

**COURSE OVERVIEW EE0060-4D**  
**LV/MV/HV Circuit Breakers & Switchgear**

*Specification, Design, Operation, Inspection, Testing, Maintenance, Repair & Troubleshooting*

**Course Title**

LV/MV/HV Circuit Breakers & Switchgear: *Specification, Design, Operation, Inspection, Testing, Maintenance, Repair & Troubleshooting*

**Course Date/Venue**

October 14-17, 2024/Club B Meeting Room, Ramada Plaza by Wyndham Istanbul City Center, Istanbul, Turkey

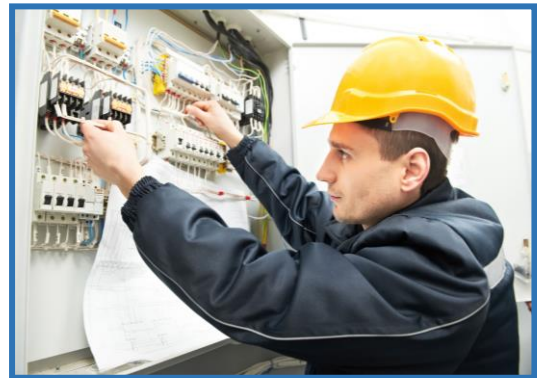
**Course Reference**

EE0060-4D

**Course Duration/Credits**

Four days/2.4 CEUs/24 PDHs

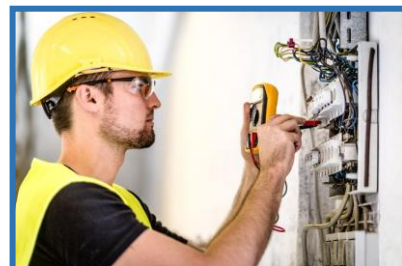
**Course Description**



***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 update participants with the latest development of Circuit Breakers and to present some of the more common and updated aspects of low, medium and high voltage switchgear maintenance. It must be understood that there is an incredible variety of equipment used on low, medium and high voltage switchgear today. Switchgears play an important role in the protection, distribution and control of electrical power in manufacturing or power plant and in a utility distribution system. Negligent maintenance practices can lead to power system inefficiency and loss of system reliability



An older plant may have switchgear that was built in the forties in the older areas and modern switchgear in other areas as the plant was upgraded. This course will present maintenance problems to the maintenance manager and technician. Newer plants will probably have modern equipment of a limited variety and manufacture. It is these similarities that will be covered in the course.

### **Course Objectives**

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

- Specify, design, operate, inspect, test, maintain, repair and troubleshoot circuit breakers and switchgears
- Apply an in-depth knowledge and skills on LV/MV/HV circuit breakers and switchgears
- Describe the switchgear details such as ratings, degree of protection, service conditions and ancillary equipment
- Explain switchgear asset management including CBM and RCM process, tripping devices, maintenance and testing
- Apply load and fault calculation to decide the task of protection system and the operating conditions of power system
- Explain circuit breaker control circuits, types and application of protective relays, structure of control circuits and the use and application of current and voltage transformers
- Discuss circuit breaker characteristics in relation to protection control circuits, selectivity, sensitivity and speed of the control circuits
- Recognize the value of earthing system to protection control circuits and the power system protection as well as fault clearance and power system redundancy through control system application
- Identify the various switchgear diagnostic techniques and employ the different types of substation circuit breaker techniques and determine the switchgear vital equipments including batteries condition and monitoring, relay applications for basic and complex busbar arrangements and zone selection logic
- Employ the substation maintenance techniques and discuss their description, structures, features and functions
- Apply the switchgear maintenance practices and improve maintenance and repair procedures
- Carryout maintenance work orders including their process development, procedures and problems encountered
- Introduce computerized maintenance management systems (CMMS) and recognize its importance in circuit breakers design, inspection, maintenance, repair and troubleshooting

### **Who Should Attend**

This course provides an overview of all significant aspects and considerations of Circuit Breakers and Switchgears for engineers and other technical staff who need a sound understanding of Low, Medium and High Voltage Switchgear and Circuit Breaker specification, design, operation, inspection, testing, maintenance, repair and troubleshooting.

### **Course Fee**


**US\$ 5,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

### 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 **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.

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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.

### 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:



**Dr. Alaa Abdel Kerim, PhD, MSc, BSc, is a Senior Electrical & Instrumentation Engineer with over 35 years of extensive experience in the Power & Water Utilities and Other Energy Sectors. He specializes in Electrical Safety, HV Cable Design, Cable Splicing & Termination, Cable Jointing Techniques, High Voltage Electrical Safety, Electrical Drawing & Schematics, Electrical Power, Electrical Wiring, Machines, Transformers, Motors, Power Stations, Substation Site Inspection, HV/MV Cable Splicing, High Voltage**

**Circuit Breaker Inspection & Repair, LV/MV/HV Circuit Breakers & Switchgear, Cable & Over Head Power Line, High Voltage Power System Safe Operation, High Voltage Safety, High Voltage Transformers, HV Switch Gear Maintenance, Power System Blackouts, High Voltage Electrical Safety, Protection Relays, Process Control & Instrumentation, Industrial UPS Systems, Safe Operation of High Voltage & Low Voltage Power Systems, Fundamentals of Electricity, Electrical Standards, Practical High Voltage Safety Operating Procedures, Modern Power System Protective Relaying, Electrical & Control System Testing, Design, Commissioning, Operation and Maintenance of Switchgears, Transformers, Substations, Medium & High Voltage Equipment and Circuit Breakers, Electrical Motors & Variable Speed Drives, Power System Equipment, Distribution Network System, Electric Distribution System Equipment, Practical Troubleshooting of Electrical Equipment & Control Circuits, Electrical & Control System Testing & Commissioning, LV/MV/HV Circuit Breakers Inspection & Maintenance, Electrical Power Substation Maintenance, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers and AC & DC Transmission, DCS, PLC, SCADA, Siemens SIMATIC S7 Maintenance & Configuration, Siemens Simatic S7 PLC, Siemens WINCC, Siemens SIMATIC & WinCC, Siemens, PLC Simatic S7-400/S7-300/S7-200, HMI, Automation System, Process Control & Instrumentation, Hydrocarbon, Level & Flow Measurements, Analytical Instrumentation, Find Control Elements, Control Loop Operation, Data Acquisition & Transmission, Electronics Technology, Power Systems Control, Power Systems Security, Power Transmissions, Power Generation, Electrical Substations and MV/LV Electrical System.**

During his career life, Dr. Alaa has been practically and academically involved in different **Power System and Instrumentation international companies and Universities as a Senior Professor & Consultant, Instrumentation Engineer and Electrical Engineer.** His recent practical applications experience includes the design, supply, installation, operation of full **DCS, SCADA, PLC, HMI Automation System for Sumid Line Petroleum, Siemens USA, AREVA USA** to name a few. His experience also includes electrical coordination, protection level adjustments and electrical testing.

Dr. Alaa has a **PhD degree in Electrical Engineering from the Technical University of Gdansk, Poland** and has **Master's and Bachelor's degrees in Electrical Machine & Power Engineering from Cairo University and Helwan University, respectively.** Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings and workshops worldwide.

### 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: Monday, 14<sup>th</sup> of October 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction</b> Voltage Convention • Fundamentals of Circuit Breakers • Types of Breakers, Construction • Ratings, Tripping Characteristics
0930 – 0945	Break
1020 – 1120	<b>Switchgear in a Network Context</b> Single Line • Utilization
1120 – 1220	<b>Switchgear in Historical Perspective</b> Oil Circuit Breakers • Air Blast CB • SF6 and Vacuum CB • Operating Mechanisms
1230 – 1245	Break
1245 – 1420	<b>Switchgear Details</b> Ratings Ur, Ik, Ip, Va • Degree of Protection • Service Conditions • Ancillary Equipment
1420 – 1430	<b>Recap</b> 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: Tuesday, 15<sup>th</sup> of October 2024**

0730 – 0930	<b>Switchgear Asset Management</b> Equipment Register • CBM and RCM Process • Switchgear Diagnostic Techniques • Tripping Devices & Maintenance & Testing
0930 – 0945	Break
0945 – 1130	<b>Circuit Breakers Control Circuits</b> Philosophy, Types & Application of Protective Relays • Control System Structure, Instrument Transformers • Current & Voltage Transformers • Panels, Signalling, Interlocking
1130 – 1230	<b>Circuit Breakers Control Circuits (cont'd)</b> Typical Connection Diagrams • Primary & Back-up Relaying • Fault Calculation • System Earthing • Circuit Breakers Characteristics • Selectivity, Sensitivity, Speed • Reliability

1230 – 1245	Break
1245 – 1420	<b>Circuit Breakers Control Circuits (cont'd)</b> Evaluation of Protection Relaying • Setting of Protection • Fault Clearance • Redundant Control Circuits
1420 – 1430	<b>Recap</b> 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: Wednesday, 16<sup>th</sup> of October 2024**

0930 – 1015	<b>Case Study</b> Circuit Breaker Settings • Selectivity, Sensitivity, Speed
0930 – 0945	Break
0945 – 1130	<b>Circuit Breaker Diagnostic Techniques</b> Diagnostic Techniques
1130 – 1230	<b>Switchgear Vital Equipments</b> Batteries Condition and Monitoring • Discussions
1230 – 1245	Break
1245 – 1420	<b>LV/MV/HV Substation Bus Arrangement, Incoming &amp; Outgoing Circuits</b> Automatic Switching During Normal or Abnormal Conditions, Bus Protection & Circuit Breaker System • Bus Differential & Breaker Failure Relay, Zone Selection Logic & CT Requirements
1420 – 1430	<b>Recap</b> 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

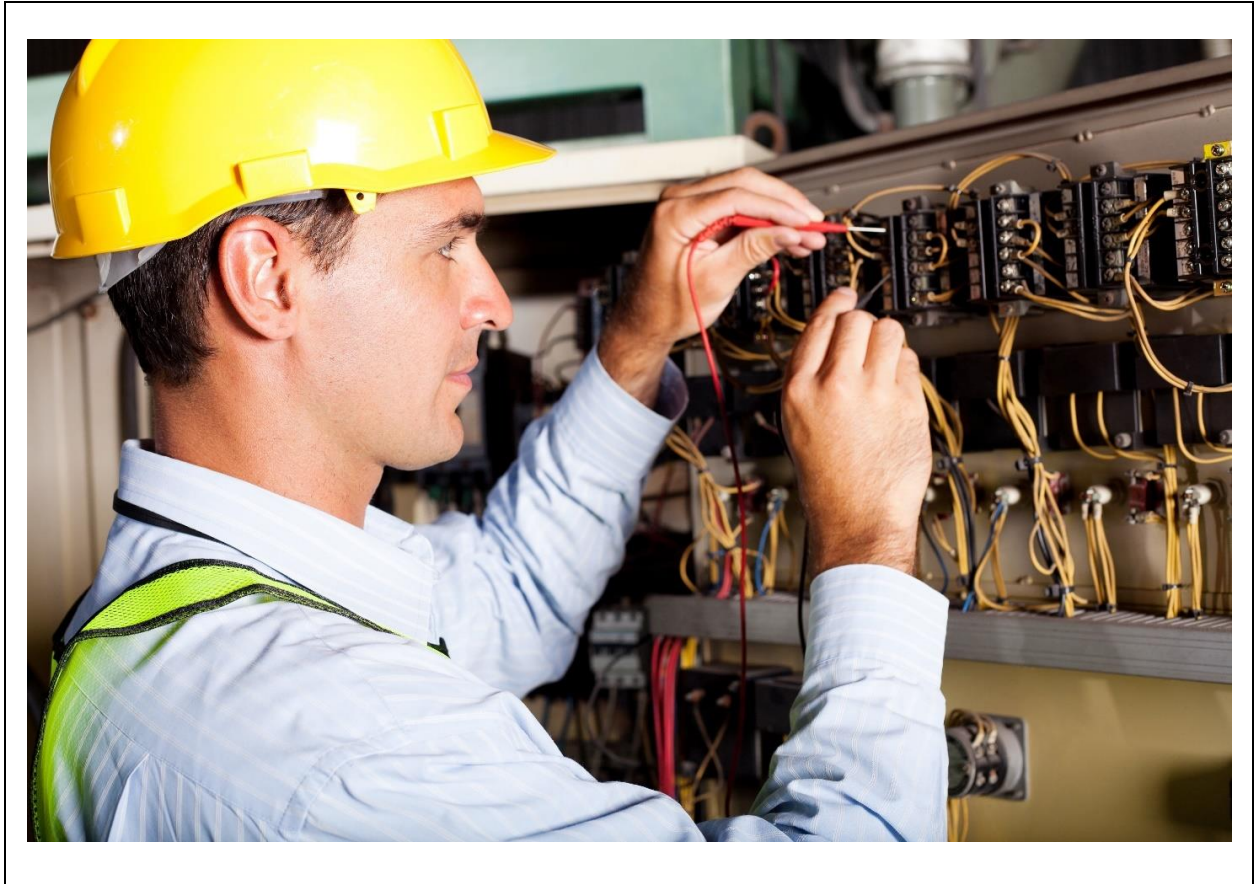
**Day 4: Thursday, 17<sup>th</sup> of October 2024**

0730 – 0930	<b>Substation Maintenance Techniques</b> Description • Structures • Fuses, Arresters, Switches • Substation Compound • Switchgear Maintenance Practices • Metal Clad Switchgear • Maintenance Details
0930 – 0945	Break
0945 – 1100	<b>Substation Maintenance Techniques (cont'd)</b> Metal Clad Switchgear Maintenance Details • Discussions • Maintenance & Repair Fundamentals • Maintenance & Repair Procedures
1100 – 1200	<b>Maintenance Work Orders</b> Process Development • Procedures • Problems Encounters • Samples, Discussions
1200 – 1215	Break
1215 – 1345	<b>Fundamentals of Computerized Maintenance (CMMS)</b>
1345 – 1400	<b>Course Conclusion</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1400 – 1415	<b>POST-TEST</b>
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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