



FE073: Advanced Cathodic Protection Techniques (Specification, Design, Commissioning, Testing & Monitoring)

Training Description:

Cathodic protection is a mature technique for controlling corrosion of steel structures immersed in waters, buried in soils and imbedded in concrete.

This intensive 5-day advanced training course thoroughly and systematically covers the fundamental principles of cathodic protection and its practical applications such as marine and offshore structures in seawater environment, storage tanks and pipelines buried in soils, and reinforcing steels embedded in concrete structures. The training course will provide detailed information on cathodic protection specification, design, commissioning, testing and monitoring. Applicable standards such as NACE, BS/ISO, AS and DnV relevant to cathodic protection design will be discussed. State-of-the-art anode materials for cathodic protection will be presented.

Participants will gain advanced knowledge and skills in cathodic protection of common types of steel structures immersed in waters, buried in soils and imbedded in concrete. Included in the training course notes are the 10-Step Guides to the design of galvanic anode cathodic protection system and impressed current cathodic protection system. Hands-on practical sections provide opportunities for participants to operate the devices and instruments used in cathodic protection. Engineers, architects and designers will grasp the theories and practices of cathodic protection which would lead to corrosion-proof designs and low-cost durability.

Training Objectives:

Participants will learn the principles and applications of advanced sensors and monitoring systems for cathodic protection monitoring, condition survey, diagnosis and troubleshooting. Facility owners will benefit from the enhanced safety and reduced maintenance costs.

Training Designed for:

This course is intended for Corrosion Control Engineers & Personnel, Process Engineers, Metallurgists, Inspection Personnel, Mechanical Engineers, Material Selection Personnel, Plant Contractors, Operations Engineers, Team Leaders & Supervisors, Maintenance Supervisors, Senior Plant Supervisors, Mechanical Engineers, Corrosion Control & Monitoring Systems Personnel, Oil and Gas Production Facilities Personnel, Chemists, Chemical Engineers, Technicians and Supervisors, New Petroleum Engineers, Asset Management Personnel, Design & Construction Engineers, Team Leaders & Coordinators, Construction Coordinators, Maintenance Engineers, Technologists, Maintenance Team Leaders & Engineers, Personnel who are / will be responsible for detecting, inspecting, monitoring, controlling corrosion in oil and gas piping, pipelines used in production operations and Personnel responsible for metallurgy, corrosion or the prevention of failures in plant and equipment.

Training Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course if required and as per the client's request."

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

❖ PRIMER ON CHEMISTRY, METALLURGY, ELECTRICITY AND MATHEMATICS

- Basic Concepts in Chemistry Relevant to Corrosion and Cathodic Protection
- Basic Concepts in Metallurgy Relevant to Corrosion and Cathodic Protection
- Basic Concepts in Electricity Relevant to Corrosion and Cathodic Protection
- Basic Math Requirement in Cathodic Protection Design Calculations
- Exercises and Quiz

❖ FUNDAMENTALS OF CORROSION

- Why do metals corrode
- How do metals corrode
- General methods of corrosion control and prevention
- Exercises and Quiz

❖ CORROSION AND CATHODIC PROTECTION

- History of Cathodic Protection
- How it works
- Why it works
- How effective it is
- Exercises and Quiz

DAY TWO:

❖ PRACTICAL PARAMETERS IN CATHODIC PROTECTION

- Structure potentials
- CP Protection Criteria: which one to use?
- Is 100 mV polarization enough? -Optimization of cathodic protection design
- Current density requirements
- Coatings and Cathodic Protection
- Exercises and Quiz

❖ RESISTIVITY AND ELECTRODE RESISTANCE

- Electrical resistivity
- Resistance of ground connections
- Non-uniform electrolytes
- Groundbed design
- Long pipeline and pipe insulating joints
- Exercises and Quiz

❖ SACRIFICIAL ANODE CATHODIC PROTECTION

- Methods of Applying Cathodic Protection
- Galvanic Anode Systems
- Applications of Galvanic Anode Systems
- Advantages of Galvanic Anode Systems
- Limitations of Galvanic Anode Systems
- Component Parts of Galvanic Systems
- Anode Selection Guide
- Specifications of Galvanic Anode Systems

- Anode Installation
- Exercises and Quiz

❖ IMPRESSED CURRENT CATHODIC PROTECTION

- Impressed Current Systems
- Impressed Current Anodes
- Power Source
- Applications of Impressed Current Cathodic Protection
- Advantages of Impressed Current Systems
- Limitations of Impressed Current Systems
- Component Parts of Impressed Current Systems
- ICCP Anode Selection Guide
- Anode Configuration and Installation
- Exercises and Quiz

DAY THREE:

❖ CATHODIC PROTECTION STANDARDS, SPECIFICATION AND DESIGN

- Applicable International Standards on Cathodic Protection
- Cathodic Protection Specification
- Cathodic Protection Design Fundamentals
- Determining Current Requirements
- Calculating Cathodic Protection Circuit Resistance
- Calculating System Capacity and Life
- Cathodic Protection Design Procedure
 - The 10-Step Guide to the Design of Galvanic Anode Cathodic Protection System
 - The 10-Step Guide to the Design of Impressed Current Cathodic Protection System
- Design of Cathodic Protection Monitoring Facilities
 - Current Distribution
 - Attenuation
- Computer software for cathodic protection design, modeling and corrosion prediction: CP-Compass
- Exercises and Quiz

❖ CATHODIC PROTECTION OF UNDERGROUND PIPELINES AND STORAGE TANKS

- Understanding ISO 15589-1 Petroleum and natural gas industries - Cathodic protection of pipeline transportation systems - On-land pipelines
- Understanding NACE SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- Cathodic Protection of Underground Pipelines
- Cathodic Protection of Storage Tanks
- Design Examples and Exercises
- Exercises and Quiz

❖ CATHODIC PROTECTION OF MARINE AND OFFSHORE STRUCTURES

- The nature of sea water and its impact on corrosion of steel structures
- Understanding DNV-RP-F103 Cathodic Protection of Submarine Pipelines by Galvanic Anodes

- Understanding ISO 15589-2 Petroleum and natural gas industries - Cathodic protection of pipeline transportation systems - Offshore pipelines
- Understanding BS EN 12474 Cathodic protection of submarine pipelines
- Understanding NORSOK M-503 Cathodic protection
- Understanding NACE SP0176 Corrosion Control of Submerged Areas of Permanently Installed Steel Offshore Structures Associated with Petroleum Production
- Slope Parameter Method in Cathodic Protection Design
- Exercises and Quiz

DAY FOUR:

❖ CATHODIC PROTECTION OF CONCRETE STRUCTURES

- The nature of concrete structure
- Understanding AS 2832-5 Cathodic protection of metals - Part 5: Steel in concrete structures
- Understanding BS EN 12696: Cathodic Protection of Steel in Concrete
- Understanding NACE SP 0290: Cathodic Protection of Reinforcing Steel in Atmospherically Exposed Concrete Structure
- Understanding NACE SP 0187: Design Considerations for Corrosion Control of Reinforcing Steel in Concrete
- Innovative Cathodic Protection systems for various concrete structures
- Sacrificial anode cathodic protection systems
- Anodes selection for impressed current Cathodic Protection systems
- Effectiveness of Cathodic Protection in concrete structures
- Optimization of Cathodic Protection systems for concrete structures
- Design Exercises and Quiz

❖ STRAY CURRENT AND CATHODIC PROTECTION INTERFERENCE, AND METHODS OF PREVENTION

- Stray current corrosion and electrolysis
- Practical stray current problems and solutions
- Interference from other Cathodic Protection installations
- AC Testing and Mitigation
- Exercises and Quiz

❖ CATHODIC PROTECTION COMMISSIONING, INSPECTION AND MONITORING

- Equipment tests
- System tests
- Inspection and monitoring
- Frequency of routine inspection
- Monitoring plan
- Monitoring equipment
- Specialized surveys
- Maintenance and repair
- Exercises and Quiz

DAY FIVE:

❖ CATHODIC PROTECTION AND COATINGS

- Economic considerations
- Specification

- Inspection
- Type of coatings
- Coating failures and analysis
- Exercises and Quiz
- ❖ **PIPELINE INSPECTION: SURVEY METHODS AND EVALUATION TECHNIQUES**
 - Survey methods for pipeline not under cathodic protection
 - Survey methods for pipeline under cathodic protection
 - NACE Standard on "Pipeline External Corrosion Direct Assessment Methodology"
- ❖ **MODELING AND PREDICTION OF EXTERNAL CORROSION OF UNDERGROUND PIPELINES**
 - Modeling and Prediction of Pipeline Internal Corrosion
 - Exercises and Quiz
- ❖ Course Conclusion
- ❖ POST-ASSESSMENT and EVALUATION

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

As per the course location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:30	Recess (Prayer Break & Lunch)
13:30 - 15:00	Last Session

For training registrations or in-house enquiries, please contact:

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