



COURSE OVERVIEW EE0076(AL4) LV/MV/HV Switchgear Operation & Maintenance

Course Title

LV/MV/HV Switchgear Operation & Maintenance

Course Date/Venue

July 13-17, 2025/Crowne Meeting Room, Crowne Plaza Al Khobar, Al Khobar, KSA

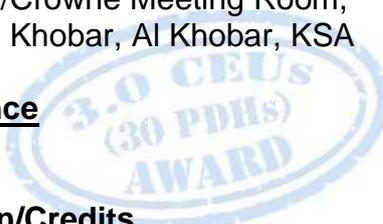
Course Reference

EE0076(AL4)

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide delegates with detailed and up-to-date overview of switchgear. It covers operation and maintenance of LV/MV/HV switchgear up to 220kV. It includes in-depth discussion on operation, troubleshooting, repair and maintenance, safe isolation and deisolation of switchgear of low, medium and high voltage systems up to 220kV.

The course will describe voltage convention classifications, switchgear components and their function, the protection system for generator, transformer and motor including switchgear construction, ground fault relay system and the three basic types of low and medium voltage circuit breaker contacts.

Safe operation, isolation, deisolation, inspection, maintenance and troubleshooting of LV/MV/HV switchgear will also be carried out during the course.

Course Objectives

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

- Operate and maintain LV/MV/HV switchgear in a professional manner
- List the voltage convention classifications
- Describe switchgear components and their function
- Explain the protection system for generator, transformer and motor
- Identify switchgear construction, ground fault relay system and the three basic types of low and medium voltage circuit breaker contacts
- Employ safe operation, isolation, deisolation, inspection, maintenance and troubleshooting of LV/MV/HV switchgear

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 switchgear for power operation and maintenance management employees who are involved in the operation, troubleshooting, repair, maintenance, safe isolation and deisolation of low, medium and high voltage switchgears.

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 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.

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. Ahmed Hayajneh is a **Senior Electrical Engineer** with **20 years** of experience in **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise widely covers in the areas of **HV/MV Cable Splicing, Jointing, Inspection & Termination, HV/LV Equipment, High Voltage Electrical Safety, LV & HV Electrical System, HV Equipment Inspection & Maintenance, HV Switchgear Operation & Maintenance, LV Distribution Switchgear & Equipment, LV/MV Electrical Safety (11 KV, 415 & 220 Voltage), Power System Equipment, Power Cable Standard and Testing, Cables & Wiring, Overhead Transmission Lines, Transmission Network Maintenance, Electrical Forecasting Techniques, Inspection Reporting Techniques, Electrical Substation Design & Planning, Electrical Drawings & Schematics, Fault Detection Analysis, Distribution Networks & Load Forecasting, Power Generation, Electrical Power System, Electrical Installations & Utilities, Electrical Distribution Systems & Control Circuits, Electrical Drawings, Relay Logic Circuits, Troubleshooting Transformers, System Grounding, Circuit Breakers, Protection Devices & Technology, Protection Relay, Transformers, Generators, Power Transformers, Motors, Substations, Switchgears & Distribution, Power System Analysis, Electrical Equipment Control Systems, Transformer Maintenance & Testing, Electrical Substation & Design, Power Quality Studies & Load Criteria, Substation Earthing System, Electrical Equipment Maintenance, Electrical Safety, Electrical Protection, Batteries, Chargers & UPS, Electrical Submersible Pumps (ESP), Power Supply Substations, Area Classification, Safety Management System, Permit to Work & Issuing Authority, Emergency Diesel Generator, Variable Frequency Drives (VFD), PLC & SCADA for Automation & Process Control, Automation Solutions & Techniques, Automating Process Equipment, DCS Automated Process Control Systems, High & Low Voltage Electrical Safety, Electrical Inspection & Testing, Electrical Control & Monitoring System, Electric Power System, Intensive Overhead Transmission Line (OHTL), Generator Maintenance & Troubleshooting, Transmission Line Networks, Distribution Engineering, HVDC Transmission & Control, Substation Maintenance Techniques and Overhead Power Line Construction & Patrolling.**

Mr. Ahmed gained his expertise and experience through several positions as a **Senior Electrical Project Engineer, Senior Electrical Engineer, Site Electrical Engineer** and **Senior Instructor/Trainer** for various companies such as United Electro-Mechanical International Company, AL OSAIS Contracting Co., ASTRACO, Saudi Service for Electro Mechanic Work Co. (S.S.E.M), Dubai Electricity & Water Authority (DEWA) and Saudi Electricity Company (SEC).

Mr. Ahmed has a **Bachelor's** degree in **Electrical Engineering**. Further, he is a **Certified Instructor/Trainer** and has delivered various trainings, seminars, conferences, workshops and courses globally.

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: Sunday, 13th of July 2025

0730- 0800	Registration & Coffee
0800 - 0815	Welcome & Introduction
0815 - 0830	PRE-TEST
0830 - 0930	General Introduction Electrical Engineering Basic Concepts • Three Phase Review & Per Unit • Voltage Levels • One Line & Three Line Diagram • Generation System Layout • Transmission System Layout • Substation System Layout • Distribution System Layout
0930 - 0945	Break
0945 - 1045	Industrial Switchgear Fuses • Auto-reclosers • Automatic Sectionalizer • Circuit Breakers • Isolator Switches
1045 - 1130	Industrial Switchgear (cont'd) Load Switches • Relays • Current Transformers • Voltage Transformers
1130 - 1230	CB Design Specification Based on Short Circuit Current Level Per Unit System • Faults on Power Systems • Typical Protection System for Generator/Transformer/Motor • Transient Phenomena in Power System • Symmetrical Component Analysis of Three Phase Network
1230 - 1245	Break
1245 - 1420	CB Design Specification Based on Short Circuit Current Level (cont'd) Network Connection for Various Fault Types • Current & Voltage Distribution in System Due to a Fault • Effect of System on Zero Sequence Quantities • Computer Programs Based Short Circuit Calculation
1420 - 1430	Recap
1430	End of Day One

Day 2: Munday, 14th of July 2025

0730 - 0930	CB Design Specification Based on Arc Phenomena & Circuit Interruption Arc Phenomena • Maintenance of the Arc • Properties of Arc • Arc Interruption Theory • Circuit Breaker Rating • Circuit Constants & Circuit Conditions • Conditions of Severity • Restriking Voltage Transient • Class A Ultra Fast Transients • Class B System Transients • Class C Low Transients • Transmission Line Transient • Switching Transients • Duties of Switchgear
0930 - 0945	Break
0945 - 1045	LV Circuit Breakers & Switchgear Low Voltage Molded Case Current Limiting Circuit Breakers • Low Voltage Molded Case Circuit Breakers with High Breaking Capacity • Insulated Case Circuit Breakers • Low Voltage Air Circuit Breakers
1045 - 1130	LV Circuit Breakers & Switchgear (cont'd) Low Voltage Circuit Breakers Specification • Low Voltage Circuit Breakers & Switchgear Safety Aspects • Low Voltage Circuit Breakers & Switchgear Safe Operation
1130 - 1230	Air Circuit Breakers & Switchgear up to 11.5kV Method of Increasing Arc Resistance • Plan Break Type • Magnetic Blow Out Type • Arc Splitter Type



1230 - 1245	Break
1245 - 1420	Air Circuit Breakers & Switchgear up to 11.5kV (cont'd) Application • Construction & Operation • Axial Air CB • Blast Air CB
1420 - 1430	Recap
1430	End of Day Two

Day 3: Tuesday, 15th of July 2025

0730 - 0930	Oil Circuit Breakers & Switchgear 11.5kV Arc Rupture Under Oil • Advantages of Oil • Disadvantages of Oil • Plan Break Oil Circuit Breakers • Arc Control Circuit Oil Breakers • Minimum Oil Circuit Breakers • Construction & Operation
0930 - 0945	Break
0945 - 1045	Modern Vacuum CB & Switchgear 11.5kV Introduction • Advantages of Vacuum Interruption • Vacuum Contactors & Interrupters • The Vacuum Medium • The Vacuum Arc • Vacuum Arc Stability
1045 - 1130	Modern Vacuum CB & Switchgear 11.5kV (cont'd) Vacuum Break Down • Vacuum Switch Construction • Applications of Vacuum Circuit Breakers • Vacuum Circuit Breakers & Switchgear Safety Aspects • Vacuum Circuit Breakers & Switchgear Safe Operation
1130 - 1230	DC Circuit Breakers & Switchgear Construction • Methods of Interruption
1230 - 1245	Break
1245 - 1420	DC Circuit Breakers & Switchgear (cont'd) Application • Construction & Operation
1420 - 1430	Recap
1430	End of Day Three

Day 4: Wednesday, 16th of July 2025

0730 - 0930	Modern SF6 CB & Switchgear up to 33kV Basic Features of SF6 Switchgear • Dielectric Properties of SF6 • Quenching Properties of SF6 • Construction of SF6 Switchgear • SF6 CB Types • Puffer Type SF6 Breakers • Double Pressure System • Single Pressure Puffer-Piston System • Single Pressure Self Blast System • Improvement in SF6 Breakers for HV • SF6 Circuit Breakers & Switchgear Safety Aspects • SF6 Circuit Breakers & Switchgear Safe Operation
0930 - 0945	Break
0945 - 1045	132kV GIS Basic Features of SF6 Switchgear 132kV GIS • Current Rating • Busbar & Connection Gas Chambers • Circuit Breakers & Operating Mechanism • Disconnectors & Earthing Switches
1045 - 1130	132kV GIS (cont'd) Interlocking, Auxiliary Switches & Contactors • Current Transformers & Voltage Transformers • Gas Handling Equipment • SF6 Circuit Breakers & Switchgear Safety Aspects • SF6 Circuit Breakers & Switchgear Safe Operation
1130 - 1230	220kV GIS Basic Features of SF6 Switchgear 220kV GIS • Current Rating • Busbar & Connection Gas Chambers • Circuit Breakers & Operating Mechanism • Disconnectors & Earthing Switches

1230 - 1245	Break
1245 - 1420	220kV GIS (cont'd) Interlocking, Auxiliary Switches & Contactors • Current Transformers & Voltage Transformers • Gas Handling Equipment • SF6 Circuit Breakers & Switchgear Safety Aspects • SF6 Circuit Breakers & Switchgear Safe Operation
1420 - 1430	Recap
1430	End of Day Four

Day 5: Thursday, 17th of July 2025

0730 - 0930	Switchgear Inspection, Maintenance & Services Inspection • General Inspection Technical Procedure • Daily Inspection of Circuit Breakers • Monthly Inspection of Circuit Breakers • Annual Inspection of Circuit Breakers • Disassembly • Cleaning • Tightening • Lubrication • Equipment Used in Testing • Testing Procedure • Direct Testing • Contact Resistance Test • Insulation Resistance Test • Test Report • Indirect Testing
0930 - 0945	Break
0945 - 1045	Switchgear Control, Protection & Testing Switchgears Control Devices & Wiring • Switchgears Protection Devices & Wiring
1045 - 1130	Switchgear Control, Protection & Testing (cont'd) Testing Classification • Testing Laboratories • Description of a Simple Testing Station
1130 - 1230	Switchgear Troubleshooting Low Insulation Resistance (Below 2000 Mega-ohms) between Phase Terminal & Earthed Frame with Breaker Closed & Phase Terminals of a Pole • Resistance between Terminals of Pole too High (Above 100 Microhms) (15 Micro-ohm per Joint) Contact Unequal Contact Wipe & Travel in 3-pole Measured from Top Surface of Interrupter Flange & the Contact Lip by a Simple Rod with Breaker Open & Breaker Closed
1230 - 1245	Break
1245 - 1345	Switchgear Troubleshooting (cont'd) One of the Pole Does Not Close • Breaker Operation too Slow during Opening Timing from Trip Command to Contact Separation Instant too Large (60 ms instead of say 40 ms)
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	End of Course

Simulators (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 our state-of-the-art “GE Multilin Relay 469” and “GE Multilin Relay 750”.



GE Multilin Relay 469 Simulator



GE Multilin Relay 750 Simulator

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org