



# Practical Artificial Lift Systems (ALS)



## Introduction:

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Artificial lift plays a crucial role in oil & gas production, especially in mature oilfield. Artificial lift is not only accelerating the production, but also vital to the economic success of the overall development. Therefore, selecting and designing the appropriate artificial lift is important. After completing the course, the participants will possess and enhance the skills necessary to select, design, plan, analyze and optimize the artificial lift system for offshore oilfield. This comprehensive course covers the artificial-lift methods and technologies that fall into two groups, those that use pumps and those that use gas. It provides information and concentrates on the proper selection, operation and maintenance of subsurface pumps so the best economical life can be obtained. It will enhance your knowledge, skills, and attitudes necessary to understand the artificial-lift methods and technologies. It provides the attendees with a thorough understanding of the theory behind all forms of artificial lift, the advantages and limitations of each system, application considerations, and sample performance predictions for each lift method.

This practical course is intended for personnel working indirectly with Artificial Lift Systems who require a fundamental overview of Electrical Submersible Pumping systems (ESP), Progressive Cavity Pumps (PCP), Gas Lift, Beam Pumping Units, Plunger Lift Systems, Jet Pumping Systems and Horizontal pumping Systems. This course will include overviews for Y-tool

systems and cable penetrator systems as well. The course is equally ideal for engineers-in-training or technical professionals from different specialist disciplines who wish to gain additional insights into Artificial Lift Methods. The course provides a detailed overview of components of an ESP, cable, down hole monitoring, surface voltage switchboards, and variable frequency controllers, PCP, Gas Lift, Beam Pumps, and Plunger Pumps. Reservoir factors that influence the design process of Artificial Lift Methods will be reviewed, as well as the fundamentals of selection and operation, common practices, troubleshooting aids, and strategies for optimizing Artificial Lift Methods.

The course will start with Multi-Phase Flow and NODAL Analysis and how to compare and select the correct artificial lift system. A thorough understanding on the principles, applications, design and operational issues on the artificial lift system will be provided. The candidates will also learn how to analyze the cost when selecting the artificial lift system. Furthermore, the course will cover the advanced artificial lift systems currently available. They will gain knowledge on the advantages and disadvantages of each type of the advanced artificial lift system.

## **Who Should Attend?**

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Production Engineers, Field Operations Engineers, Production Technologists, Production Coordinators, Production Supervisors, Assist Production Engineers, Junior and Senior Petroleum Engineers, Senior Operators, Field Technicians; Geoscientists, Reservoir Engineers who wish to understand the implications of production systems on their field reservoirs.

## **Workshop/Field-Trip**

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This workshop/field-trip will enable the candidates to be aware of the installation, operation, maintenance and troubleshooting of ALS systems. The candidates will be in contact with representatives and specialists of different artificial lift companies to ask for operating parameters, advantages and disadvantages. They will gain hands-on practice and acquire practical experience.

## **Course Objectives:**

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**By the end of this course delegates will be able to:**

- Be aware of artificial lift technology
- Compare systems to determine which one is most economically feasible
- Specify components and auxiliary equipment needed for each system Select the appropriate ALS
- Use principles and content mentioned below to focus on maximizing oil production with artificial lift systems
- Understand and apply multiphase tubing and pipe flow principles
- Know what best practices are available to extend the life of equipment and installed lift systems
- Apply basic design and analysis concepts & understand Nodal Analysis
- Learn how to select and design an ALS, plan its operation, monitor, analyze and optimize its performance
- Design system features that allow for gassy production, production with solids, viscous production, and for other harsh environments
- Understand the fundamentals and the production performance of the various artificial lift methods for offshore application
- Be able to manage and control the production of artificial lift wells and fields
- Be able to study and compare the cost between artificial lift systems
- Learn fluid properties and reservoir performance & understand the relationship between natural flow & ALS
- Recognize the relative advantages and limitations of the different artificial lift methods
- Understand the sucker-rod string design options and select the right design process for their fields
- Determine the pumping parameters of an existing installation
- Understand the grave importance of optimizing the complete pumping system; and find the most energy efficient conditions
- Describe the operation of a well placed on continuous flow gas lift with the use of NODAL analysis techniques
- Optimize the operation of a single continuous flow gas lift installation
- Properly allocate the available lift gas among several wells
- Understand the operation of ESP components under different well conditions
- Design an ESP installation for normal and gassy well service
- Understand the advantages of using VSD units
- Analyze and troubleshoot ESP installations

## Course Outline:

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### Multi-Phase Flow, NODAL Analysis & Artificial Lift Selection & Analysis

- Introduction, Black Oil PVT
- Inflow Performance Relationship
- Multiphase Flow
  - Pressure loss equation in pipe, Slip holdup phenomenon
  - Multi-phase flow correlations and applicability
  - Multi-phase flow correlation matching
- NODAL Analysis
  - Artificial Lift comparisons, Overview of Artificial Lift, Comparison of Artificial Lift Systems
  - Artificial Lift Analysis Using Measured Data, Artificial Lift Selection
- Artificial Lift Selection: Selection Criteria & Lift Type Suitability
  - Critical parameters affecting artificial lift type, Artificial lift type and limits
- Artificial Lift Analysis Using Measured Data
  - Traditional methods, Use of discharge pressure
  - Process where discharge pressure is not available

### Gas Lift Design & Optimization

- Overview of Gas Lift
- Understanding fluid mechanics, fluid properties and gas lift principles
- Principles of Gas Lift
- Installation Types, Total Systems, Optimum Design
- Valve Mechanics

- Fluid Operated Valves vs. Casing Pressure Operation
- Gas Lift Operations
- Gas Lift Installation Types
- Continuous Flow, Intermittent Lift
- Gas Lift Troubleshooting

### **Beam (Rod) Pump Systems**

- Surface and Subsurface Equipment
- Pumping unit, rods, pump, prime movers, gas anchor, pump-off controls
- Power Requirements
- Dynamometers and Troubleshooting
- Pump Off Controls, Optimization

### **Progressive Cavity Pumps System**

- Applications, Surface and Subsurface Equipment
- Geometry of Downhole Pump
- Fit (Interference), Viscosity, Slip
- Elastomers, Power Requirement

### **Electric Submersible Pumping (ESP) Design & Optimization**

- ESP Systems, ESP Components, Multisensors, Applications
- Pump Performance Curves, Pump Intake Curves
- ESP Design And Selection, ESP Installation & Operation
- Operational Issues
- ESP Diagnostics and Real Time Well Operations & Optimization
- ESP Diagnostics & Troubleshooting
- Real Time Well Operations & Optimization

### **Artificial Lift Offshore & Advanced Artificial Lift Systems**

- Artificial Lift Offshore

## Best Technology Solutions **(BTS)**

## Training Program

- Advanced Artificial Lift Systems
- Gas Lift System & Plunger Lift System