MERCURY

Artificial Lift System (ESP) Training

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Introduction:

Artificial lift systems are essential to enhancing production in the oil and gas industry, particularly when natural reservoir drive is insufficient. This comprehensive ESP artificial lift course aims to thoroughly understand these systems, focusing on Electric Submersible Pumps ESPs as a key technology.

Participants will delve into the major types of artificial lift systems, exploring their advantages, limitations, and ideal applications. The curriculum emphasizes using Nodal systems analysis to effectively design, optimize, and troubleshoot ESP systems, addressing various challenges encountered in oil and gas artificial lift production.

Targeted Groups:

The ESP artificial lift course is for Production, Reservoir, Completion Engineers, Supervisors, and Engineering staff involved in subsurface production operations, design, performance, and monitoring wells requiring artificial lift solutions.

Course Objectives:

By the end of this ESP artificial lift course, participants will:

- Apply an in-depth knowledge of subsurface production operations and artificial lift techniques.
- Understand reservoir performance in terms of inflow and outflow relationships.
- Evaluate and select the most suitable artificial lift methods and equipment.
- Identify and analyze the components of the ESP system.
- Design and carry out performance calculations for an ESP system.
- Maximize oil production by effectively employing ESP artificial lift systems.
- Select the appropriate ESP for specific operational needs, especially in harsh environmental conditions.
- Interpret downhole tool data and ESP logs for improved artificial lift performance.
- Tackle the challenges of gas, solids, and corrosion in produced fluids.
- Conduct thorough ESP failure analyzes to derive optimization solutions.

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Targeted Competencies:

Upon the end of this ESP artificial lift training, participants competencies will:

- Proficiency in understanding the principles and operation of ESPs in the context of oil and gas extraction.
- Ability to analyze wellbore and reservoir performance to determine the need for artificial lift systems.
- Competence in selecting and designing ESP systems based on oil and gas well characteristics and production requirements.
- Skill in troubleshooting and diagnosing ESP installation, operation, and maintenance issues.
- Know alternative ESP applications and configurations to address various well conditions and challenges.
- Understand the capability to monitor and surveil ESP performance parameters for optimal operation and reliability.
- Understand environmental considerations and regulatory compliance related to ESP operations in the oil and gas industry.
- Awareness of future trends and innovations in ESP technology and their implications for the industry.

Course Content:

Unit 1: Introduction to Artificial Lift Technology:

- Overview of artificial lift systems oil and gas, including sucker rod pumps, gas lift, and ESP.
- The impact of ever-changing well conditions on the necessity of artificial lift.
- Practical applications and limits of various artificial lift types.

Unit 2: Reservoir Performance:

- Comprehensive understanding of wellbore and reservoir performance.
- The concept of productivity index and essential artificial lift definitions.
- Detailed examination of inflow and outflow relationships.

Unit 3: Fundamentals and Applications of ESP:

- Intro to ESPs and ESP Systems within the artificial lift sector.
- Electrical and hydraulic principles of ESP operation.
- In-depth description and functional features of all ESP system components like pumps, gas separators, protectors, motors, and downhole sensors.

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Unit 4: ESP System Design, Performance Calculations, and Equipment Sizing:

- Steps to establish basic artificial lift requirements.
- Process for determining well production capacity.
- Calculate the fluid composition and manage the free gas volume in the system.
- Total Dynamic Head calculation and its role in artificial lift optimization.
- Optimal selection of pump and motor types and sizes.
- Determine suitable downhole cable configurations, including sizing and artificial lift techniques.
- Optimal selection and design of drive systems, power supplies, and associated artificial lift tools and equipment.
- Variable speed drive requirements and design examples featuring ESP artificial lift systems.

Unit 5: Alternative ESP Application and Configurations:

- Apply ESPs in various conditions, including handling multiphase, high-viscosity, abrasive contaminants, high temperatures, and corrosive substances.
- Explore alternative ESP configurations, including inverted/bottom intake and dual/POD ESPs.

Unit 6: ESP Installation, Commissioning, Operation, and Troubleshooting:

- Learn about best practices for the installation of ESP artificial lift equipment.
- Commissioning and troubleshooting guidelines for surface equipment.
- The efficiency of ESP operation, the impact of surface chokes, and measures for artificial lift optimization.
- Case studies and real-world examples of ESP-related problems and failures.
- Root cause analysis techniques to diagnose and resolve failed artificial lift equipment issues.

Unit 7: ESP Monitoring and Surveillance:

- Continuous monitoring of ESP performance parameters like flow rate, pressure, temperature, and motor current.
- Utilize downhole gauges and surface sensors for real-time data collection.
- Integrate data acquisition systems with SCADA for remote monitoring and control.
- Alarm systems for detecting abnormal operating conditions and potential failures.
- Regular surveillance is important for identifying trends and preemptively addressing issues.
- Implement predictive maintenance strategies based on surveillance data analysis.

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Unit 8: ESP Reliability and Maintenance:

- Proactive maintenance is important to maximize ESP reliability and longevity.
- Routine checks for mechanical wear, corrosion, and fluid contamination.
- Schedule replacement of critical components such as seals, bearings, and cables.
- Use condition monitoring techniques like vibration analysis and oil analysis.
- Apply reliability-centered maintenance RCM principles for optimizing maintenance schedules.
- Collaborate with OEMs and service providers for specialized maintenance tasks.

Unit 9: Environmental Considerations and Regulatory Compliance:

- Environmental impact assessment of ESP operations, including fluid disposal and emissions.
- Compliance with environmental regulations related to air quality, water usage, and waste management.
- Implement best practices for minimizing ecological footprint and community impact.
- Integrate environmental management systems EMS into ESP operations.
- Train programs for personnel on environmental stewardship and regulatory compliance.
- Continuous improvement initiatives to enhance environmental performance.

Unit 10: Future Trends and Innovations in ESP Technology:

- Explore emerging technologies like smart sensors and IoT for ESP monitoring and control.
- Adopt advanced materials to improve ESP component durability and efficiency.
- Integrate machine learning algorithms for predictive maintenance and optimization.
- Develop next-generation ESP systems capable of handling extreme conditions.
- Collaborate with research institutions and technology partners to drive innovation.
- Anticipate market trends and regulatory changes shaping the future of ESP technology.

Conclusion:

Through this ESP artificial lift course, participants will emerge as proficient artificial lift engineers with the skills to implement and improve artificial lift performance and system maintenance.

In the ESP artificial lift training, participants will also help participants understand an artificial lift system and how ESPs can meet specific production challenges in the oil and gas industry.