowby for passing returns during drilling
Running the Low Pressure Housing
13 5/8” Wellhead Housing and Running Tools

13 5/8” Slimbore Wellhead Housing

- 4.0 million ft-lb bending capacity (18 ¾ H4)
- Rigidizing Mechanism provides 1.5 million pounds of preload
- 2.85 million lb. Internal load shoulder rating
- Capacity for up two casing hangers, or one hanger and tubing hanger
- 10,000 psi plus 1.0 million pounds casing for 1st hanger and 650,000 pounds casing/tubing

13 5/8” Wellhead Housing Running Tool

- 1.0 MM Rated Casing Capacity
- Runs and Retrieves Nominal Bore Protector
- Performs BOP tests up to 10,000 psi

Rigid Lock Setting Tool

- “Bolts-on” to the Wellhead Housing Running Tool
- Preloads the Rigid Lock using ROV or Drill Pipe Pressure
Pre-skid the High Pressure Housing
Casing Hanger, Seal Assembly & Running Tool

13 5/8” x 10 ¾” Casing Hanger
- 1.0 MM lbs casing weight
- Supports up to 650,000 lbs casing or tubing weight + 10 ksi BOP Test
- Hangers have 5.65 square inches of flow-by area (0.60” particle)

13 5/8” Annulus Seal Assemblies
- Used to seal off the annulus between the casing and the wellhead
- PR2 Qualified 30°F to 250°F, 10K Bore Pressure, 10K Annulus
- External Lock Ring is rated to 0.8 million lbs
- Seal is retrieved to surface if not fully energized and locked onto the hanger

13 5/8” Single Trip Tool
- Installs the casing hanger and annulus seal assembly in the same trip
- Tool rated for 1,000,000 lbs of casing and a 10,000 psi pressure test.
- Seal assembly is hydraulically set with 3200 psi drill pipe pressure. Drill pipe is vented with 4500 psi.
- Lead impression blocks give a tell-tail that the seal assembly is locked to hanger and fully energized
Plug Loading and Running the Casing Hanger
13 5/8” Spring Loaded Tool & Wear Bushing

- 10,000 psi Rated Working Pressure
- Run/Retrieve all Wear Bushings and pressure test BOP stack on the same trip
- Can perform BOP tests in all wellhead positions
- Retrieve 13 5/8” Annulus Seal Assemblies
- Spring loaded mandrel provides 4.63 in$^2$ of flowby area
- 5,000 lbs of drill string weight required to compress spring and close flowby
- No drill pipe rotation required to function tool
Spring Loaded Tool and Wear Bushing
13 5/8” Isolation Test Tool

- Test Annulus Seal Assemblies while landed isolating the DR and BOP stack
- Rated for 10,000 psi Annulus Seal tests
- 5,000 lbs of drill string weight required to shear shear pins to actuate tool
- No drill pipe rotation required to function tool
- Pressure through the drill string creates a downward force on the mandrel, preventing the tool from disengaging prematurely
Isolation Test Tool
In-Wellhead Completions
13 5/8” EVDT Tubing Hanger
(shown in wellhead)

- 10,000 psi Working Pressure
- Available for 5” – 7” tubing
- Features a 1-1/2” annulus gate valve
- Can accommodate up to 11 down hole lines
Installing a Tubing Hanger in the Wellhead

Measurement Run using 13 5/8” Gage Tool

- Run on drill pipe
- Measures the distance between the internal shoulder of the wear bushing and the running grooves of the wellhead housing
- Retrieves the Wear Bushing
- Uses a setting stand to portray the wellhead and allow the tubing hanger to be set
- Adjust the Tubing Hanger Bearing Ring per wellhead measurement
- Install Tubing Hanger inside of the wellhead using the Tubing Hanger Running Tool
Casing Hanger Measurement Tool
5X2, 10K EVDT WITH IN-THE-WELLHEAD STYLE TUBING HANGER

CAPABILITIES:
- 9 DOWN HOLE HYDRAULIC
- 2 DOWN HOLE ELECTRICAL
- 1 1/2 INTEGRAL TUBING HANGER GATE VALVE
- CONFIGURABLE PRODUCTION OR WATER INJECTION FLOW MODULE