



**COURSE OVERVIEW EE0060**

**LV/MV/HV Circuit Breakers and Switchgear**

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

**Course Title**

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

**Course Date/Venue**

Session 1: February 09-13, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: August 10-14, 2025/Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA



**Course Reference**

EE0060

**Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs

**Course Description**



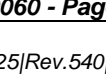
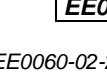
***This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.***



This course is designed to 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

## 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 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 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)

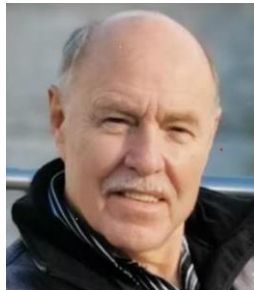
Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas.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

### 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. Fred Du Plessis** is a **Senior Electrical Engineer** with over **45** years of extensive experience within the **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise widely covers in the areas of **Thermal Gas Power Generation, Power Station Operations, Power Generation Plant Outage Management, Power System Analysis, Power System Generation & Distribution, Electric Power System Design, Renewable Energy, Energy Storage Technologies, Maintenance, Testing & Troubleshooting, Transformer Protection, Transformer Problem and Failure Investigations, Power System Operation and Control, Fault Analysis in Power Systems, HV/MV Cable Splicing, High Voltage Electrical Safety, 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, ORHVS for Responsible and Authorized Person High Voltage Regulation, Transformers Maintenance, inspections & repairs, Commissioning of LV & HV Equipment, Oil Purification and High Voltage Maintenance, HT Switch Gear - Testing, Safe Operating, Maintenance, Inspection & Repairs on LV & HT Cables - Testing (Pulse & Megger), Line Patrol in Low Voltage & Distribution, Transmission, Operating Principles up to 132KV, Abnormal Conditions & Exceptions, Commissioning & Testing, Transformer Inspections & Repairs, Live Line Work up to 33KV, Basic Power System Protection, High Voltage Operating Preparedness Phasing (110V to 132KV), HV Operating & Fault Finding (up to 132KV), Maintenance & Construction Supervision, VSD/VFD Installations & Testing, Electrical Panel Design, VSD/VFD Installations & Testing, Instrument Installation and wiring, AC/DC Supplies & Change Over Systems, AC & DC Winders and VLF Testing, Gas Turbines, Steam Turbine with a Station Generation, Project Management & Project Controls, Water Treatment & Reverse Osmosis Plant Management and Mechanical Maintenance Management.**

During Mr. Du Plessis's career life, he has gained his practical experience through several significant positions and dedication as the **Project Manager/Owner, Maintenance Manager, Project Execution Manager, Commissioning & Operating Manager, Acting Operating Manager, Optimization/Commissioning Manager, Operating Support Manager, Operating Production/Shift Manager, Operations Lead Engineer, Electrical Engineer, Production/Maintenance Planner, Unit Shift Supervisor, Principal Plant Operator, Workshop & Maintenance Consultant, Assistant Electrical Supervisor, Trainee Motor Mechanic and Senior Instructor/Trainer** from various international **power station** companies like the Dunamis Energy, Peterhead Power Station, Lijaco Services, Eskom, Matla Power Station, Grootvlei Power Station, Ellisras Brick & Ceramic, Hlalisani Mechanical Contractor, Matimba Power Station, Matimba Power Station, Eskom Kriel Power Station and Transvaal Provincial.

Mr. Du Plessis has a **Bachelor's** (with Honours) degree in **Operations Management**. Further, he holds certification in Red & Silver Seal Accreditation Power Generation – (ESETA), a SAMTRAC & NOSA **Auditor** – (NOSA), a **Certified Instructor/Trainer** and has further 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 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.

### 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 &amp; Coffee</i>
0800 – 0815	<i>Welcome &amp; Introduction</i>
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction</b> <i>Voltage Convention • Fundamentals of Circuit Breakers • Types of Breakers, Construction • Ratings, Tripping Characteristics</i>
0930 – 0945	<i>Break</i>
1020 – 1120	<b>Switchgear in a Network Context</b> <i>Single Line • Utilization</i>
1120 – 1220	<b>Switchgear in Historical Perspective</b> <i>Oil Circuit Breakers • Air Blast CB • SF6 and Vacuum CB • Operating Mechanisms</i>
1230 – 1245	<i>Break</i>
1245 – 1420	<b>Switchgear Details</b> <i>Ratings Ur, Ik, Ip, Va • Degree of Protection • Service Conditions • Ancillary Equipment</i>
1420 – 1430	<b>Recap</b>
1430	<i>Lunch &amp; End of Day One</i>

#### **Day 2**

0730 – 0930	<b>Switchgear Asset Management</b> <i>Equipment Register • CBM and RCM Process • Switchgear Diagnostic Techniques • Tripping Devices &amp; Maintenance &amp; Testing</i>
0930 – 0945	<i>Break</i>
0945 – 1130	<b>Circuit Breakers Control Circuits</b> <i>Philosophy, Types &amp; Application of Protective Relays • Control System Structure, Instrument Transformers • Current &amp; Voltage Transformers • Panels, Signalling, Interlocking</i>



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>
1430	Lunch & End of Day Two

**Day 3**

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>
1430	Lunch & End of Day Three

**Day 4**

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 - 1130	<b>Substation Maintenance Techniques (cont'd)</b> Metal Clad Switchgear Maintenance Details • Discussions
1130 - 1230	<b>Substation Maintenance Techniques (cont'd)</b> Maintenance & Repair Fundamentals
1230 - 1245	Break
1245 - 1420	<b>Substation Maintenance Techniques (cont'd)</b> Maintenance & Repair Procedures
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day Four

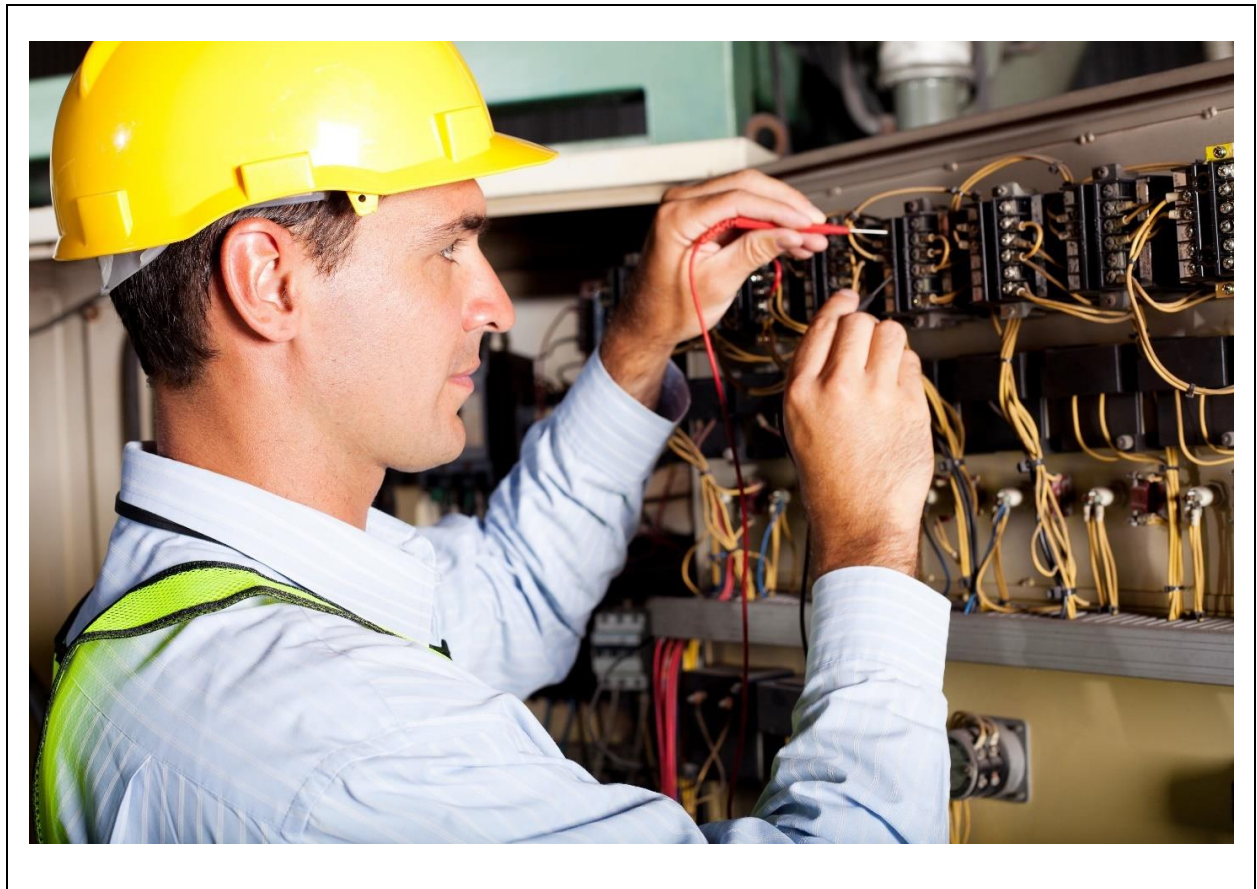
**Day 5**

0730 - 0930	<b>Maintenance Work Orders</b> Process Development
0930 - 0945	Break
0945 - 1100	<b>Maintenance Work Orders (cont'd)</b> Procedures

1100 – 1200	<b>Maintenance Work Orders (cont'd)</b> <i>Problems Encounters • Samples, Discussions</i>
1200 – 1215	<i>Break</i>
1215 – 1345	<b>Fundamentals of Computerized Maintenance (CMMS)</b>
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch &amp; 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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