Electrical Submersible Pumps (ESP) Training Course: Design and Operation

10 – 14 January 2027
Amman (Jordan)

UK Traininig
PARTNER



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Ref: 27_239571 **Date:** 10 – 14 January 2027 **Location:** Amman (Jordan) **Fees:** 4900 GBP

Introduction:

Electrical Submersible Pumps ESP design and operation refers to the engineering practice of sizing, deploying, and managing multistage downhole centrifugal pumping systems for fluid artificial lift. This one-week course prepares production and artificial lift engineers to build an Electrical Submersible Pump Design and Operational Surveillance Runbook. Delivered at practitioner depth through a hands-on modelling build practical mode, the course applies ISO 15551-1:2015 alongside API RP 11S4 sizing methodologies. Engineering professionals study Electrical Submersible Pumps ESP Training Course: Design and Operation with Blackbird Training Centre to optimize artificial lift run-life and well production efficiency.

Course Objectives:

- Select suitable downhole pump stages and motor configurations according to well inflow performance relationships and API RP 11S4 sizing calculations.
- Distinguish between radial flow and mixed flow impeller geometries to mitigate mechanical wear under varying abrasive fluid flow rates.
- Compare fixed-frequency switchboards against variable speed drive controllers to evaluate motor thermal stress and operational operating envelopes.
- Apply ISO 15551-1:2015 standards alongside API RP 11S3 procedures to conduct safe downhole equipment assembly and tubing installation.
- Interpret downhole sensor telemetry and surface electrical power logs to diagnose mechanical scale deposition and electrical ground faults.
- Justify downhole gas separation and gas handling equipment selection based on free-gas volume fraction and reservoir bubble-point pressures.

Target Audience:

- Production engineers responsible for artificial lift design who must choose between radial flow and mixed flow pump stage configurations.
- Completions engineers responsible for downhole assembly architecture who must decide between standard tubing-conveyed and alternative deployed ESP configurations.
- Artificial lift surveillance engineers responsible for production optimization who must evaluate variable speed drive frequencies against pump operating limits.
- Field electrical operations specialists responsible for surface power distribution who must select appropriate step-up transformer taps and cable voltage ratings.



Course Outline:

Day 1: Reservoir Inflow Dynamics and ESP System Fundamentals

- Radial Flow vs Mixed Flow Stages: Evaluating Impeller Geometries for Volumetric Discharge Rates and Solids Handling Capacity
- Reservoir Inflow Performance Relationships: Applying Vogel and Darcy Equations for Bottomhole Pumping Intake Calculations
- API RP 11S4 Sizing Fundamentals: Determining Total Dynamic Head and Multiphase Fluid Volume Corrections
- Downhole Fluid Properties Modelling: Calculating Solution Gas Ratios and Fluid Viscosity Effects on Head
- Wellbore Mechanical Configuration: Assessing Casing Clearances and Dogleg Severity for Downhole String Integrity

Day 2: Equipment Standards and Downhole Component Architecture

- Fixed-Frequency Switchboards vs Variable Speed Drives: Analyzing Motor Speed Regulation and Thermal Stress During Frequency Range Modulation
- ISO 15551-1:2015 Design Verification: Enforcing Manufacturing Specifications and Downhole Assembly Testing Benchmarks
- API RP 11S7 Seal Chamber Standards: Balancing Downhole Pressure Fluctuations and Isolating Motor Dielectric Cooling Oil
- Induction Motor vs Permanent Magnet Motor: Comparing Electrical Efficiency and Downhole Operating Temperature Envelopes
- IEEE Std 1018 Power Cable Standards: Sizing Ethylene Propylene Insulation and Metallic Armor Against Voltage Drop

Day 3: Nodal Analysis and Electrical Submersible Pump System Sizing

- Static Nodal Analysis vs Dynamic Inflow Matching: Simulating System Operating Points Using Commercial Production Engineering Software
- Total Dynamic Head Calculations: Sizing Multistage Centrifugal Pump Impellers Against Wellbore Friction Losses
- Downhole Motor Sizing Calculations: Determining Brake Horsepower Loading and Derating Curves Under Elevated Reservoir Temperatures
- API RP 11S5 Cable Selection: Sizing Conductor Cross-Sections to Minimize Downhole Transmission Electrical Losses
- Transformer and Surface Sizing: Calculating Transformer KVA Requirements and Step-Up Voltage Tapping Configurations



Day 4: Gas Handling, Failure Diagnostics, and Well Surveillance

- Rotary Gas Separators vs Gas Handling Pumps: Managing High Gas-to-Oil Ratio Slugs in Multiphase Wellbore Streams
- API RP 11S8 Vibration Thresholds: Diagnosing Mechanical Shaft Unbalance and Bearing Wear from Downhole Telemetry
- API RP 11S1 Teardown Procedures: Classifying Mechanical Seal Failures and Severe Downhole Electrical Insulation Breakdown
- Solid Particle and Scale Mitigation: Specifying Tungsten Carbide Bearings and Chemical Inhibition Downhole Injection Systems
- Electrical Fault Troubleshooting: Detecting Ground Faults and Phase Imbalance Across Cable and Motor Windings

Day 5: Modelling Build: Integrated Well Sizing and Surveillance Runbook Development

- Downhole Sensor Telemetry vs Ammeter Chart Interpretation: Detecting Pump Gas Locking and Electrical Underload Tripping Events
- Prosper Inflow Performance Matching: Calibrating Well Production Test Data and PVT Correlations for Sizing
- Variable Speed Drive Optimization: Adjusting Drive Frequencies to Maintain Operating Points Within Recommended Ranges
- API RP 11S2 Pump Performance Testing: Verifying Factory Hydraulic Head and Flow Rates Against Published Curves
- Design Runbook Finalization: Delivering the Electrical Submersible Pump Design and Operational Surveillance Runbook

Skills You Will Gain:

- Nodal Analysis Modelling
- API RP 11S4 Pump Sizing
- Variable Speed Drive Optimization
- Multiphase Gas Handling Selection
- Downhole Cable Voltage Drop Calculation
- Electrical Submersible Pump Teardown Diagnosis
- Real-Time Well Telemetry Surveillance



Why Attend This Course:

- From relying on generic pump charts to conducting rigorous nodal analysis sizing aligned with API RP 11S4 standards.
- From reacting to downhole pump failures to diagnosing early electrical and mechanical degradation using real-time telemetry.
- From struggling with free gas interference to selecting appropriate rotary gas separators and multiphase handling stages.
- From managing undocumented ESP installations to delivering an Electrical Submersible Pump Design and Operational Surveillance Runbook.

Conclusion:

Electrical Submersible Pumps ESP design and operation delivers the engineering foundation required to lift hydrocarbons efficiently across varying wellbore dynamics and reservoir decline conditions. The course clarifies foundational distinctions between radial and mixed flow impellers, fixed-frequency and variable speed drive control, and downhole mechanical separation versus active multiphase gas handling. Tailored for production engineers and artificial lift specialists operating at practitioner depth, this course equips technical teams to size pump stages, verify electrical cable integrity, and implement proactive downhole surveillance strategies.

Frequently Asked Questions FAQ:

What is Electrical Submersible Pumps ESP design and operation?

Electrical Submersible Pumps ESP design and operation is the engineering discipline of selecting, sizing, installing, and monitoring downhole multistage centrifugal pumping systems and surface power packages. It balances reservoir inflow performance against total dynamic head requirements to maximize hydrocarbon recovery and pump run-life.

What is the difference between radial flow and mixed flow stages in Electrical Submersible Pumps ESP?

Radial flow stages discharge fluid perpendicular to the pump shaft, making them ideal for low-to-medium flow rates with high head generation, whereas mixed flow stages propel fluid both radially and axially, providing superior tolerance for abrasive solids and high flow volumes at lower per-stage pressure.

Which technical standards govern this Electrical Submersible Pumps ESP course?

This course follows international artificial lift standards, including API RP 11S4 for sizing, API RP 11S for operation, API RP 11S2 for testing, API RP 11S3 for installation, ISO 15551-1:2015 for downhole equipment specifications, and IEEE Std 1018 for power cable testing and specification.



Is this Electrical Submersible Pumps ESP course suitable for production engineers?

Yes, this course is designed specifically for production engineers, completions engineers, and artificial lift specialists. It provides practitioner-level instruction in calculating total dynamic head, configuring variable speed drives, modelling multiphase inflow, and diagnosing mechanical and electrical downhole anomalies without requiring prior advanced pump manufacturing experience.

