



Electric Submersible Pump (ESP)

Course Duration : 5 Days

Date : 15-Jul-2024 to 19-Jul-2024

Location : Cairo, Egypt

Type of Participant : Petroleum Engineers, Reservoir, Drilling and field technicians who are responsible for the selection, operation, and maintenance of ESP.

Summary:

The Electric Submersible Pump System (ESP) is considered an effective and economical means of lifting large volume of fluids from great depths under a variety of well conditions. Over the years, the ESP companies have gained considerable experience in producing high viscosity fluids, gassy wells, high temperature wells, etc.

This course is designed to help participants to improve their knowledge and get the necessary experience required for the practical analysis of well performance and the evaluation of the ESP wells. It discusses all the issues related to ESP starting from candidate's selection, ESP design, installation, start-up and troubleshooting till the failure analysis stage.

Objective:

This advanced course is designed to provide recommendations for designing ESP systems for special applications including gassy wells, production of fluids with solids, viscous oil, dual completions, Y tool applications, shrouded motors, production through the annular, high temperature and recirculation.

Upon successful completion of the course, students will be able to:

- Provide in depth knowledge of the advantages and limitations of the Electric



Submersible Pumps used in aggressive environment applications.

- Define factors affecting both the inflow and outflow
- Determine the screening criteria for artificial lift methods
- Choose the optimum conditions for ESP as an AL method
- Specify surface and downhole components and auxiliary equipment needed for ESP
- Apply design for an ESP and analysis concepts
- Use the field practical techniques to prolong the life time of an ESP and maximize the revenue
- Design system features that allow for gassy production, production with solids, viscous production, and for other harsh environments
- Use the available techniques to monitor the performance of an ESP and troubleshoot the problematic ones
- Determine the concerns that should be considered during installing, starting-up or pulling an ESP
- Get the basic knowledge of some of the new ESP technologies like PMM motors and some unconventional installations like cable-deployed ESPs.

Contents:

Module 1: Refreshment on Production System and Its Components

- Reservoir Considerations
- Production System Components
- Inflow Performance
- Outflow Performance
- Prediction of Flowing Well Performance
- Introduction to Artificial Lift
- Overview and Comparison of Artificial Lift Methods
- Artificial Lift analysis and selection

Module 2: Overview of Electric Submersible Pump (ESP)

- ESP as an AL Method
- Conditions suitable for ESP



- General Description of ESP Surface and Downhole Equipment
- Basic Electric Concepts related to ESP

Module 3: Detailed Description of ESP Components (Surface & Downhole)

The ESP Centrifugal Pump

- The Theory of Centrifugal Pump
- Different Terminologies of the Pump: Materials, Series, Configurations
- (Mixed/Radial, Floater/Compression, Upper/Lower Tandem...etc)
- Pump Operating Range: Up-Thrust and Down-Thrust Problems

Gas Handling Equipment & its Limitations

- Gas Separator (Rotary & Vortex)
- Advanced Gas Handler
- Poseidon / MVP

Protector Section with its Different Configuration

- Bag Design
- Labyrinth Design
- Shaft Selection
- Thrust Bearing and Different Configurations

Induction Motor Overview and Theory

- Motor Construction
- Motor Performance Characteristics
- Motor Different Configuration

Downhole Sensor



Power Cable with Its Different Types and Applications

- Cable Construction
- Cable Classification
- Cable Selection

ESP Surface Equipment including Transformer, VSD and Junction Box

- FSD Different Electric Modules / applications
- VSD Different Electric Modules
- VSD Effect on the Performance of an ESP
- Step-up Transformer
- Wellhead Penetrator
- Choke Console & related Surface Connections

ESP Design

- Steps for Designing a Conventional ESP
- Example of Hand Calculations to Calculate the Total Dynamic Head (TDH)
- Software Applications for ESP Design
- Design Considerations for Sever Conditions like Gassy Wells, Abrasive Materials and Viscous Fluids
- Design Considerations for Future Conditions: Reservoir Depletion or Increasing Water Cut Values

Module 4: Applied Field Techniques to Monitor & Troubleshoot an ESP Performance

- Real Time Data using DH Sensors and Watching Tools
- VSD Set Points for Surface and DH Alarms and Trips
- Alarms related to Power Supply or any Other Surface Parameters
- Alarms related to Downhole Parameters
- Analysis of Surface and DH ESP Data
- Practical Field Examples of Troubleshooting a Problematic ESP using Sensor Data



- Field Practices to Re-start an ESP (Reverse Rotation while Running, Thermal Stall, Rocking...etc.)
- Analysis of DH sensor Calibration Parameters and Current Leakage using Diagnostic Tables
- Troubleshooting using Amps Charts
- Harmonic Measurements and Analysis

Module 5: Installation and Pulling Procedures

- Field Example for Installation Report
- Consideration during Running an ESP: Cable Meggering, Checking DH Data, Motor and Protector Servicing...etc.
- Cable Splicing Procedures
- Packer and WH Penetrator Installation
- Start-up Procedures
- Field Example for Pulling Report
- Dismantle Inspection and Failure Analysis (DIFA) for an ESP

Module 6: Special ESP Applications and New Technologies

- Y-Tool Application & Sizing
- Permanent Magnet Motors (PMM)
- Cable-Deployed ESP
- Thru-Tubing ESP (Access ESP)

Module 7: Data Keeping

Module 8: Maintenance and Monitoring

Training Methodology:

The following is a simple list of the techniques that will be used during the course/workshop

- PowerPoint Presentations (as short as possible)



- Flip chart and white board Writings
- Videos
- Group quizzes
- Individual and group exercises
- Case studies
- Key learning point reviews
- Practice, Practice and Practice