MERCURY

Electrical Submersible Pumps (ESP) Design, Operation, and Troubleshooting Training Course

26 – 30 September 2027
Kuala Lumpur (Malaysia)



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Electrical Submersible Pumps (ESP) Design, Operation, and Troubleshooting Training Course

Ref: 47_1082668 **Date:** 26 – 30 September 2027 **Location:** Kuala Lumpur (Malaysia) **Fees:** 4900 Euro

The Electrical Submersible Pumps ESP Design, Operation, and Troubleshooting Training Course is a one-week course for production engineers, artificial lift specialists, electrical field technicians, and petroleum operations staff responsible for artificial lift performance. Working with sizing calculations, power skids, and teardown diagnostics, you assemble an ESP System Design and Troubleshooting Dossier. Mercury Training Center delivers this course to build practical expertise across electrical submersible pump installations.

About This Course

Premature pump run-life failures, electrical insulation breakdown, and unmanaged gas interference cause severe production downtime and high intervention costs in artificial lift operations. To follow this course, you must already understand basic reservoir inflow performance, wellbore hydraulics, and standard electrical power distribution. Through technical exercises and operational evaluations, you practice pump sizing, surface drive tuning, and failure investigation workflows.

Who It Is For

- Production engineers responsible for designing artificial lift completions, reviewing inflow performance, and selecting downhole pump stages.
- Artificial lift engineers responsible for monitoring operating run-life, assessing motor thermal profiles, and managing gas separation systems.
- Electrical facility technicians responsible for configuring surface variable speed drives, dedicated step-down transformers, and wellhead motor leads.
- Well surveillance specialists responsible for evaluating downhole sensor logs, identifying hydraulic instabilities, and executing root-cause failure analyses.

This course is not for entry-level field operators requiring basic wellsite mechanical safety practices, who are better served by introductory oilfield operations training, nor is it for corporate financial analysts tracking joint-venture reservoir assets, who would gain more from general energy project economics coursework.

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Competencies You Will Build

- Hydraulic Stage Sizing: Calculating total dynamic head, multi-phase fluid adjustments, and stage counts to match specific well inflow potential.
- Downhole Component Matching: Selecting motor ratings, thrust bearing protector chambers, and gas separators to withstand operating stresses.
- Surface Power Configuration: Specifying dedicated step-down transformers, switchgear, and variable speed drive parameters to secure stable downhole electrical supply.
- Operational Surveillance: Interpreting downhole sensor pressures, motor winding temperatures, and electrical amperage charts to detect production anomalies.
- Root-Cause Teardown Analysis: Evaluating component wear, scale accumulation, and insulation decay to determine mechanical or electrical failure mechanisms.

What You Will Be Able to Do

By the end of the course you will be able to:

- From well inflow test data and fluid PVT reports, calculate total dynamic head and select pump stage configurations aligned with API RP 11S4.
- Given harsh sour production environments, specify downhole metallurgy, seal elastomers, and motor insulation systems meeting ISO 15551-1 and NACE MR0175/ISO 15156-1.
- Using well pad layout criteria, design surface electrical power systems including dedicated transformers and loop feed distribution according to SAES-I-001.
- From variable speed drive trend logs and motor temperature monitors, diagnose operational faults such as gas locking, pump off, and fluid recirculation.
- Using electrical teardown inspection logs, conduct structured component evaluations following API RP 11S1 and API RP 11S2 testing guidelines.
- From historical operational metrics, establish run-life surveillance benchmarks and preventive maintenance schedules to extend run-life across well clusters.

Course Content

Day 1: Inflow Hydraulics and Pump Sizing Fundamentals

- Reservoir Inflow Performance Relationship and Wellbore Hydraulics Evaluation
- Total Dynamic Head Calculation and Multi-Phase Gas Adjustments
- Centrifugal Pump Impeller Geometry and Stage Performance Curves Under API RP 11S4
- Viscous Fluid Degradation Factors and Slurry Abrasion Management
- Gas Handling Technologies Including Rotary Separators and Multi-Phase Pumps

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Day 2: Downhole Assemblies, Motors, and Metallurgy

- Induction and Permanent Magnet Motor Ratings and Thermal Dissipation Limits
- Seal Section Protector Configurations, Mechanical Seals, and Bag Elastomers
- High-H2S Metallurgy Selection and Elastomer Limits Under NACE MR0175/ISO 15156-1
- Downhole Sensor Packages for Intake Pressure, Discharge Pressure, and Vibration
- Power Cable Construction, Armor Selection, and Pothead Penetration Integrity

Day 3: Surface Electrical Distribution and Drive Controls

- Surface Variable Speed Drive Topologies and Harmonics Mitigation Systems
- Dedicated Step-Down Transformers and Surface Switchgear Complying with 55-SAMSS-003
- Multi-Well Pad Electrical Architecture and SAES-I-001 Surface Loop Distribution Limits
- Motor Controller Logic and Outdoor Skid Requirements Aligned with 55-SAMSS-001
- Rigless Coiled Tubing Deployment Considerations for ESP Intervention Cost Reduction

Day 4: Field Commissioning, Operation, and Surveillance

- Pre-Installation Cable Testing and IEEE Std P43 Motor Insulation Resistance Checks
- Wellhead Space-Out, Tubing Hanger Penetration, and Lowering Procedures
- Flushing and Commissioning Acceptance Protocols Aligned with API RP 11S3
- Real-Time Diagnostic Interpretation of Ammeter Charts and Intake Choke Adjustments
- Troubleshooting Under-Load, Overload, Gas Locking, and Up-Thrust Conditions

Day 5: Failure Diagnostics and System Dossier Finalization

- Exercise on Multi-Phase Stage Sizing and Variable Speed Selection
- Exercise on Surface Power Transformer Sizing and Loop Configuration
- Exercise on Root-Cause Teardown Analysis Using API RP 11S1 Schematics
- Exercise on Factory Performance Testing and Acceptance Run Analysis via API RP 11S2
- Final Assembly and Review of the ESP System Design and Troubleshooting Dossier

Case Studies and Exercises

These suggested activities provide practical application of pump engineering methods across different operational environments:

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- Case study: A mature onshore oilfield producing high water-cut crude, where you calculate hydraulic stage requirements, select appropriate protector chambers, and adjust drive frequencies to avoid pump cavitation.
- Case study: A sour offshore reservoir containing severe hydrogen sulfide, where you evaluate downhole metallurgical specifications, configure NACE-compliant coatings, and assess alternative rigless deployment methods.
- Exercise: A clustered well pad with tight wellhead spacing, where you design the electrical surface layout, verify dedicated step-down transformer capacities, and validate loop circuit compliance against SAES-I-001 standards.
- Exercise: An unexpected well trip event, where you evaluate ammeter records, examine downhole sensor histories, and determine root cause using API RP 11S1 teardown classification procedures.

What You Take Back

The ESP System Design and Troubleshooting Dossier provides engineering calculation worksheets, surface power verification templates, and diagnostic flowcharts to support your artificial lift operations during your first month back at work. You will use it to standardize pump sizing, evaluate vendor proposals, and systematically troubleshoot downhole pump trips.

- Standardized hydraulic sizing sheets and total dynamic head calculation templates
- Surface electrical layout checklists and transformer spacing specification guidelines
- Downhole component teardown assessment forms and root-cause failure investigation trees
- Real-time operating surveillance protocols and ammeter chart diagnostic references

Quick Answers FAQ

What background is required before attending the Electrical Submersible Pumps ESP Design, Operation, and Troubleshooting Training Course?

You need working familiarity with basic petroleum production concepts, reservoir inflow relationships, and basic industrial electrical circuits. Experience reviewing well performance logs or working around surface artificial lift infrastructure helps you engage effectively with sizing calculations and electrical drive troubleshooting exercises.

How does this course differ from general artificial lift engineering courses?

General artificial lift courses survey multiple lifting methods such as rod pumps, gas lift, and progressing cavity systems at a theoretical level. This course concentrates exclusively on electrical submersible pump assemblies, detailed stage sizing, surface electrical distribution standards, downhole metallurgy, and component teardown failure analysis.

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Why is downhole motor insulation integrity critical during electrical submersible pump operations?

Downhole motors operate under extreme hydrostatic pressures, elevated temperatures, and aggressive wellbore fluids. A breakdown in motor dielectric oil or insulation resistance quickly leads to phase-to-ground electrical shorts, causing sudden motor failure and requiring expensive, unplanned workover rig interventions to retrieve the completion string.

What work product do participants complete in the Electrical Submersible Pumps ESP Design, Operation, and Troubleshooting Training Course?

You complete the ESP System Design and Troubleshooting Dossier. It contains your customized stage sizing calculations, surface power distribution layouts, commissioning checklists, and teardown failure analysis procedures ready for direct use in monitoring and troubleshooting artificial lift installations at your operational facility.

For Your Manager

This course equips your engineer or technical specialist to evaluate artificial lift performance, optimize pump sizing, and resolve premature electrical submersible pump failures. The participant returns with the ESP System Design and Troubleshooting Dossier, providing ready-to-use calculation sheets and teardown investigation workflows. Your operations team will apply these tools immediately to enhance run-life, reduce intervention downtime, and improve well economics.