BOOST
THE LEADING TRAINING PROVIDER

Electrical Engineering

Electrical Submersible Pump: Design, Installation, Commissioning and Maintenance

Course Introduction

Electric Submersible Pumps (ESPs) are used in most of global oil production operations. This training course is a complete package of topics that cover all aspects in relation to ESP; fundamental knowledge, equipment selection, installation, commissioning, operation monitoring, control and maintenance from the Electrical point of view. In addition, this training course will familiarize the user with the ESP system and its application by; detailed description of components and design features analysis. Recent innovations in ESP technology will also be presented and discussed so that the delegates are updated with current developments in ESP industry.

Target Audience

- Electrical Engineer
- Electrical Project Engineer
- Electronics-research engineer
- Instrumentation and Electrical (I&E) Reliability Engineer

Learning Objectives

- Overview the (ESP) systems main basic components of Electric Submersible Pumps.
- Optimize well productivity using ESP systems
- Identify the function of each component of the ESP system, and to select optional components and add-ons
- Optimize system power efficiency
- Monitor system performance using the different types of sensors available
- Description of every component comprising the electrical submersible system
- Installation considerations and important best practices to apply
- Learn about the different types of ESP systems and its specific applications

- Understand the components and equipment used with ESP
- Be aware of the innovations in ESP pump technology
- Selection of proper ESPs for specific purposes
- Carry out ESP performance calculations
- List the advantages and limitations of various ESP drive systems
- Outline the power supply requirements of ESP installations
- Maintain and troubleshoot ESP systems

Course Outline

- **DAY 01**

  Electrical power system configuration & components

  - Power system parameters and engineering criteria
  - Introduction to ESP technology and artificial lifting
  - Types of Oil lifting (Oil Production Methods)
  - Natural lifting.
  - Artificial lifting
  - Artificial lifting Types
  - Reciprocating displacement rod lift systems
  - Progressing Cavity Pumping systems (PCP)
  - Hydraulic lift systems
  - Gas lift systems
  - Electric Submersible Pumping Systems (ESP)
  - Practical ESP component
  - Submersible Electric motor.
  - Motor seal section (protector).
  - Intake or gas separator.
  - Centrifugal pump.
  - Power cable.
  - Electric power supply (power transformer).
  - Junction box.
  - Circuit breaker for operation and protection.
  - Variable Speed Drive (VSD).
  - Down-hole monitoring (sensor).
- **Day 02**

Introduction to AC Machine operation

- Ac Motor Types
- Idea of Operation AC Motor
- AC motor construction & component
- Stator
- Rotor
- Bearing
- Mechanical basics
- Developing a rotating magnetic field
- Ac motor Problem of starting
- Ac motor normal operation control
- ESP Motor Parameter (Technical specs)
- Motors speed torque characteristics
- Methods of electric motor speed control
- Electric motors breaking methods
- ESP Motors speed / Torque characteristics
- Starting torque
- Pull-up torque
- Breakdown torque
- Full load torque
- Starting values of current
- Motor NEMA design
- Practical Motors Troubleshooting
- ESP Motor enclosures
- Practical Permanent Magnet Motors (PMG)
- AC Induction Motors vs. Permanent Magnet Synchronous Motors

• **Day 03**

Practical Motor starting methods

- Direct-on-line (DOL)
- Star-delta starters
- Primary resistance starters
- Electronic soft starters
- ESP Motor sizing and selection
- Electrical supply considerations
- Load Curve
- Motor efficiency
- Pump low efficiency.
- Pump gas locking.

- Locked pumps.
- Tubing leaks.
- Fluid recirculation.
- Loss of flow due to a closed valve.
- Motor overloading.
- ESP Motor Spin
- Overload
- Vibration
- Misalignment
- Friction
- Stray oil
- ESP Power Cable.
- Characteristics of copper IEC 60228
- Introduction of IEC 60502
- Cables conductors’ types
- Cables insulation
- Cable components.
- Motor connection.
- Selection The insulation of the cables.
- Voltage drops in the (ESP) cable.
- Cables splices.
- Steps of fault location finding of the cables.
- Cables megger testing and burners.
- Insulation test methods
- Cables grounding during the test

• **Day 04**

Power Transformers design and operation

- Transformer operation and construction
- Power Transformers construction Testing & Inspection
- ESP Transformers accessory Testing & Inspection
- Electrical transformer protection Testing & Inspection
- Mechanical and Electrical Testing & Inspection
- Practical Determine Power Required by Pump
- Practical Determine Total Power Required by Pump
- Practical Power Required by Protector
- Practical Determine Total System Power Required
- Practical Determine Motor Current Required
- Practical power cable losses
- Practical Pump performance curve for single stage at 60hz

- Practical Motor composite curve
- Practical Generic protector loading curve
- Practical Chart to determine 3 phase voltage drop in a power cable at 77°F
- ESP various type of controllers
- ESP Digital and analogue signals
- Microcontrollers technology
- HMI
- Communications systems in ESP
- Microprocessor RAM and ROM
- Data transmission (wire and wireless) technologies
- Alarms / Events / Notifications

• **Day 05**

Introduction to power electronics

- Types of electronics switches and converters
- Difference between various types of VFDs
- Practical VFD components
- Rectifier
- DC link
- Inverter
- Practical VFD types
- VFD effect of Motor Operation
- Disassembly of an AC Drive
- Component Identification
- Various Designs of Drives
- Hands-On Programming and Operation of an AC Drive and Motor
- Adjust Minimum and Maximum Speed
- Reset Drive to Factory Defaults
- Adjusting Torque Output
- General Drive Programming
- Variable Frequency drives parameter programming and applications
- Methods of Speed and Torque Control
- VFD Rectifier Parts
- Diode
- Practical Rectifier Configuration
- Practical VFD Rectifier pulses
- 6 pulse
- 12 pulse
- 18 pulse
- 24 pulse

- VFD DC Link Parts
- Coil and capacitor configuration
- Effect of DC link
- Operations of DC link energy and inverters, regeneration or dynamic slowdown, dynamic breaking, plugging
- Sizing of capacitor effect
- Configuration of DC link
- VFD Inverter Parts
- Thyristor (SCR), IGBT, MOSFET, GTO operation concept
- Thyristor (SCR), IGBT, MOSFET, GTO configuration
- Thyristor (SCR), IGBT, MOSFET, GTO types
- Practical Inverter configuration
- Pulse Width Modulation PWM concept
- Control of frequency
- Control of voltage
- V/F ratio control
- General discussion

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
April 14, 2025	April 18, 2025	5 days	4250.00 $	UAE - Dubai
July 21, 2025	July 25, 2025	5 days	4250.00 $	UAE - Abu Dhabi
Dec. 21, 2025	None	None days	4250.00 $	Qatar - El Doha
Nov. 9, 2025	Nov. 13, 2025	5 days	4250.00 $	oman - salalah