COURSE OVERVIEW EE0850

Maintenance and Inspection of Electrical and Instrumentation Equipments

Course Title

Maintenance and Inspection of Electrical and Instrumentation Equipments

Course Date/Venue

Session 1: April 13-17, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: September 15-19, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference

EE0850

Course Duration

Five days

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.

Maximum efficiency, reliability, and longevity of instrumentations and electrical equipment such as the various types of motors, variable-speed drives, transformers, generators, rectifiers, inverters, uninterruptible power systems, circuit breakers, fuses, power station electrical and protective systems, flowmeters, pressure gauges, thermometers, control valves and DP transmitters are of great concern to many industries. These objectives can only be achieved by understanding the characteristics, selection criteria, common problems and repair techniques, preventive and predictive maintenance. This course is a MUST for anyone who is involved in the selection, applications, or maintenance of instrumentations and electrical equipment. The course covers how these equipments operate and provide guidelines and rules that must be followed for a successful operation. Their basic design, operating characteristics, specification, selection criteria, fault detection techniques, critical components as well as some maintenance issues are covered in general.

Course Objectives

This course is designed to provide an overview of the various types of motors, variable-speed drives, transformers, generators, rectifiers and inverters, uninterruptable power systems (UPS), circuit breakers, fuses, flowmeters, pressure gauges, thermometers, control valves and DP transmitters. Upon the successful completion of this course, participants will have general idea about these equipment and their applications. During the duration of this course, participants will have general overview of the following:-

- Fundamentals of Electric Systems
- Introduction to Machinery Principles
- Transformers
- Transformer Components and Maintenance
- AC Machine Fundamentals
- Induction Motors
- Speed Control of Induction Motors
- Maintenance of Motors
- Power Electronics, Recifiers and Pulse-Width Modulation Inverters
- Variable Speed Drives
- Synchronous Machines
- Synchronous Generators
- Generator Components, Auxiliaries and Excitation
- Generator main Connections
- Performance and Operation of Generators
- Generator Surveillance and Testing
- Generator Inspection and Maintenance
- Generator Operational Problems, and Refurbishment Options
- Circuit breakers
- Fuses
- Power Station Electrical Systems and Design Requirements
- Power Station Protective Systems
- Pressure Measurement
- Level Measurement
- Temperature measurement
- Flow Measurement
- Control Valves
- Process Considerations
- Integration of the System

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 conveniently saved in a **Tablet PC**.*

Who Should Attend

Engineers of any discipline, managers, technicians, technologists and other technical personnel, who are interested in Electrical Equipments and Instrumentations

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: -

- 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.

- 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.

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. Ken Steel is a **Senior Electrical & Instrumentation Engineer** with over **45 years** of extensive experience. His expertise widely covers **Earthing & Lightning Protection Design, Underground Equipment**, **Electrical Safety**, **Electrical Motors Testing**, **Heat Tracing** & Insulation Installation & Testing, **HV Terminations**, **High & Low Voltages** on Overhead Cranes, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear, HV Cable** Design, **Medium & High Voltage** Equipment, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power** System, **HV Equipment** Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, Resin / **Heat Shrink & Cold Shrink** Joints, **HV/LV Equipment**, **LV & HV** Electrical System, **Cable** Splicing & Termination, **High Voltage** Electrical Safety, **LV**, **MV & HV Cable** Installations & Properties, **LV Substation**, **MV & LV Cable**, **UPS Systems**, **MV & LV** Direct on Line Motor Drives, **MV & LV** VSD Motor Drives, **MV & LV** Soft Starter Motor Drives, **LV Two Speed Motor Drives**, Underground **Transformer Oil Containment Tank**, **Electrical & Instrumentation Construction** Installation, 1500KW, 1000KW, 1752KW **Diesel Power Plant Installation**, **110KV Overhead Line**, **110KV Outdoor Switchgear**, 110KV/10KV 6500KVA **Transformer**, **Transformer Substation**, 1600KVA 10KV/0.4KV & 2 Off 1000KVA **Diesel Generators**, 1600KVA 10KV/0.4KV & 1650KVA **Diesel Generator**, **110KV/35KV/10KV Substation**, 110KV/10KV **Transformers**,110KV & 2 Off 6KV **Overhead Lines**, 34.5KV,13.8KV ,4.16KV & 480V **Switchgear**, 4.16KV & 480V MCC, **Transformers & Motor Drives** Substations, **Diesel Driven Generators**, **Overhead Cranes**, **Overhead Cranes & HVAC Units**, **AC & DC Drives**, **Data Logger**, **Electrical, Instrumentation & Mechanical** Installation Maintenance, Slab Mills, Pre Heat Ovens, Hydraulic Shears, Stamping Machine, Gearboxes, Rollers, Pumps, Valves, Electro Magnets & Pump House Operation, Boilers Construction And Commissioning, Valve Calibration & Testing, Level Gauges, Pressure & Flow Transmitters Installation & Calibration, Pressure & Leak Testing of Boilers, Leak Testing, SMP, Elect, I&C, F&G, HVAC & Utility Services, Nitrogen Leak Test Operations, Steam Blowing Activities, SMP, Elect, I&C, F&G, HVAC & Utility Services, PTW Issue (PA/AC), Installation & Mechanical Piping and Hydro Testing & Leak Testing of Lines Installation.

During Mr. Steel's career life, he has gained his practical experience through several significant positions and dedication as the **3GP PBF & Boilers SC Commission Support**, **SC Site Execution Superintendent**, **E&I Construction Superintendent**, **High Voltage Construction Supervisor**, **Control & Power Construction Supervisor**, **Electrical & Instrumentation Supervisor**, **Electrical Technician**, **Construction Support Electrical Engineer**, **E&I Engineer**, **Electrical/Instrumentation Site Supervisor**, **Q.A/Q.C Inspector**, **Electrical/ Instrumentation Technician**, **Maintenance Fitter Instrumentation Technician**, **Millwright**, **Apprentice Millwright** and **Senior Instructor/Lecturer** for Tengiz Chevron Oil Kazakhstan, Al Jubail Saudi Arabia, Escravos Delta state Nigeria, Lurgi S.A, SuD Chemie Sasol Catalysts, J C Groenewalds Construction (LTA), Tycon (Goodyear S.A.), Dragline Construction and Iscor Vanderbijlpark.

Mr. Steel has a **Diploma** in **Electronics Mechanic**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars 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.

Course Fee

US$ 5,500 per Delegate + **VAT**. The 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 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	*Registration & Coffee*
0800 - 0815	*Welcome & Introduction*
0815 - 0915	***Fundamentals of Electric Systems*** *Capacitors, Current and Resistance, The Magnetic Field, Faraday's Law of Induction, Lenz's Law, Inductance, Alternating Currents, Three-Phase System*
0915 - 1015	***Introduction to Machinery Principles*** *Electric Machines and Transformers, Common Terms and Principles, The Magnetic Field, Magnetic Behavior of Ferromagnetic Materials, Faraday's Law – Induced Voltage From a Magnetic Field Changing with Time, Core Loss Values, Permanent Magnets, Production of Induced Force on a Wire, Induced Voltage on a Conductor Moving in a Magnetic Field*
1015 - 1030	*Break*
1030 - 1130	***Transformers*** *Importance of Transformers, Types and Construction of Transformers, The Ideal Transformer, Impedance Transformation Through a Transformer, Analysis of Circuits Containing Ideal Transformers, Theory of Operation of Real Single-Phase Transformers, The Voltage Ratio Across a Transformer, The Magnetizing Current in a Real Transformer, The Dot Convention, The Equivalent Circuit of a Transformer, The Transformer Voltage Regulation and Efficiency, The Autotransformer, Three-Phase Transformers, Transformer Ratings*

1130 - 1230	***Transformer Components and Maintenance*** *Introduction, Classification of Transformers, Main Components of a Power Transformer, Types and Features of Insulation, Forces, Cause of Transformer Failures, Transformer Oil, Gas Relay and Collection Systems, Relief Devices, Interconnection with the Grid*
1230 - 1245	***Break***
1245 - 1400	***AC Machine Fundamentals*** *The Rotating Magnetic Field, The Induced Voltage in AC Machines, The Induced Torque in a Three-Phase Machine, Winding Insulation in AC Machines, AC Machine Power Flow and Losses*
1400 -1420	***Induction Motors*** *Induction Motor Construction, Basic Induction Motor Concepts, The Equivalent Circuit of an Induction Motor, Losses and The Power-Flow Diagram, Induction Motor Torque-Speed Characteristics, Control of Motor Characteristics By Squirrel-Cage Rotor Design, Starting Induction Motors*
1420 - 1430	***Recap***
1430	*End of Day One*

Day 2:

0730 - 0830	***Speed Control of Induction Motors*** *Speed Control by Changing the Line Frequency, Speed Control by Changing the Line Voltage, Speed Control by Changing the Rotor Resistance, Solid-State Induction Motor Drives, Motor Protection, The Induction Generator, Induction Motor Ratings*
0830 - 0930	***Maintenance of Motors*** *Characteristics of Motors, Enclosures and Cooling Methods, Application Data, Design Characteristics, Insulation of AC Motors, Failures in Three-Phase Stator Windings, Predictive Maintenance, Motor Troubleshooting, Diagnostic Testing for Motors, Repair and Refurbishment of AC Induction Motors, Failures in Three-Phase Stator Windings*
0930 - 0945	*Break*
0945 - 1100	***Power Electronics, Rectifiers and Pulse-Width Modulation Inverters*** *Introduction to Power Electronics, Power Electronics Components, Power and Speed Comparison of Power Electronic Components, Basic Rectifier Circuits, Filtering Rectifier Output, Pulse Circuits, A Relaxation Oscillator Using a PNPN Diode, Pulse Synchronization, Voltage Variation By AC Phase Control, The Effect of Inductive Loads on Phase Angle Control, Inverters*
1100 - 1230	***Variable Speed Drives*** *Basic Principles of AC Variable Speed Drivers (VSD'S), Inverters, Input Power Converter (rectifier), DC link Energy, Output IGBT Inverter, Input Sources for Regeneration or Dynamic, Regeneration, PWM-2 Considerations, Transients, Harmonics Power Factor and Failures, Thyristor Failures and Testing, AC Drive Application Issues, AC Power Factor, IGBT Switching Transients, Cabling Details For AC Drives, Cable, Motor Bearing Currents, Summary of Application Rules For AC Drives, Selection Criteria of VSD's, Maintenance, Common Failure Modes, Motor Application Guidelines*
1230 - 1245	***Break***
1245 -1420	***Synchronous Machines*** *Physical Description, Pole Pitch: Electrical Degrees, Airgap and Magnetic Circuit of a Synchronous Machine, Synchronous Machine Windings, Field Excitation, No-Load and Short-Circuit Values, Torque Tests, Excitation of a Synchronous Machine, Machine Losses*
1420 - 1430	***Recap***
1430	*End of Day Two*

Day 3:

0730 – 0830	***Synchronous Generators*** *Synchronous Generator Construction, The Speed of Rotation of a Synchronous Generator, The Internal Generated Voltage of a Synchronous Generator, The Equivalent Circuit of a Synchronous Generator, The Phasor Diagram of a Synchronous Generator, Power and Torque in Synchronous Generators, The Synchronous Generator Operating alone, Parallel Operation of AC Generators, Operation of Generators in Parallel With Large Power Systems, Synchronous Generator Ratings, Synchronous Generator Capability Curves, Short-Time Operation and Service Factor*
0830 - 0930	***Generator Components, Auxiliaries and Excitation*** *Introduction, The Rotor, Turbine-Generator Components, Cooling Systems, Shaft Seals and Seal Oil Systems, Stator Winding Water Cooling Systems, Other Cooling Systems, Excitation, The Voltage Regulator, The Power System Stabilizer, Characteristics of Generator Exciter Power Systems (GEP), Generator Operation*
0930 - 0945	*Break*
0945 - 1115	***Generator Main Connections*** *Introduction, Isolated Phase Bus Bar Circulatory Currents, System Description.* ***Performance and Operation of Generators*** *Generator Systems, Condition Monitoring, Operational Limitations, Fault Conditions,* ***Generator Surveillance and Testing*** *Generator Operational Checks (Surveillance and Monitoring), Generator Diagnostic Testing, Insulation Resistance and Polarization Index, DC Hipot Test, AC Tests for Stator Windings, Synchronous Machine Rotor Windings, Partial Discharge Tests, Low Core Flux Test (EL-CID), Mechanical Tests, Groundwall Insulation, Rotor Winding, Turn Insulation, Slow Wedges and Bracing, Stator and Rotor Cores*
1115 - 1230	***Generator Inspection and Maintenance*** *On-Load Maintenance and Monitoring, Off-Load Maintenance, Generator Testing.* ***Generator Operational Problems, and Refurbishment Options*** *Typical Generator Operational Problems, Generator Rotor Reliability and Life Expectancy, Generator Rotor Refurbishment, Types of Insulation, Generator Rotor Modifications, Upgrades and Uprates, High Speed Balancing, Flux Probe Test*
1230 - 1245	*Break*
1245 - 1330	***Circuit Breakers*** *Theory of Circuit Interruption, Physics of Arc Phenomena, Circuit Breaker Rating, Conventional Circuit Breakers, Methods for Increasing Arc Resistance, Plain Break Type, Magnetic Blow-out Type, Arc Splitter Type, Application, Oil Circuit Breakers, Recent Developments in Circuit Breakers* ***Fuses*** *Types of Fuses, Features of Current Limiting Fuses, Advantages of Fuses Over Circuit Breakers*
1330 -1420	***Power Station Electrical Systems and Design Requirements*** *Introduction, System Requirements, Electrical System Description, System Performance, Power Plant Outages and Faults, Uninterruptible Power Supply (UPS) Systems, DC Systems* ***Power Station Protective Systems*** *Introduction, Design Criteria, Generator Protection, DC Tripping Systems*
1420 - 1430	***Recap***

1430	*End of Day Three*

Day 4:

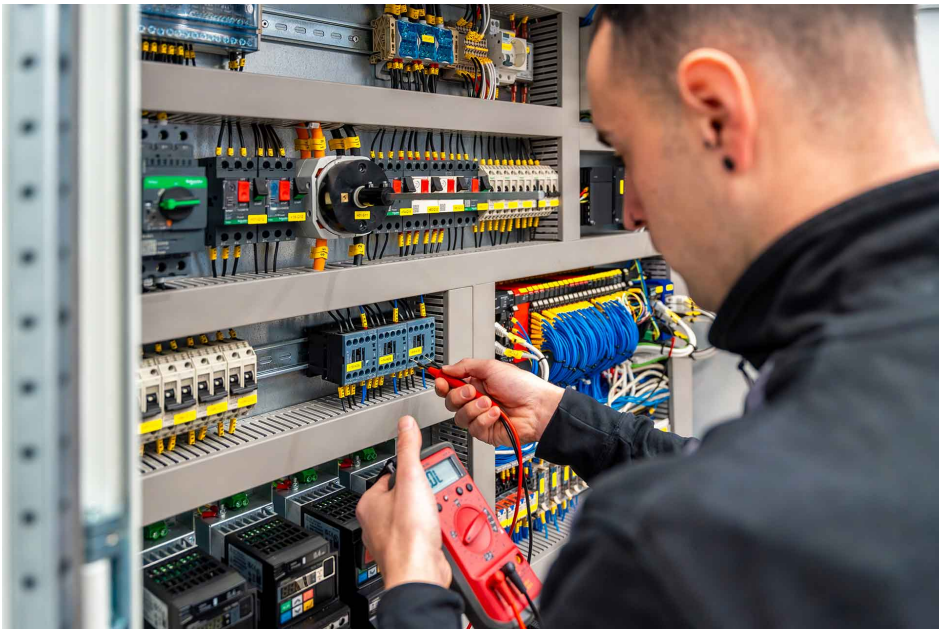
0730 - 0930	***Introduction to Instrumentation*** *Basic concepts, Definitions, Overview of pressure, level, temperature and flow, Overview Of Valves*
0930 - 0945	*Break*
0900 - 1030	***Pressure Measurement*** *Principles, Sources, Transducers and elements, Specifications, Installation issues*
1130 - 1230	***Level Measurement*** *Principles, Simple sight glasses, Buoyancy tape systems, Hydrostatic pressure, Ultrasonic measurement, Radiation measurement, Electrical measurement, Density measurement, Installation issues*
1230 - 1245	*Break*
1400 -1420	***Temperature Measurement*** *Principles, Thermocouples, Resistance temperature detectors, Thermistors, Liquid-in-glass, filled, bimetallic, Pyrometers, Installation issues*
1420 - 1430	***Recap***
1430	*End of Day Four*

Day 5:

0730 - 0930	***Flow Measurement*** *Principles, Differential pressure flowmeters, Open channel flow measurement, Oscillatory flow measurement, Magnetic flow measurement, Positive displacement , Ultrasonic flow measurement, Mass flow measurement, Installation issues*
0930 - 0945	*Break*
0945 - 1030	***Control Valves*** *Principles, Control valve types, Selection, Characteristics / trim, Noise and cavitation, Actuators and positioners, Installation issues*
1030 – 1230	***Process Considerations*** *Transmitters, Noise, Material of construction*
1230 - 1245	*Break*
1245 - 1345	***Integration of the System*** *Individual instrument error and total error, Testing and commissioning*
1345 – 1400	*Course Conclusion*
1400 - 1415	***POST-TEST***
1415 - 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

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



Course Coordinator

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