COURSE OVERVIEW EE0382

ABB LV & MV Switchgears & Associated Equipment Operation, Maintenance, Testing, Troubleshooting & Protection

Course Title

ABB LV & MV Switchgears & Associated Equipment Operation, Maintenance, Testing, Troubleshooting & Protection

H-STK© INCLUDED

3.0 CEUs (30 PDHs) AWARD

Course Date/Venue

Session 1: February 08-12, 2026/Meeting Plus 9, City Centre Rotana, Doha, Qatar
Session 2: September 27-October 01, 2026/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference

EE0382

Course Duration/Credits

Four 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 participants with a detailed and up-to-date overview of ABB LV & MV switchgears and associated equipment operation, maintenance, testing, troubleshooting and protection. It covers the electrical hazards; the personnel protection; the energized work and de-energized and electrical switching practices; the fundamentals of ABB circuit breakers; and the switchgear details, circuit breakers control circuit and ABB protection relaying.

During this interactive course, participants will learn the ANN switchgear asset management, equipment register, switchgear diagnostic techniques, tripping device, maintenance and testing; the ABB LV/MV substation bus arrangement, incoming and outgoing circuits, current transformers and voltage transformers; the components of protection schemes; the numerical relays and ground potential rise during power system faults; the feeder overcurrent protection, distribution protection and breaker failure, bus protection, transformer protection, motor protection, power quality and distribution protection; and the ABB medium voltage fuses, current limiting switching device, ABB vacuum interrupters, medium voltage surge arrestors and ABB relay configuration.

Course Objectives

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

- Apply and gain an in-depth knowledge on ABB LV & MV switchgears and associated equipment operation, maintenance, testing, troubleshooting and protection
- Discuss electrical hazards covering electrical shock, electrical arc and blast
- Identify personnel protection covering rubber gloves/blanket, flash suits, eye protection, hard hats and explosion protection
- Differentiate energized work and de-energized work as well as apply electrical switching practices
- Recognize the fundamentals of ABB circuit breakers covering types of breakers, construction, ratings and trippings characteristics in a network context
- Describe switchgear details, circuit breakers control circuit and ABB protection relaying
- Carryout ANN switchgear asset management, equipment register, switchgear diagnostic techniques, tripping device, maintenance and testing
- Recognize ABB LV/MV substation bus arrangement, incoming and outgoing circuits, current transformers and voltage transformers
- Identify the components of protection schemes as well as discuss numerical relays and ground potential rise during power system faults
- Carryout feeder overcurrent protection, distribution protection and breaker failure, bus protection, transformer protection, motor protection, power quality and distribution protection
- Discuss ABB medium voltage fuses, current limiting switching device, ABB vacuum interrupters, medium voltage surge arrestors and ABB relay configuration

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 ABB LV & MV switchgears and associated equipment operation, maintenance, testing, troubleshooting and protection for engineers and technicians who are working with ABB LV & MV switchgears; for those who are responsible for designing and configuring ABB switchgear protection systems; and those who are responsible for isolating and correcting problems or performing basic maintenance on ABB LV & MV switchgear components.

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**. 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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with almost **30 years** of extensive experience within the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Utilities** industries. His experience widely covers in the areas of **Protection Relay Application**, **Maintenance & Testing**, **Information Confidentiality**, **Data Confidentiality** Classification, **IT Risk Management** Concepts, **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**, 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, 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**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **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** & **Bachelor** degrees 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 Fee

US$ 6,000 per Delegate. 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	*Registration & Coffee*
0800 – 0815	*Welcome and Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Electrical Hazards*** *Electrical Shock ● Electrical Arc ● Blast ● Accident Discussions*
0930 – 0945	*Break*
0945 – 1100	***Personnel Protection*** *Rubber Gloves/Blanket ● Flash Suits ● Eye Protection ● Hard Hats ● Explosion Protection*
1100 – 1215	***Energized Work*** *Policies & Procedures ● Recognition ● Work Zones (Controlled Areas) ● Work Clearances ● Planning a Job ● Proper Tools*
1215 – 1230	*Break*
1230 – 1330	***De-Energized Work*** *Policies & Procedures ● Voltage Detection Equipment ● Lock & Tag Out ● Grounds/Grounding ● Personal Grounds*
1330 – 1420	***Electrical Switching Practices*** *Loads ● Transformers ● Capacitors ● Air Switches*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Fundamentals of ABB Circuit Breakers*** *Types of Breakers & Construction ● Ratings & Tripping Characteristics Switchgear in a Network Context ● SF6 & Vacuum CB ● Operating Mechanisms*
0930 – 0945	*Break*
0945 – 1100	***Switchgear Details*** *Ratings Ur, Ik, Ip, Va ● Degree of Protection ● Service Conditions ● Ancillary Equipment ● The ABB Medium Voltage Switchgear Using either Vacuum or SF6 Circuit Breakers*
1100 – 1230	***Circuit Breakers Control Circuit*** *Control System Structure & Instrument Transformers ● Current & Voltage Transformers ● Panels, Signaling & Interlocking ● Typical Connection Diagrams ● Primary & Back-up Relaying ● Fault Calculation ● Circuit Breakers Characteristics ● Selectivity, Sensitivity & Speed ● Reliability*

1230 – 1245	Break
1245 – 1330	***ABB Protection Relaying*** Setting or Protection ● Fault Clearance ● Redundant Control Circuits
1330 – 1420	***ANN Switchgear Asset Management*** Equipment Register ● CBM & RCM Process ● Switchgear Diagnostic Techniques ● Tripping Device, Maintenance & Testing
1420 – 1430	***Recap***
1430	Lunch & End of Day Two

Day 3

0730 – 0930	***ABB LV/MV Substation Bus Arrangement, Incoming & Outgoing Circuits*** Automatic Switching During Normal or Abnormal Conditions ● Bus Protection & Circuit Breaker System ● Breaker Failure Relay & Zone Selection Logic
0930 – 0945	Break
0945 – 1100	***Current Transformers & Voltage Transformers*** Various Types of C.T.'s V.T.'s & C.V.T.'s ● Theory & Characteristics of C.T.'s ● Application Requirements of C.T.'s for Protective Relaying ● Accuracy Classifications ● Future Trends in C.T. Design Using Optics ● Testing of C.T.'s & V.T.'s
1100 – 1230	***Components of Protection Schemes*** Fault Detecting Relays ● The Transition from Electro-Mechanical Relays to Electronic & Digital Microprocessor-Based Relays ● Tripping Relays & Other Auxiliary Relays ● The Application of Programmable Logic Controllers ● Circuit Breakers – Bulk-Oil, Air-Blast, Vacuum & SF_6
1230 – 1245	Break
1245 – 1330	***Numerical Relays*** Hardware Architecture of ABB Numerical Relays ● Digital Signal Processors ● Modern Microprocessor-Based Relays ● Optical Communications ● Review Types of Available ABB Protection Relays
1330 – 1420	***Ground Potential Rise During Power System Faults*** Step Voltage, Touch Voltage & Mesh Voltage ● Tolerable Limits of Body Currents During Power System Faults ● Calculation of Allowable Step & Touch Potentials
1420 – 1430	***Recap***
1430	Lunch & End of Day Three

Day 4

0730 – 0930	***Feeder Overcurrent Protection*** Protective Relaying Requirements for Radial Systems ● Protective Relaying Requirements for Ringl Systems
0930 – 0945	Break
0945 – 1100	***Distribution Protection & Breaker Failure*** Distribution Systems ● Selective Coordination ● Protection Zones & Reach ● Minimizing Customer Impact ● Symmetrical Components Review
1100 – 1230	***Bus Protection*** Types of Bus Protection Schemes ● Basic Concept of Differential Protection ● Application to Various Bus Configurations ● Application of High Impedance Relays ● Relay Setting Criteria ● Testing of Bus Protection Schemes
1230 – 1245	Break

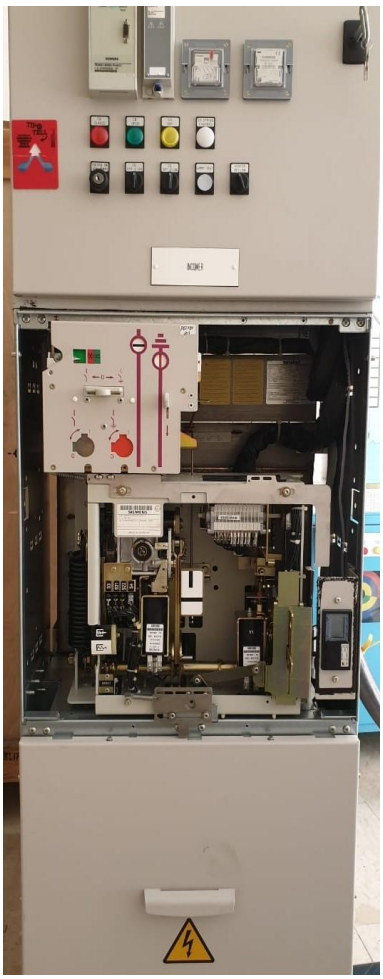
1245 – 1420	***Transformer Protection*** *Basic Theory of Transformers ● Types of Transformers & Applications ● Main Electric Characteristics & Vector Group ● Built-on Protections (Buchholz Relay, Overpressure, Oil & Winding Temperature) ● Transformer Differential Protection (Principle & Application) ● Overcurrent Protection ● Practical Examples*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

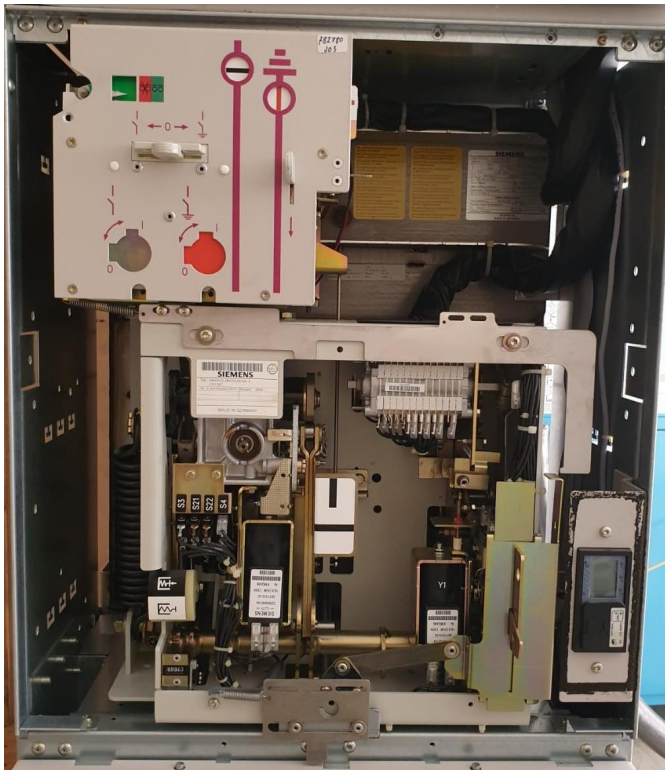
Day 5

0730 – 0930	***Motor Protection*** *Motor Data Requirements ● Common Types of Faults (Electrical & Mechanical) ● Motor Controllers & Starters ● Overcurrent (Phase-to Earth & Phase-to-Phase Short-Circuit) & Thermal Overload Protection ● Negative Phase Sequence, Phase Unbalance & Phase Reversal Protections ● Bearing Temperature, Winding Temperature, Vibration & Blocked Rotor Protections ● Practical Examples & Exercises*
0930 – 0945	*Break*
0945 – 1130	***Power Quality & Distribution Protection***
1130 – 1230	***ABB Medium Voltage Fuses, Current Limiting Switching Device, ABB Vacuum Interrupters & Medium Voltage Surge Arrestors***
1230 – 1245	*Break*
1245 – 1345	***Configure ABB Relay*** *Use the Input/Output Matrix ● Program the Default & Control Display ● Program Additional Logic ● Analyze Fault Records*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

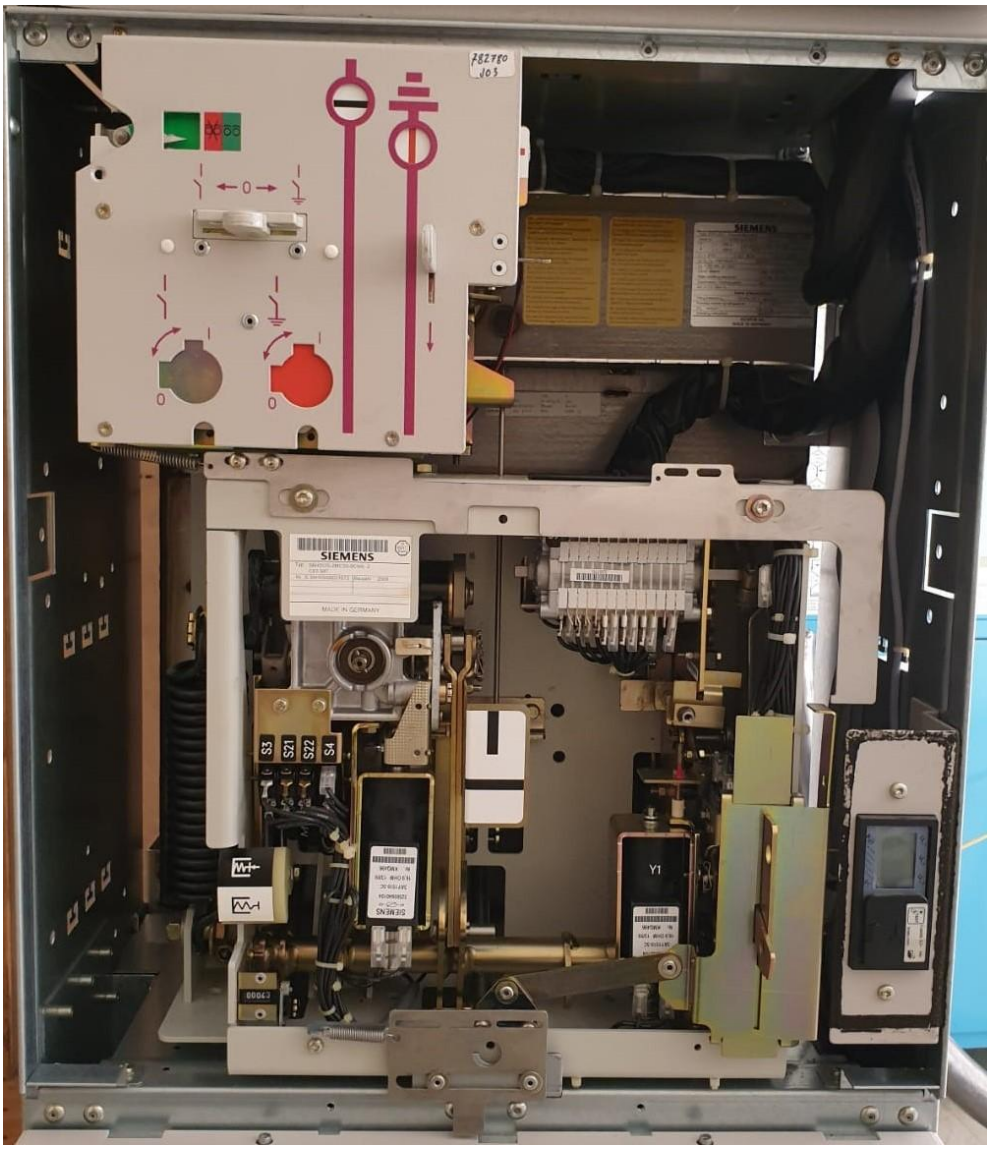
Simulators (Hands-on Practical Sessions)

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 “Switchgear Simulator”, “GE Multilin Relay 469” and “GE Multilin Relay 750”.





Switchgear Simulator



Switchgear Simulator

GE Multilin Relay 469 Simulator

GE Multilin Relay 750 Simulator

Course Coordinator

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