

# Electric Submersible Pumps (ESPs)

## INTRODUCTION

- This highly participative training course is designed to provide the participants with the skills to understand the principals of Electric Submersible Pumps (ESPs), how they are Selected, Installed, Operated and Maintained in both Onshore and Offshore Oil Production Installations.
- This Electric Submersible Pumps (ESPs) training course is interactive and encourages delegates to participate through questions and answers, along with opportunities to discuss with the presenter specific issues which may result in appropriate solutions. Participants will learn:
- Mainstream ESP System Configurations
- Alternative ESP System Configurations
- Installing ESPs in Difficult and Harsh Environments
- How ESPs and their associated Drives are Selected
- Installing, Operating and Monitoring ESP Systems
- Maintaining and Troubleshooting ESP Systems

## PROGRAMME OBJECTIVES

The Electric Submersible Pumps (ESPs) training course aims to enable participants to achieve the following objectives:

- Learn about the different types of ESP Systems and where they are used
- Understand the components and equipment used in ESP Systems
- Learn about ESP Pump Technology
- Learn about ESP Selection and Performance Calculations
- Understand the Advantages and Limitations of various ESP Drive Systems
- Understand the Power Supply Requirements of ESP Installations
- Learn about installing, maintaining and troubleshooting ESP systems

## PRE-REQUISITE

- The Electric Submersible Pumps (ESPs) training course has strong electrical engineering content. Therefore, personnel attending this training course should preferably have a basic understanding of electric principals.

## WHO SHOULD ATTEND?

This training course is designed to provide a practical and detailed insight for personnel who are directly involved in the design, selection, installation, operation and maintenance of Electric Submersible Pumps. The training course will greatly benefit:

- Project, Design and Maintenance Professionals
- Petroleum, Chemical and Mechanical Engineers
- Electrical Engineers
- Field Operators and Technicians
- Maintenance Engineers and Personnel

## TRAINING METHODOLOGY

- The training course will combine presentations with interactive practical exercises, supported by video materials, activities and case studies. Delegates will be encouraged to participate actively in relating their particular protection requirements at their workplace.
- There will be adequate time given for group discussion during and at the end of each session, including detailed case studies and anecdotes on based on the subject matter and the facilitator's own experience in the field.

## PROGRAMME SUMMARY

- This Electric Submersible Pumps (ESPs) training course covers a comprehensive range of topics relating to Electric Submersible Pumps (ESPs), which are used in 60% of global oil production. Several disciplines are covered in this programme – Petroleum, Mechanical, Chemical, Electrical, Control and Instrumentation, and as such it considers ESP installations as systems.
- The selection of equipment, how it is installed, operated and maintained are all covered, with a particular emphasis on electrical, control and instrumentation as that is where a significant part of successful ESP operation resides.

## PROGRAM OUTLINE

### Fundamentals of Electric Submersible Pumps

- Introduction to ESPs and ESP Systems
- A Brief History of ESPs
- Design Requirements for Typical Mainstream ESPs
- ESP Pump Designs
- ESP Motor Designs
- Cabling Requirements
- Motor Control
- Miscellaneous Accessories
- Alternative ESP Configurations

## Application of ESPs in Difficult or Harsh Environments

- On-Shore and Off-Shore
- Multiphase Fluids
- Abrasive Contaminants
- High Temperature and Corrosive Substances
- Viscous Fluids, Emulsions, Scaling/Asphaltenes
- Off-Shore
- Modular Requirements
- Platform Cable Connections
- FPSO Disconnectable Turret Swivel and Mooring System
- Subsea Cabling and Electrical Connections
- Subsea Located Equipment

## ESP System Selection, Performance Calculations and Equipment Sizing

- Establishing Basic Requirements
- Determining Well Production Capacity
- Determining Fluid Composition and Volume, Including Volume of Free Gas
- Calculation of Total Dynamic Head
- Determination of Optimum Pump and Motor Type and Size
- Determination of Downhole Cable Configuration and Sizing
- Identifying Optimum Drive Systems, Power Supplies and Accessories
- Variable Speed Drive Requirements
- Design Examples

## ESP Monitoring, Control and Protection, Installation

- Downhole Monitoring and Sensors
- Embedded Fibre Optic Cable for Downhole Monitoring and Sensors
- Earthed (Grounded) and Unearthed (Ungrounded) ESP motors
- Earthing and Lightning Propagation in ESP Circuits
- Electrical Protection Equipment for ESPs
- SCADA/EMS (ESP Management System) for Local and Remote Installations
- Safety and Shut-Down Systems

## Commissioning, Operation and Maintenance

- Commissioning Requirements and Procedures
- Pre-Production Optimisation
- Regular Operation and Monitoring
- Maintenance Management, Monitoring and Detecting Abnormal Conditions
- Troubleshooting Guidelines
- Case Studies and Examples of ESP Problems and Failures
- Servicing Equipment
- Well Workover Rigs
- Cable Reels, Reel Supports, and Cable Guides