Drilling Engineering and Operations: Well Planning, Casing, Hydraulics and Well Control

13 – 24 December 2026
Dammam - Eastern Province five-star



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Ref: 148_15074 **Date:** 13 – 24 December 2026 **Location:** Dammam - Eastern Province five-star **Fees:** 35100 SAR

Introduction:

Weak drilling engineering and operations practice shows up on the rig as narrow mud weight windows, casing seats set in the wrong place, poor hole cleaning, kicks, stuck pipe, losses and hours of non-productive time. This Core Concept course takes experienced engineers through the full well construction chain from offset data and pore pressure prediction to casing and cement design, drill string and BHA, fluids and hydraulics, bits and rate of penetration, then adds directional work, well control engineering, stuck pipe and loss prevention and performance analysis in week two. Participants build a Drilling Programme and Well Plan.

Course Objectives:

- Construct a pore pressure and fracture gradient window from offset data and select mud weights and casing setting depths from it
- Design casing strings and primary cement jobs against burst, collapse, tension and kick tolerance load cases
- Specify drill string, BHA, drilling fluid system and hydraulics that keep equivalent circulating density inside the window and clean the hole
- Plan directional trajectories, survey programmes and torque and drag limits for deviated, extended-reach and HPHT wells
- Calculate kill parameters and set kick detection, shut-in, stuck pipe and lost circulation contingencies for each hole section
- Analyse drilling time data for non-productive and invisible lost time and set performance targets for the next well

Target Audience:

- Engineers who design hole sections, casing and cement programmes for development and exploration wells
- Rig-based engineers and supervisors who execute the drilling programme and make real-time parameter decisions
- Well planners who prepare trajectories, BHA and fluid programmes with service companies
- Performance engineers who analyse rig time, benchmark wells and run lessons-learned reviews
- Engineers from drilling contractors and service companies who support operator well delivery

Course Outline:

Day 1: Well Planning Foundations: Offset Data and the Pressure Window

- Offset Well Data Review: Bit Records, Mud Logs and Daily Drilling Reports
- Pore Pressure Prediction from Sonic, Resistivity and d-Exponent Trends
- Fracture Gradient Estimation from Leak-Off and Formation Integrity Tests
- Pore Pressure and Fracture Gradient Window Plot for Mud Weight Selection
- Well Objectives, Target Tolerances and Basis of Design Document

Day 2: Casing Design and Primary Cementing Engineering

- Casing Setting Depth Selection from the Pressure Window
- Burst, Collapse and Tension Load Cases with Design Factors
- Casing Grade, Weight and Connection Selection Worksheet
- Primary Cement Job Design: Slurry Density, Spacers, Centralisation and Displacement Rate
- Cement Job Evaluation Criteria and Remedial Squeeze Decision Points

Day 3: Drill String, BHA and Drilling Fluid Systems

- Drill String Design for Tension, Torsion and Margin of Overpull
- BHA Configuration: Stabiliser Placement, Drill Collars, Heavy-Weight Pipe and Jars
- Drilling Fluid System Selection: Water-Based, Oil-Based and Synthetic-Based Muds
- Mud Rheology Models and Filtration Control Testing
- Solids Control Equipment Layout and Mud Weight Management

Day 4: Hydraulics, Bits and Rate of Penetration

- Circulating Pressure Loss Calculation and Pump Pressure Budget
- Equivalent Circulating Density Modelling Against the Fracture Gradient
- Hole Cleaning Indicators: Annular Velocity, Cuttings Transport Ratio and Cavings Monitoring
- PDC and Roller Cone Bit Selection with Dull Grading of Returned Bits
- Drill-Off Test and Mechanical Specific Energy for Weight on Bit and Rotary Speed Optimisation

Day 5: Week-One Integration: Guided Section Design Case

- Case Study: Pressure Window and Casing Seat Selection for a Development Well
- Case Study: Casing Load Check and Cement Programme Review
- Case Study: BHA, Mud System and Hydraulics Plan for the Intermediate Section
- Case Study: Bit and Drilling Parameter Roadmap from Offset Performance
- Week-One Section Design Review and Peer Challenge

Day 6: Directional Drilling, Surveying and HPHT Wells

- Directional Well Profiles: Build-Hold, S-Shape and Horizontal Trajectory Design
- Rotary Steerable Systems versus Steerable Mud Motors
- MWD Survey Calculation by Minimum Curvature and Anti-Collision Separation Factor
- Torque, Drag and Buckling Modelling for Extended-Reach Sections
- HPHT Well Overview: Temperature Effects on Fluids, Elastomers and Casing Loads

Day 7: Well Control Engineering and Well Construction Risk

- Kick Tolerance Calculation and Its Effect on Casing Seat Selection
- Kick Detection Indicators: Pit Gain, Flow Checks and Trip Tank Monitoring
- Shut-In Procedures and Bottom-Hole Pressure from Shut-In Drill Pipe and Casing Pressures
- Kill Sheet Calculations for the Driller's, Wait and Weight and Concurrent Methods
- Well Construction Risk Register and Management of Change for Programme Deviations

Day 8: Stuck Pipe, Lost Circulation and Rig-Site Coordination

- Differential Sticking Mechanisms and Prevention Practices
- Mechanical Sticking Diagnosis: Pack-Off, Wellbore Geometry and Key Seating
- Jarring and Freeing Decision Tree with Sidetrack Trigger Criteria
- Lost Circulation Classification, Loss Control Material and Wellbore Strengthening Selection
- Drill-the-Well-on-Paper Session, Pre-Spud Meeting and Shift Handover Protocol

Day 9: Drilling Performance Analysis: NPT, Invisible Lost Time and Benchmarking

- Rig Time Breakdown Coding: Productive Time, NPT and Invisible Lost Time
- Technical Limit Analysis and Flat-Time Reduction Plans
- Days-Versus-Depth Curve Benchmarking Against Offset Wells
- Drilling KPIs: Metres per Day, Connection Time and Tripping Speed
- After-Action Review and Lessons-Learned Database for Continuous Improvement

Day 10: Capstone: Drilling Programme and Well Plan

- Capstone Build: Basis of Design and Pressure Window for a Participant Well
- Capstone Build: Casing, Cementing and Drilling Fluid Programme Sections
- Capstone Build: Directional Plan, BHA and Hydraulics Summary
- Capstone Build: Well Control, Stuck Pipe and Loss Contingencies with Performance Targets
- Drilling Programme Presentation and Technical Panel Review

Skills You Will Gain:

- Pore Pressure Prediction
- Casing Load Analysis
- Cement Job Design
- Drilling Hydraulics Modelling
- Bit and ROP Optimisation
- Directional Trajectory Planning
- Kill Sheet Calculation
- Invisible Lost Time Analysis

Why Attend This Course:

- Return with a Drilling Programme and Well Plan built for a well from your own portfolio
- Move from single-section design in week one to directional, well control, stuck pipe and performance work in week two
- Reduce flat time and trouble time by linking offset data, parameter choices and contingencies in one programme
- Compare well delivery practice with engineers from operators, drilling contractors and service companies working onshore and offshore

Conclusion:

Well construction outcomes are set long before spud, in the pressure window, casing seats, fluid and hydraulics choices and the contingencies written into the programme. Week one builds section design from offset data through casing, cement, drill string, fluids, hydraulics and bits, closing with a guided case. Week two adds directional and HPHT planning, well control engineering, stuck pipe and loss prevention, and performance analysis of non-productive and invisible lost time. The final day produces a Drilling Programme and Well Plan ready for technical review.