

## E&I Technology for Oil & Gas Facilities

5 days  
Overview

E&I/E&I1GB

### LEVEL

Foundation

### PURPOSE

This course provides the knowledge of the hardware and construction standards of electrical equipment used in the Oil & Gas industry (generation and distribution of electrical energy) and instrumentation materials used in control and safety instrumented systems.

### LEARNING OBJECTIVES

Upon completion of the training, participants will be able to:  
identify electrical and instrumentation equipment used in Oil & Gas,  
develop expertise to optimize the operation and deem the performance of electrical equipment and networks,  
acquire the technological knowledge necessary to understand and analyze the control and safety processes,  
be familiarized with instrumentation equipment, digital control systems and programmable logic controllers.

### WAYS AND MEANS

Interactive animation by specialists from the Oil & Gas and the energy fields.  
Numerous applications and illustrations.

### LEARNING ASSESSMENT

Written test upon training course completion.

### PREREQUISITES

No prerequisites for this course.

## Agenda

### ELECTROTECHNIC PREREQUISITES

0.25 d

Generalities:

Origin of electricity, electrical energy production, alternate and direct currents, the electrical circuits.

Main magnitudes and formulas on electricity and magnetism:

Voltage, intensity, frequency, energy, power, Ohm's, Joule's and Laplace's laws.

Standards, symbols, diagrams:

SI units, symbols and drawings.

Different types of electrical drawings, how to interpret/read a basic electrical drawing.

### ELECTRICAL GENERATION

0.25 d

Alternator: constitution, operation, control of the voltage and frequency produced, protections.

Coupling of sources and throughput on structured networks.

Equipment monitoring and maintenance.

### ELECTRICAL NETWORKS

0.5 d

Electrical networks:

Constitution and constituents of an HV and LV network, architectures and equipment.  
Distribution philosophy: power distribution, network stability, selectivity, source redundancy and power supply.

Constituents:

HV & LV boards and cabinets.

Transformers: types, main parameters, protections, auxiliaries.

Breakers, control elements and isolation.

UPS: inverters/battery chargers.

Batteries: battery types, charging modes.

Protections: types of electrical protection, specialized relays.

## ASYNCHRONOUS MOTORS

0.5 d

Constitution and operation of three-phases AC electric motors:

Constitution and technology of AC, induction three-phases motors (asynchronous motors).

Windings coupling, adjustment to site conditions.

Routine monitoring.

Troubleshooting.

Electric motor-related equipment:

Starting systems.

Variable speed systems: principle, functioning, constitution.

Maintenance.

## PROTECTION AGAINST THE ELECTRICAL RISKS

0.25 d

Electrical risks (as per the UTE C 18-510):

Hazards in the electrical installations.

Effects and consequences of the electrical risks.

Protection against the electrical risks: concept and protection classes.

## HAZARDOUS AREAS & ATEX STANDARDS

0.25 d

ATEX specifications and standards:

Current standards: concept and philosophy.

Protection and identification of the material set in hazardous area.

Impact for the organization (certification, accreditation, operating and maintenance guidance).

## INSTRUMENTATION

0.5 d

Functional study, functional blocks, symbolization.

Pneumatic, electrical and digital technologies.

Power and pneumatic power supply, signal transmission and conversion.

## MEASURING ELEMENT - SENSORS

0.5 d

Operating parameters measurement (temperatures, pressures, flowrates, levels). Measurement uncertainties.

Physical principles, technologies, units of measurement, local reading/transmission.

End position sensors, position sensor.

Security equipment: temperature security devices, pressure, flow, level...

## ACTUATORS - CONTROL VALVES

0.5 d

Control valves: technology, types of valves, characteristic curves, safety position.

Positioners: principle of operation, types (pneumatic, electro pneumatic...).

Special technologies: single or double seat valves, cage valve, "Camflex", three-way valve...

Contactors: position sensors, solenoid valves for safety...

ON/OFF valves: different types, single or double actuator. Special ON/OFF valves: SDV, ESDV, BDV.

## CONTROLLER - CONTROL STRUCTURE

0.5 d

Purpose, principle of operation, direct or inverse action, operating procedures.

Behavior of a P&ID regulator: operating point, gain, interactions, proportional, integral and derivative characteristics of a controller.

Control (fixed setpoint), servo control (variable setpoint).

Control loops: simple, cascade and split-range.

## DISTRIBUTED CONTROL SYSTEM

0.5 d

Processing philosophy, workstation, terminology-glossary.

Architecture:

Functional organization, hardware architecture.

Safety/redundancy.

Connection (sensors, actuators, networks, PLCs, others).

## SAFETY INSTRUMENTED SYSTEMS (SIS)

0.5 d

Safety loops, safety functions.

High Integrity Protection Systems (HIPS), Emergency ShutDown (ESD), Emergency DePressurization (EDP).

Fire & Gas System.