COURSE OVERVIEW EE1153
Wire & Cable Systems – Design, Testing & Fault Diagnosis

Course Title
Wire & Cable Systems – Design, Testing & Fault Diagnosis

Course Date/Venue
August 10-14, 2025/Jazeera Meeting Room, Al Bandar Rotana - Creek, Dubai, UAE

Course Reference
EE1153

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes practical sessions and exercises where participants carryout cable design and testing. Theory learnt in the class will be applied using the latest heat-shrink jointing and termination methods suitable for in-class training.

This course is designed to provide participants with a detailed and up-to-date overview on Wire and Cable Systems – Design, Testing and Fault Diagnosis. It covers the wire and cable systems, electrical properties of cables and mechanical properties of cables; the cable materials and construction, cable standards and specifications and cable sizing and selection basics; the cable design process, voltage and current rating design, cable routing and layout design and specialty cables design; the environmental and installation conditions in design and cable terminations and joint design; and the pre-installation testing, high voltage testing, routine maintenance testing and cable fault location.

During this interactive course, participants will learn the testing of joints and terminations and documentation and reporting of test results; the common cable fault types and causes covering mechanical damage, insulation degradation, water ingress and thermal overloading; the fault location techniques, on-site troubleshooting procedures and interpreting test results for fault diagnosis; the preventive measures to avoid cable failures, modern cable monitoring and diagnostic systems and design for reliability and longevity; and the earthing and shielding design for cables, fire safety and cable management and quality assurance in cable projects.

Course Objectives

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

- Apply and gain an in-depth knowledge on the design, testing and fault diagnosis of wire and cable systems
- Identify wire and cable systems, electrical properties of cables and mechanical properties of cables
- Recognize cable materials and construction, cable standards and specifications as well as cable sizing and selection basics
- Illustrate cable design process, voltage and current rating design, cable routing and layout design and specialty cables design
- Carryout environmental and installation conditions in design as well as cable terminations and joint design
- Apply pre-installation testing, high voltage testing, routine maintenance testing and cable fault location
- Test joints and terminations and apply proper documentation and reporting of test results
- Identify common cable fault types and causes covering mechanical damage, insulation degradation, water ingress and thermal overloading
- Employ fault location techniques, on-site troubleshooting procedures and interpreting test results for fault diagnosis
- Carryout preventive measures to avoid cable failures, modern cable monitoring and diagnostic systems and design for reliability and longevity
- Apply earthing and shielding design for cables, fire safety and cable management and quality assurance in cable projects

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

This course provides an overview of all significant aspects and considerations on the design, testing and fault diagnosis of wire and cable systems for electrical engineers and technicians, maintenance and reliability engineers, instrumentation and control engineers, project engineers and managers, utility and power distribution personnel, cable manufacturers and suppliers, quality assurance and testing professionals, technical inspectors and supervisors and EPC (engineering, procurement, and construction) personnel.

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

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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 **30 years** of extensive experience. His expertise widely covers **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.

Accommodation

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

Course Fee

US$ 6,250 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 workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: ***Sunday, 10th of August 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Wire & Cable Systems*** *Types of Cables (Power, Control, Instrumentation, Communication) • Functions & Applications in Various Industries • Basic Components (Conductor, Insulation, Shielding) • Standards & Codes Governing Cables*
0930 – 0945	*Break*
0945 – 1030	***Electrical Properties of Cables*** *Conductivity & Resistivity • Capacitance & Inductance • Dielectric Strength • Losses (I^2R Losses, Dielectric Losses)*
1030 – 1130	***Mechanical Properties of Cables*** *Tensile Strength & Elongation • Bending Radius • Flexibility Requirements • Impact & Crush Resistance*
1130 – 1215	***Cable Materials & Construction*** *Copper & Aluminum Conductors • Insulation Types (PVC, XLPE, EPR) • Armoring & Sheathing Materials • Fire-Resistant & Flame-Retardant Designs*
1215 – 1230	*Break*

1230 – 1330	***Overview of Cable Standards & Specifications*** *IEC & IEEE Standards • NEMA & BS Specifications • Regional Codes (NEC, Local Regulations) • Manufacturer Datasheets & Compliance*
1330 – 1420	***Cable Sizing & Selection Basics*** *Load Calculations • Voltage Drop Considerations • Short-Circuit Rating • Environmental Factors (Temperature, Chemicals, UV)*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: Monday, 11th of August 2025

0730 – 0830	***Cable Design Process*** *Gathering Design Input Data • Calculating Electrical Loads • Selecting Insulation Level • Finalizing Mechanical Requirements*
0830 - 0930	***Voltage & Current Rating Design*** *Determining Operating Voltage • Derating Factors (Ambient Temperature, Grouping) • Current Carrying Capacity • Harmonic Considerations*
0930 – 0945	*Break*
0945 – 1100	***Cable Routing & Layout Design*** *Trench & Tray Layouts • Separation of Power & Control Cables • Earthing & Bonding Practices • Accessibility for Maintenance*
1100 – 1215	***Specialty Cables Design*** *Fire Survival & Flame-Retardant Cables • Halogen-Free & Low Smoke Cables • Marine & Offshore Cables • Submersible & Mining Cables*
1215 – 1230	*Break*
1230 – 1330	***Environmental & Installation Conditions in Design*** *Underground versus Overhead Considerations • Exposure to Chemicals & Moisture • Thermal Resistivity of Soil • UV & Rodent Protection*
1330 – 1420	***Cable Terminations & Joint Design*** *Selection of Terminations (Heat Shrink, Cold Shrink) • Jointing Techniques for HV/MV Cables • Sealing & Stress Control • Testing of Terminations*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3: Tuesday, 12th of August 2025

0730 – 0830	***Pre-Installation Testing*** *Visual Inspection & Dimensional Checks • Insulation Resistance Test (Megger) • Continuity & Phase Identification • Manufacturer's Factory Test Certificates*
0830 – 0930	***High Voltage Testing*** *DC & AC Hi-Pot Testing • Partial Discharge Testing • Very Low Frequency (VLF) Testing • Interpretation of Results*
0930 – 0945	*Break*

0945 – 1100	***Routine Maintenance Testing*** *Periodic Insulation Resistance Measurement • Tan Delta (Power Factor) Testing • Sheath Integrity Test • Thermographic Inspections*
1100 – 1215	***Cable Fault Location Principles*** *Types of Faults (Open, Short, Earth Fault) • Fault Detection Methods • Pre-Location Techniques (TDR, Impulse) • Pinpointing Techniques (Acoustic, Surge Wave)*
1215 – 1230	*Break*
1230 – 1330	***Testing of Joints & Terminations*** *Stress Grading Validation • Joint Resistance Measurement • Thermal Imaging of Joints • Corona Detection*
1330 – 1420	***Documentation & Reporting of Test Results*** *Test Formats & Templates • Compliance with Standards • Interpretation of Abnormal Values • Recommendations for Remedial Action*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4: ***Wednesday, 13th of August 2025***

0730 – 0830	***Common Cable Fault Types & Causes*** *Mechanical Damage • Insulation Degradation • Water Ingress • Thermal Overloading*
0830 – 0930	***Fault Location Techniques*** *Time Domain Reflectometry (TDR) • Bridge Methods (Murray, Varley) • Arc Reflection Method • A-Frame & Audio Frequency Methods*
0930 – 0945	*Break*
0945 – 1100	***On-Site Troubleshooting Procedures*** *Visual Inspection & Site Survey • Isolating the Faulty Section • Safety Precautions During Fault Finding • Temporary Restoration Techniques*
1100 – 1215	***Interpreting Test Results for Fault Diagnosis*** *Reading Insulation Resistance Trends • Analyzing Hi-Pot & VLF Test Failures • Tan Delta Deterioration Patterns • Thermal Imaging for Hotspots*
1215 – 1230	*Break*
1230 – 1330	***Preventive Measures to Avoid Cable Failures*** *Proper Installation Practices • Correct Jointing Techniques • Scheduled Maintenance & Inspections • Monitoring of Load Conditions*
1330 – 1420	***Case Studies in Fault Diagnosis*** *Analysis of Real-Life Cable Faults • Lessons Learned from Major Failures • Best Practices for Future Prevention • Role of Condition Monitoring Systems*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

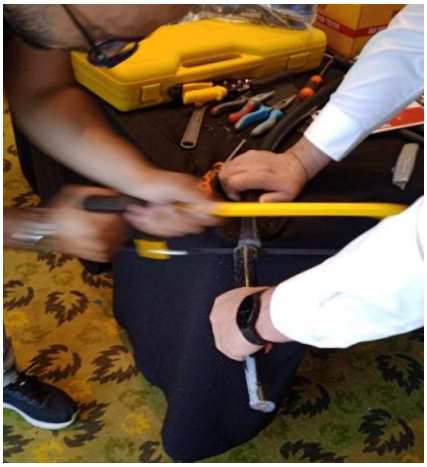
Day 5: **Thursday, 14th of August 2025**

0730 – 0830	***Modern Cable Monitoring & Diagnostic Systems*** *Online Partial Discharge Monitoring • Fiber Optic Sensing in Cables • Continuous Thermal Monitoring • Integration with SCADA*
0830 – 0930	***Design for Reliability & Longevity*** *Redundancy & Spare Routes • Design Margins & Safety Factors • Selection for Harsh Environments • Future-Proofing Cable Systems*
0930 – 0945	*Break*
0945 – 1100	***Earthing & Shielding Design for Cables*** *Earthing Techniques for MV/HV Cables • Cross Bonding & Sheath Voltage Management • Shielding for EMI/RFI • Earthing Fault Detection*
1100 – 1215	***Fire Safety & Cable Management*** *Fire-Resistant Cable Selection • Firestop Systems in Penetrations • Cable Tray & Ladder Selection • Emergency Cable Replacement Strategies*
1215 – 1230	*Break*
1230 – 1345	***Quality Assurance in Cable Projects*** *Factory Acceptance Testing (FAT) • Site Acceptance Testing (SAT) • Installation Quality Checks • Third-Party Inspection Requirements*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

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 splicing, jointing and termination exercises using heat-shrink kits, suitable for classroom training.






Course Coordinator

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