

Course No. 1288

Cathodic Protection Systems Training Course

CORROSION, INSPECTION & NDT
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Cathodic Protection Systems Training Course provides a comprehensive and practical understanding of cathodic protection principles, system design, installation, operation, monitoring, inspection, and maintenance for industrial assets exposed to corrosion. The course focuses on how electrochemical protection methods can be applied to reduce corrosion of metallic structures and extend asset service life while supporting integrity, reliability, safety, and maintenance objectives.

Cathodic protection is an important corrosion control technology for buried, submerged, and other metallic assets operating in aggressive environments. It is commonly applied to pipelines, storage tanks, marine structures, offshore facilities, water systems, underground structures, and selected process equipment. Effective protection requires more than installing an anode or rectifier; it requires understanding electrochemical behavior, environmental conditions, coating performance, current distribution, electrical continuity, interference, monitoring requirements, and system performance.

The course covers the two principal cathodic protection approaches: galvanic sacrificial anode systems and impressed current cathodic protection systems. Participants will examine electrochemical fundamentals, electrode potentials, anode selection, rectifiers, reference electrodes, test stations, cables, isolation devices, coatings, current requirements, grounding and interference considerations, and protection criteria. Particular attention is given to practical system assessment, measurement interpretation, troubleshooting, and maintenance.

A strong emphasis is placed on integrating cathodic protection with broader corrosion management and asset integrity programs. Participants will learn how to evaluate system performance, interpret potential and current measurements, identify under-protected and over-protected areas, investigate abnormal readings, assess coating and anode performance, and develop monitoring and maintenance programs. The course supports more effective corrosion prevention decisions and helps organizations improve the reliability and long-term integrity of critical metallic assets.

Objectives

- Analyze the electrochemical principles underlying cathodic protection and explain their relevance to corrosion control during the course.
- Identify the main components, configurations, and applications of galvanic and impressed

current cathodic protection systems.

- Evaluate soil, water, electrolyte, coating, temperature, and environmental conditions that influence cathodic protection performance.
- Apply appropriate criteria for selecting sacrificial anodes, impressed current anodes, reference electrodes, rectifiers, cables, and associated system components.
- Assess current requirements, potential distribution, electrical continuity, isolation, and other factors affecting system effectiveness.
- Evaluate cathodic protection measurements and interpret structure-to-electrolyte potential and current data.
- Identify conditions associated with under-protection, over-protection, coating deterioration, anode depletion, electrical faults, and interference.
- Develop inspection, testing, monitoring, and maintenance strategies for cathodic protection systems.
- Apply systematic troubleshooting methods to investigate abnormal cathodic protection readings and system performance.
- Assess the interaction between protective coatings and cathodic protection and identify opportunities to improve overall corrosion control.
- Strengthen coordination between corrosion, inspection, engineering, maintenance, operations, and asset integrity teams responsible for protected assets.
- Develop a practical cathodic protection management and monitoring plan for a selected industrial asset by the end of the course.

Who Should Attend

The Cathodic Protection Systems Training Course is designed for professionals responsible for corrosion control, asset integrity, inspection, engineering, maintenance, reliability, and the operation of metallic infrastructure. It is particularly suitable for corrosion engineers, materials engineers, cathodic protection specialists, inspection engineers, asset integrity engineers, pipeline engineers, mechanical engineers, electrical engineers, maintenance engineers, reliability engineers, and technical specialists involved in corrosion prevention and monitoring.

The course is also relevant to inspection managers, corrosion managers, asset integrity managers, engineering managers, maintenance managers, pipeline managers, reliability managers, and supervisors responsible for underground and submerged assets. Professionals working with pipelines, storage tanks, marine structures, offshore facilities, water infrastructure, buried metallic

structures, process facilities, and other assets requiring corrosion protection will benefit from the program.

The course is also valuable for project engineers, technical authorities, asset owners, procurement professionals, and decision makers involved in specifying, designing, installing, commissioning, operating, inspecting, or maintaining cathodic protection systems. It supports multidisciplinary teams seeking to establish consistent approaches to corrosion control, system performance evaluation, inspection planning, and long-term asset integrity management.

Learning Outcomes

- Explain the electrochemical principles and corrosion mechanisms relevant to cathodic protection.
- Distinguish between galvanic sacrificial anode systems and impressed current cathodic protection systems and identify appropriate applications for each.
- Identify the major components of a cathodic protection system and explain their individual functions.
- Evaluate environmental and asset-related factors affecting cathodic protection performance.
- Select appropriate anode materials and system configurations for representative industrial applications.
- Interpret structure-to-electrolyte potential measurements and other cathodic protection monitoring data.
- Assess electrical continuity, isolation, current distribution, reference electrode performance, and rectifier operation.
- Identify indicators of insufficient protection, excessive protection, coating deterioration, anode depletion, and system malfunction.
- Develop inspection and monitoring plans for pipelines, tanks, marine structures, and other protected metallic assets.
- Apply structured troubleshooting methods to investigate abnormal readings and cathodic protection system failures.
- Evaluate the relationship between protective coatings and cathodic protection performance.
- Prepare a practical cathodic protection management plan incorporating monitoring, inspection, maintenance, troubleshooting, and performance evaluation.

Course Outline

DAY 01

Fundamentals of Corrosion and Cathodic Protection

- Introduction to corrosion and electrochemical corrosion mechanisms.
- Electrochemical cells, anodic and cathodic reactions, and electron flow.
- Electrode potentials and the electrochemical behavior of metals.
- Principles and objectives of cathodic protection.
- Relationship between cathodic protection and corrosion control.
- Galvanic sacrificial anode cathodic protection systems.
- Impressed current cathodic protection systems.
- Applications for pipelines, storage tanks, marine structures, offshore assets, and buried metallic infrastructure.
- Influence of soil, water, electrolyte properties, temperature, and environmental conditions.
- Relationship between protective coatings and cathodic protection.

PRACTICAL APPLICATION

Assess a representative metallic asset and determine whether cathodic protection is an appropriate corrosion control method.

DAY 02

Cathodic Protection System Components and Design Considerations

- Sacrificial anode materials and selection criteria.
- Impressed current anodes and common system configurations.
- Rectifiers, power supplies, and control equipment.
- Reference electrodes and monitoring devices.
- Test stations, cables, junction boxes, and electrical connections.
- Electrical continuity and isolation requirements.
- Coating systems and their influence on cathodic protection current demand.
- Current requirement estimation and distribution considerations.

DAY 02 — CONTINUED

- Anode placement and current distribution.
- Protection of complex structures and areas with different exposure conditions.
- Stray current and electrical interference considerations.

PRACTICAL APPLICATION

Develop a conceptual cathodic protection configuration for a selected pipeline, tank, or submerged metallic structure.

DAY 03

Cathodic Protection Monitoring, Testing, and Performance Evaluation

- Principles of cathodic protection monitoring and performance verification.
- Structure-to-electrolyte potential measurements.
- Reference electrode selection, positioning, and condition.
- Measurement equipment and field testing practices.
- Interpretation of potential readings and protection trends.
- Current output measurement and system performance assessment.
- Rectifier inspection and operational checks.
- Sacrificial anode performance and depletion assessment.
- Evaluation of coating condition and current demand.
- Identification of under-protection and over-protection conditions.
- Monitoring locations, test intervals, data recording, and trend analysis.

PRACTICAL APPLICATION

Analyze cathodic protection field measurements and determine whether a representative asset is adequately protected.

DAY 04

Troubleshooting, Inspection, and Maintenance

- Common cathodic protection system failures and performance problems.
- Troubleshooting abnormal structure-to-electrolyte potentials.
- Investigation of low or excessive current output.
- Rectifier faults and power supply problems.
- Anode deterioration, depletion, and connection problems.
- Reference electrode and measurement errors.
- Electrical continuity and isolation faults.
- Coating breakdown and increased current demand.
- Stray current and interference investigation.
- Inspection and maintenance of test stations, cables, anodes, rectifiers, and monitoring equipment.
- Corrective actions and system optimization.

PRACTICAL APPLICATION

Diagnose a cathodic protection system showing abnormal measurements and develop a structured troubleshooting and corrective action plan.

DAY 05

Cathodic Protection Management and Asset Integrity

- Developing an integrated cathodic protection management program.
- Establishing inspection, testing, monitoring, and maintenance requirements.
- Defining system performance indicators and monitoring trends.
- Integrating cathodic protection with corrosion management and asset integrity programs.
- Linking cathodic protection data with inspection and maintenance planning.
- Managing changes in operating conditions, coatings, structures, and system configuration.
- Documentation of system design, commissioning, inspection, testing, and maintenance activities.
- Developing cathodic protection records, measurement databases, and technical reports.
- Establishing preventive maintenance and corrective action processes.

DAY 05 — CONTINUED

- Assessing system effectiveness and identifying opportunities for optimization.
- Roles and responsibilities of corrosion, engineering, inspection, maintenance, and operations teams.

FINAL WORKSHOP

Develop a comprehensive cathodic protection management plan for a selected industrial asset, including asset characterization, corrosion exposure, system selection, component requirements, monitoring locations, measurement methods, inspection frequency, performance criteria, troubleshooting procedures, maintenance activities, reporting requirements, and continuous improvement actions.

Register or Request More Information

Course page: <https://quest-training.com/courses/cathodic-protection-systems-training-course>

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