COURSE OVERVIEW FE0270-4D
Modern Cathodic Protection Systems
Design, Installation, Testing & Repair

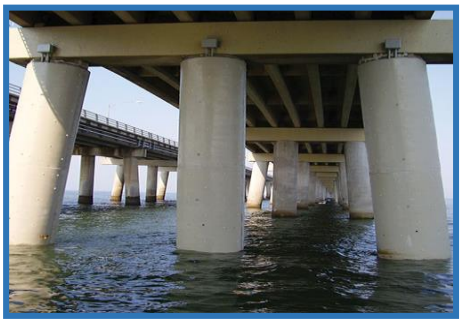
Course Title
Modern Cathodic Protection Systems: *Design, Installation, Testing & Repair*

Course Date/Venue
August 12-15, 2024/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
FE0270-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Description



This practical and highly-interactive course includes practical sessions and exercises where participants carryout cathodic design, fabrication, installation, testing and repair. Theory learnt in the class will be applied using the "RE-5C Electrode" suitable for in-class training.

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: -

- 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 **2.4 CEUs** (Continuing Education Units) or **24 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.

- 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.

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. Salah Younes is a **Senior Pipeline & Corrosion Engineer** with over **30 years** of extensive **onshore** & **offshore** experience within the **Oil**, **Gas**, **Refinery** and **Petrochemical** industries. His wide expertise covers in the areas of **Inspection and Corrosion Foundations**, **Pipeline Inspection**, **Corrosion & Repair**, **LP/HP Gas**, **Condensate & Fuel Production**, **Corrosion Control**, **Corrosion Mechanism & Chemical Reactions**, **Corrosion Prevention & Control Techniques**, **Corrosion** Management & Monitoring, **Corrosion Inhibitors**, **Corrosion Analysis & Remedial Actions**, **Corrosion Inspection**, Facility Integrity Assessments & Rehabilitation, **Production Corrosion Control**, **Cathodic Protection Testing**, **Painting Inspection**, **Pipeline Integrity** Management, **Pipeline Pigging & Assessment**, **Pipeline Design**, Facility Integrity & Assessment, **Risk Based Inspection**, **Process Piping**, **Storage Tanks**, **Tank Farm Piping Network**, **Pigging**, ANSI/ASME B31, **Pressure Vessels** Design & Fabrication, Offshore Structure & Facilities, Onshore Facilities & Storage Tanks, **Pressure Vessels**, **Inhibitors**, **Protective Coatings**, **Water Treatment & Injection**, **Water Flooding**, **Chemical Treatment & Injection**, Oil & Gas Process and **Steel Structure Painting**. Further, his expertise includes soil resistivity, platform structures, atmospheric tanks, safety relieves valves, heat exchangers, fire heaters, fireproofing materials, lifting equipment, tubing, casing and gas lifting systems, fabrication yards, coatings & non-metallic materials, external & internal coatings, linear polarization and hot tapping. Currently, he is the **Engineering General Manager** wherein he prepares and follow-up periodical inspection plans for all plant equipment internally and externally during downtime and/or maintenance programs at oil processing plant, gas plant, water flooding plant and production platforms.

Earlier in Mr. Salah's career, he acquired his practical and technical expertise and held key positions as the **Engineering Manager**, **Corrosion Department Manager**, **Facilities Integrity Manager**, **Corrosion Specialist**, **Offshore Engineer**, **Pipeline Integrity Consultant**, **Corrosion & Chemical Treatment Head**, **Coating Engineer**, **Corrosion Engineer**, **Chemical Engineer**, **Lecturer/Trainer** and **Senior Consultant** from international companies like the **ADMA-OPCO**, Qatar Petroleum (**QP**), **RASGAS**, **MAERSK Oil** Qatar, **GUPCO** and **Bureau Veritas**.

Mr. Salah has a **Bachelor** degree in **Chemical Engineering**, a **Post Graduate Diploma** in **Chemical Engineering** and a **Diploma** in **Corrosion & Water Treatment**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), a **Certified BGAS-CSWIP Painting Inspector** and a **Certified ASNT-NDT Level II** in Magnetic Particles Testing (**MT**), Penetrant Testing (**PT**) and Radiographic Testing (**RT**). Moreover, he has published various technical papers related to Corrosion Management and Cathodic Protection that have been presented at several international courses and conferences and has delivered numerous trainings, courses, seminars, conferences and workshops globally.

Dr. Faysal has a **PhD**, **Master's** and **Bachelor's** degree in **Engineering** from the **University of British Columbia** (**Canada**). He is a **Certified Instructor/Trainer**, a member of the **Chamber of Civil Engineers**, **Structural Stability Research Council**, **American Institute of Steel Construction** and **American Society of Civil Engineers** (**ASCE**), **USA**. He also published numerous books, researches and scientific papers and received several awards and recognitions for Journal of Materials Engineering and Performance and has further delivered numerous trainings, courses, seminars, workshops and conferences internationally.

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.

Training program is based in NACE published books, NACE Standard Practices for Cathodic Protection of Underground and Submerged Structures, Pipelines, Tanks and Vessels, and NACE Cathodic Protection technical compilations.

Course Fee

US$ 4,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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: ***Monday, 12th of August 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Electrochemical Basis of Corrosion & Cathodic Protection*** *Electrochemistry • Electrochemical & Galvanic Series • Thermodynamics • Kinetics • Immunity & Passivity*
0900 – 0930	***Introduction to Corrosion Forms*** *Nature of Corrosion • Forms of Corrosion • Effects of Soil Conditions • Effects of System Operation • Microbiological Corrosion • Electrolytic Corrosion*
0930 – 0945	*Break*
0945 – 1130	***Cathodic Protection Fundamentals*** *Mechanism of Cathodic Protection • Energy Diagrams • Equivalent Circuits • Types of Cathodic Protection Systems • Synergy with Coatings*
1130 – 1215	***Cathodic Protection Measurements*** *Reference Electrodes • Voltmeters • Field measurements*
1215 – 1230	*Break*
1230 – 1300	***Cathodic Protection Design Fundamentals*** *Design Objectives • Required Information • Environment • Field Surveys • Current Requirement • Current Densities • Coatings • Sacrificial Anodes Design • Impressed Current Design*
1300 – 1420	***Associated Aspects of Corrosion Control*** *Materials Selection • Metals • Non Metals • Metal Alloys • Stainless Steels • Standards • Environment • Design Do's Don'ts • Cathodic Protection • Protective Coatings*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2: Tuesday, 13th of August 2024

0730 – 0830	***Corrosion Control Using Coatings*** *Organic Coatings • Active (Galvanic) Coatings • Inhibitive Coatings • Application of Coatings • Failure Mechanism of Coatings • Test Methodologies*
0830 – 0930	***Sacrificial CP Design – Offshore Structures & Pipelines*** *Platform Anodes • Design • Types of Anodes • Fabrication of Anodes • Effect of Temperature • Anodes Resistance • Connections • Crossings• Landfalls • Anodes Retrofitting • Anodes Sleds*
0930 – 0945	*Break*
0945 – 1100	***Offshore Sacrificial Cathodic Protection Systems - Statistics*** *Offshore CP Operational Integrity • CP Anodes Retrofitting Forecast & Replacement Plan • Case History Arabian Gulf*
1100 – 1215	***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*
1215 – 1230	*Break*
1230 – 1315	***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*
1315 – 1345	***Impressed Current Cathodic Protection Design – Onshore Pipelines*** *Corrosion Cells • Design • Preliminary Steps & Site Survey • Current Densities• Basic Calculations • Road Crossings • Isolation Joints*
1345 – 1420	***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*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3: Wednesday, 14th of August 2024

0730 – 0800	***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*
0800 – 0830	***Corrosion Management on Pipelines with Cathodic Protection*** *Pipeline Risks & Corrosion • Galvanic Sacrificial Anodes • Impressed Current System • Case Study SA • Case Study ICCP*
0830 – 0930	***Cathodic Protection System Design for Tanks*** *New Systems • Retrofit Systems • Grid Systems • Secondary Containment • Double Bottom Tanks • Monitoring Issues*
0930 – 0945	*Break*
0945 – 1100	***Cathodic Protection System Design for Tanks – Case History*** *Background • Investigation Methodology • Diagnostic & Troubleshooting • Findings • Proposed Strategies*
1100 – 1215	***Cathodic Protection Systems Interactions*** *Areas of Interferences • CP Interference • HVAC Interference • DC Interference • AC interference • Mitigation Methods*
1215 – 1230	*Break*

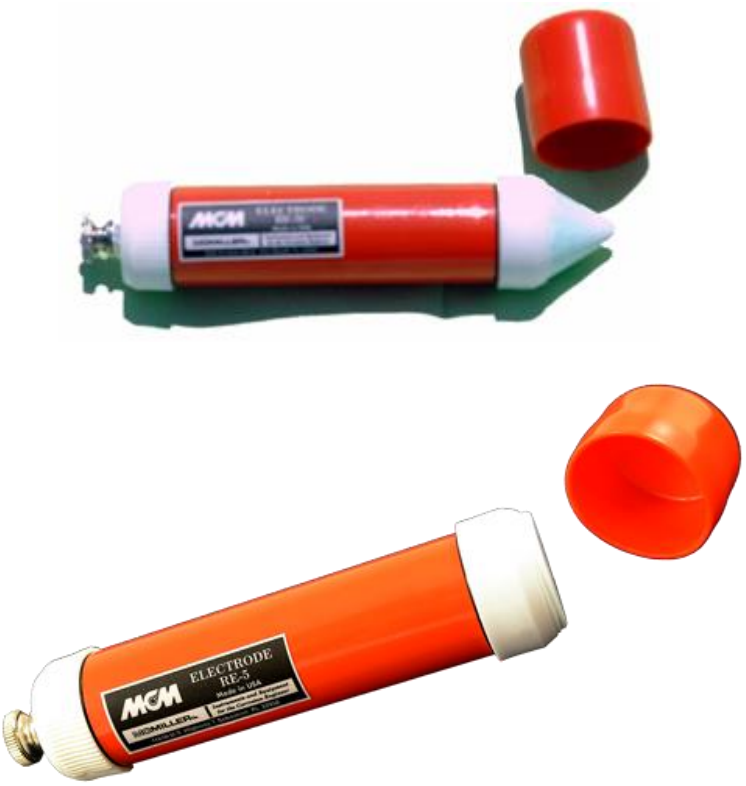
1230 – 1300	***Stray Current Interaction with Other Structures*** *Anodic Areas • Service Corridors • Pipeline Interactions • Stray Currents • Current Drainages • Electrical Fields • Traction Systems*
1300 – 1400	***Reinforced Concrete – Corrosion & Corrosion Control*** *Rebar Corrosion • Types of Concrete Damage • Breakdown of Passive Film • Detection of Corrosion • Rust & Chloride Migration • Pourbaix • Current Densities • Cathodic Protection • Type of Anodes*
1400 – 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***
1430	*Lunch & End of Day Three*

Day 4: ***Thursday, 15th of August 2024***

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 – 1215	***CP Troubleshooting Techniques*** *Measurements • Galvanic Anodes Troubleshooting • Potential Instant Off • Impressed Current Systems Troubleshooting*
1215 – 1230	*Break*
1230 – 1315	***Cathodic Protection Rectifiers*** *Basic Electrical Circuit • Output Regulation • Control Modes • Surge Protection • Fault finding*
1315 – 1345	***Summary / Open Forum***
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Equipment (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "RE-5C Electrode".



RE-5C Electrode

Course Coordinator

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