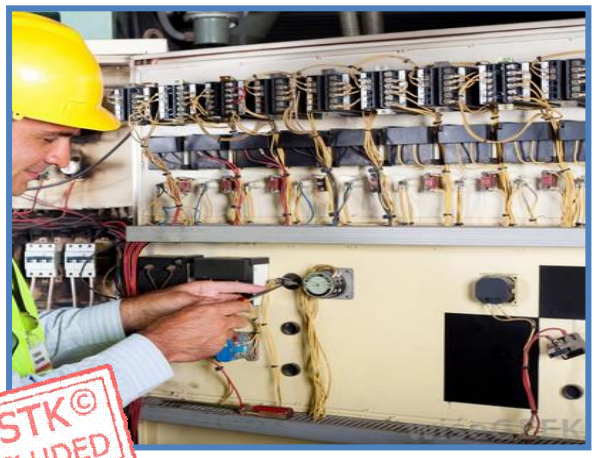
COURSE OVERVIEW EE0076(AL4)
LV/MV/HV Switchgear Operation & Maintenance

Course Title
LV/MV/HV Switchgear Operation & Maintenance

Course Date/Venue
October 12-16, 2025/Boardroom 2, Elite Byblos Hotel, Al Barsha, Sheikh Zayed Road, Dubai, UAE

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.

Accommodation

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

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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience in the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Water** & **Utilities**. He specializes in **Fire Fighting** System Instrumentations, **Fire Protection** System, **Fire & Gas Detection** & Alarm System, **Instrumentation Protection Devices** Maintenance & Testing, **Protection Devices** Troubleshooting, Water **Meter Calibration**, Liquid & Gas Flowmetering & **Meter Calibration**, **Testing & Calibration of Energy Meters**, **DCS & ESD** System Architecture, **Distributed Control System**, **DCS** & **SCADA**, Distributed Control System (**DCS**) Selection & Troubleshooting, Advanced **DCS Yokogawa**, **Yokogawa CENTUM VP DCS**, **Modern Distributed Control System** (**DCS**) **& Process Instrumentation**, **Cyber Security** of Industrial System, **DCS System** (**Honeywell**), **DCS Experion** System, **DCS Siemens Telepherm XP**, **Relay Coordination Using ETAP Software**, **Power System Study on ETAP**, **ETAP-Power System Analysis**, **Flow Measurement** Foundation, **Hydrocarbon** Measurement & Sampling, **Gas Dosiers** Preparation, **Gas/Liquid Fuel** Measurement, **Instrumentation Measurement & Control System**, **Flow** Measurement, **Pressure** Measurement, **Level & Temperature** Measurement, **Measurement Devices & Control System**, **Instrumentation & Control** Systems, **Control System** Orientation, Uninterruptible Power Supply (**UPS**) **Battery Charger**, **Industrial UPS Systems Construction & Operation**, **Test Lead-Acid & Ni-cad Battery Systems**, **Hazards & Safe Work Practice**s, **Transformer** Operational Principles, Selection & Troubleshooting; **HV & LV Transformers**, **Control Valves & Actuators**, **Electrical Safety**, **Protection Relay Application**, **Maintenance & Testing**, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces, Alerting Techniques, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, **Load Forecasting**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators**, **Generator Protection**, **GE Gas Turbines**, PLC, SCADA, DCS, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, SIS, SIL, ESD, **Alarm Management** Systems, **Energy** Management System, Engine Management System, Bearing & Rotating Machine, Fieldbus Systems and Fiber Optics Technology. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority** and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Instrumentation & Control Engineer**, **Fire Protection Engineer**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Instrumentation & Control Instructor**, **Project Coordinator**, **Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like **ETAP**, Load Management Concepts, **PLC** Programming, Installation, Operation and Troubleshooting, **AC Drives** Theory, Application and Troubleshooting, Industrial Power Systems Analysis, AC & DC **Motors**, Electric Motor **Protection**, **DCS SCADA**, **Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality** Standards, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer** and **Switchgear** Application, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics**, **Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD**, **Master's** & **Bachelor's** degree in **Electrical Engineering** from the **University of Wisconsin Madison**, **USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), an active member of IEEE and ISA as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability.

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, 12th of October 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	*Lunch & End of Day One*

Day 2: ***Monday, 13th of October 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	*Lunch & End of Day Two*

Day 3: ***Tuesday, 14th of October 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	*Lunch & End of Day Three*

Day 4: ***Wednesday, 15th of October 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	*Lunch & End of Day Four*

Day 5: ***Thursday, 16th of October 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	*Lunch & 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

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