

COURSE OVERVIEW FE0270

Cathodic Protection Systems: Design, Installation, Testing & Repair

Course Title

Cathodic Protection Systems: Design, Installation, Testing & Repair

Course Date/Venue

Session 1: September 01-05, 2024/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: December 15-19, 2024/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE



Course Reference

FE0270

Course Duration/Credits

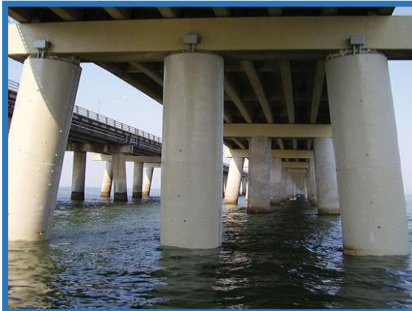
Five days/3.0 CEUs/30 PDHs



Course Description



This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.



This course is designed to provide participants with a solid grounding in cathodic protection engineering. It provides theoretical knowledge and fundamentals for testing on both sacrificial and impressed current systems. It covers the cathodic protection systems for a wide range of industrial structures including buried and subsea pipelines, storage tanks, petrochemical plants and concrete structures.



The course is based on NACE International Standard Practices and NACE Official Cathodic Protection Technical Publications.

The course involves lectures and case studies describing equipment and instruments used in Cathodic Protection testing and In-Line current monitoring using new technology Cathodic Protection Current Measurement tool (CP CM).

Course Objectives

Upon the successful completion of this course, each participant will be able to: -

- Apply systematic techniques on the design, installation, testing and repair of modern cathodic protection systems
- Recognize the nature of corrosion, forms of corrosion and the various effects of soil condition and system operation
- Carryout cathodic protection and measurement and recognize their importance in the effectiveness of cathodic protection system
- Identify the associated aspects of corrosion control such as the materials selection, coatings and sacrificial cathodic protection including its design, types, selection and fabrication
- Discuss offshore cathodic protection design, operational integrity impact in offshore structures, CP anodes retrofitting forecast and replacement programs
- Discuss impressed current cathodic protection including their design, use and application
- Illustrate cathodic protection system design for tanks and explain the secondary containment, double bottom tanks and its monitoring issues
- Apply the impressed current cathodic protection design used in plants and explain stray current interaction with other structures
- Identify the corrosion and corrosion control present in reinforced concrete and employ the proper monitoring procedures of cathodic protection systems
- Employ the specialized survey techniques used in the evaluation of data for cathodic protection and demonstrate cathodic monitoring programmes
- Illustrate the technique of in-line cathodic protection current measurement (CPCM) to evaluate CP efficiency and possible interference currents as well as cathodic protection rectifiers

Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides an overview of all significant aspects and considerations of cathodic protection for those who are responsible for cathodic protection systems, measuring the effectiveness of cathodic protection systems and/or recording this data, including pipeline design engineers, pipeline operations engineers, corrosion engineers, materials engineers, design engineers, mechanical engineers, inspection engineers, chemical engineers, marine maintenance people, offshore structure design and operation people, CP field personnel, supervisors and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -


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The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units (CEUs)** in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

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British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Fee

US\$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. George Poulos, MBA, MSc, BSc, CEng, is a **Senior Corrosion & Metallurgical Engineer** with over **45 years** of extensive experience within the **Corrosion Control, Corrosion Inhibition, Cathodic Protection Systems, Oil & Gas, Petrochemical, Refinery, Construction, Aircraft & Shipbuilding** Industry. His wide experiences cover in the areas of **Metallurgical Failure Analysis & Prevention, Corrosion Fabrication & Inspection, Fabrication & Repair, Corrosion Prevention, Corrosion Engineering, Corrosion**

Management in Process Operations, Corrosion & Prevention of Failures, Material Selection, Steel Metallurgy, Steel Structure Welding, Steelmaking Slag, Steel Making Application, Steel Making Process, Steel Manufacturing, Steel Forging, Steel Manufacturing & Process Troubleshooting, Hot Rolling Process, Hot Strip Mill, Mill Operations, Roll Mill, Electric Arc Furnace (EAF), Slit Rolling, Carbon Steel Pipe Wall Thickness & Grade Selection, Ferro-Alloys, Heat Treatment & Prevention Techniques and Post Weld Heat Treatment. Further, he is also well-versed in **Welding Inspection, Welding & Machine Techniques, TIG & Arc Welding, Shielded Metal Arc Welding, Gas Tungsten & Gas Metal Arc Welding, Welding Procedure Specifications & Qualifications, Aluminium Welding, Hot Work-Safety, SMAW, GTAW, Welding Techniques, Pipeline Welding Practices, Welding Engineering, Welding Fatigue & Fracture Mechanics, Welding Inspection Technology, Welding Safety, Welding Defects Analysis, Welding Technology, Welding Problems, Welding & Non Destructive Testing and Metallurgy Techniques.**

During his career life, Mr. Poulos has gained his practical and field experience through his various significant positions and dedication as the **Chief Executive, Head of Technical Studies, Manager, Senior Consultant, Lead Welding Engineer, Senior Welding Engineer, Design Engineer, Sales Engineer, Author, Welding Instructor, Visiting Lecturer and Technical Proposal Research Evaluator** from various international companies such as Greek Welding Institute, Hellenic Quality Forum and International Construction Companies such as Shipbuilding, Aircraft Industry and Oil and Gas Industry.

Mr. Poulos is a **Registered Chartered Engineer** and has a **Master's degree in Naval Architecture**, a **Bachelor's degree in Welding Engineering** and a **Master of Business Administration (MBA)** from the **Sunderland University, Aston University and Open University, UK**, respectively. Further, he is a **Certified Trainer/Instructor**, an active Member of **Chartered Quality Institute (CQI)**, **The British Welding Institute Society (TWI)**, **The Royal Institution of Naval Architects (RINA)** and **American Welding Society (AWS)**, a **Registered EWF/IW (European Welding Federation-International Welding Institute W/E)** and an **IRCA Accredited External Quality Systems Auditor** through **BVQI**. He is an **Author** of **Technical Book** dealing with **Protection/Health/Safety** in the **Welding/Cutting** domain and delivered various trainings, seminars, conferences, workshops and courses globally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 – 0930	<i>Electrochemical Basis of Corrosion & Cathodic Protection</i> <i>Electrochemistry • Electrochemical & Galvanic Series • Thermodynamics • Kinetics • Immunity & Passivity</i>
0930 – 0945	<i>Break</i>
0945 – 1130	<i>Introduction to Corrosion Forms</i> <i>Nature of Corrosion • Forms of Corrosion • Effects of Soil Conditions • Effects of System Operation • Microbiological Corrosion • Electrolytic Corrosion</i>
1130 – 1230	<i>Cathodic Protection Fundamentals</i> <i>Mechanism of Cathodic Protection • Energy Diagrams • Equivalent Circuits • Types of Cathodic Protection Systems • Synergy with Coatings</i>
1230 – 1245	<i>Break</i>
1245 – 1300	<i>Cathodic Protection Measurements</i> <i>Reference Electrodes • Voltmeters • Field measurements</i>
1300 – 1420	<i>Cathodic Protection Design Fundamentals</i> <i>Design Objectives • Required Information • Environment • Field Surveys • Current Requirement • Current Densities • Coatings • Sacrificial Anodes Design • Impressed Current Design</i>
1420 – 1430	<i>Recap</i> <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch & End of Day One</i>

Day 2

0730 – 0830	<i>Associated Aspects of Corrosion Control</i> <i>Materials Selection • Metals • Non-Metals • Metal Alloys • Stainless Steels • Standards • Environment • Design Do's Don'ts • Cathodic Protection • Protective Coatings</i>
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0830 – 0930	Corrosion Control Using Coatings Organic Coatings • Active (Galvanic) Coatings • Inhibitive Coatings • Application of Coatings • Failure Mechanism of Coatings • Test Methodologies
0930 – 0945	Break
0945 – 1230	Sacrificial CP Design – Offshore Structures & Pipelines Platform Anodes • Design • Types of Anodes • Fabrication of Anodes • Effect of Temperature • Anodes Resistance • Connections • Crossings • Landfalls • Anodes Retrofittings • Anodes Sleds
1230 – 1245	Break
1245 – 1315	Offshore Sacrificial Cathodic Protection Systems - Statistics Offshore CP Operational Integrity • CP Anodes Retrofitting Forecast & Replacement Plan • Case History Arabian Gulf
1315 – 1420	Cathodic Protection Design – Land Pipelines Sacrificial Anodes • Types of Anodes • Impressed Currents Anodes • Type of Anodes • Ground Bed Designs • Design Steps • Example Calculations • Road Crossings • Casings
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3

0730 – 0845	Cathodic Protection Design – Production & Injection Well Casing Well Completion & Construction • CP Current & CP Design • Ground Bed Designs • CP Deep Well • Transformer Rectifiers • Alternative Power Supplies • CP Monitoring
0845 – 0930	Impressed Current Cathodic Protection Design – Onshore Pipelines Corrosion Cells • Design • Preliminary Steps & Site Survey • Current Densities • Basic Calculations • Road Crossings • Isolation Joints
0930 – 0945	Break
0945 – 1100	Impressed Current Cathodic Protection Design - Plants Effects of Geometry • Earthing, Concrete Foundations • Drains & Slab-on-Grade • Anode Layouts • Remote • Close • Combination • Monitoring Using Coupons • Voltage Gradient • Pulse Techniques
1100 – 1230	Best Practices in Pipelines Cathodic Protection Design, Monitoring, Assessment & Maintenance Best Practices during CP Design • CP Monitoring • CP Assessments • CP Maintenance • New Initiatives • Lessons Learnt
1230 – 1245	Break
1245 – 1420	Corrosion Management on Pipelines with Cathodic Protection Pipeline Risks & Corrosion • Galvanic Sacrificial Anodes • Impressed Current System • Case Study SA • Case Study ICCP
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three



Day 4

0730 – 0820	Cathodic Protection System Design for Tanks New Systems • Retrofit Systems • Grid Systems • Secondary Containment • Double Bottom Tanks • Monitoring Issues
0820 – 0930	Cathodic Protection System Design for Tanks – Case History Background • Investigation Methodology • Diagnostic & Troubleshooting • Findings • Proposed Strategies
0930 – 0945	Break
0930 – 1015	Cathodic Protection Systems Interactions Areas of Interferences • CP Interference • HVAC Interference • DC Interference • AC interference • Mitigation Methods
1015 – 1230	Stray Current Interaction with Other Structures Anodic Areas • Service Corridors • Pipeline Interactions • Stray Currents • Current Drainages • Electrical Fields • Traction Systems
1230 – 1245	Break
1245 – 1320	Reinforced Concrete – Corrosion & Corrosion Control Rebar Corrosion • Types of Concrete Damage • Breakdown of Passive Film • Detection of Corrosion • Rust & Chloride Migration • Pourbaix • Current Densities • Cathodic Protection • Type of Anodes
1320 – 1420	Underwater CP Inspection Methods Why CP Inspection • Stds & Regulations • Offshore Structures Life • CP Measurements • CP Surveys • ROV • Trailing Wire • Calibrations • Reporting • Data Analysis
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

Day 5

0730 – 0830	Monitoring of Cathodic Protection Systems Test Point Monitoring • On/Off Potential • Soil Gradient • CP Coupons • Current Surveys • Close Interval Surveys • Offshore CP Monitoring • ROV
0830 – 0915	Specialised CP Survey Techniques CIPS • Pearson • DCVG • AC Attenuation • Combined Surveys • Evaluation of Data • CPCM Case History
0915 – 0930	Break
0930 – 1015	Cathodic Protection Construction Sacrificial Anodes • Deep Wells • Cables & Connections • Circuit Resistance & Soil Resistivity • Backfills • Example Calculations • CP Materials • HSE
1015 – 1230	CP Troubleshooting Techniques Measurements • Galvanic Anodes Troubleshooting • Potential Instant Off • Impressed Current Systems Troubleshooting
1230 – 1245	Break
1245 – 1315	Cathodic Protection Rectifiers Basic Electrical Circuit • Output Regulation • Control Modes • Surge Protection • Fault finding

1315 - 1345	Summary / Open Forum
1345 - 1400	Course Conclusion <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course</i>
1400 - 1415	POST-TEST
1415 - 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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