



COURSE OVERVIEW EE0382-4D

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

Course Title

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

Course Date/Venue

July 15-18, 2024/Nakheel Meeting Room, Royal Rose Hotel, Abu Dhabi, UAE

Course Reference

EE0382-4D

Course Duration/Credits

Four days/2.4 CEUs/24 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, sample video clips of the instructor’s actual lectures & practical sessions during the course 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


Certificates are accreditation 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 Fee

US\$ 4,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.



Course 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. Mike Tay, PhD, MSc, BSc, is a Senior Electrical, Instrumentation & Communications Engineer with over 40 years of extensive experience. His expertise widely covers in HV Switchgear Operation & Maintenance, HV/LV Equipment, High Voltage Electrical Safety, LV & HV Electrical System, HV Equipment Inspection & Maintenance, LV Distribution Switchgear & Equipment, Circuit Breaker, Motor Protection, Electric Motors, Power Generation Operation & Control, Power System Generation and Distribution, Power System Protection & Relaying, Modern Power System Protective Relaying, Protection Relay Maintenance, Cable & Over Head Line, Electrical Drawing, Electrical, Distribution Networks, Electrical Forecasting, Protective Devices Troubleshooting, Protective Devices Testing & Maintenance, Uninterruptible Power Supply (UPS) Design, Industrial UPS Systems & Battery Power Supplies Maintenance & Troubleshooting, UPS & Battery System, Battery & Battery Charger & UPS and Measurement Devices, UPS System & Battery Chargers Maintenance & Troubleshooting, UPS & Battery Design, Operation, Maintenance & Troubleshooting, UPS Operation & Alarm Panel Reading, Application & Testing, System Analysis, Power System Faults, Protection Scheme Components, Current & Voltage Transformers, Power System Neutral Grounding, Feeder Overcurrent Protection, Electrical Protection Systems, Bus Protection, Starting & Control, Transformer Protection, Generator Protection, Capacitor Protection, Numerical Relays, SCADA Security, ESD System Analysis & Control, Electrical & Instrumentation, Installation & Inspection, Custody Measurement, Loss Control for Petroleum Products, Process Control & Instrumentation, Fiber Optics Access Network Planning, Safety Instrumented System (SIS), Safety Integrity Level (SIL), PLC Design, Power System, Power Supply Design Management, Basic Electronics & Transformers, Diesel Generator, Electrical Fundamentals, Basic Electricity & Electrical Codes. Further, he is also well-versed in Communications, Telecommunications, Mobile Protocols, 4G LTE, GSM/UMTS, CMDA2000, WIMAX Technology, HSPA+, Alarm Management System, Computer Architecture, Logic & Microprocessor Design, Embedded Systems Design plus Computer Networking with CISCO, Network Communication, Industrial Digital Communication, Designing Telecommunications Distribution System, Electrical Engineering, WiMAX Broadband Wireless System, TT Intranet & ADSL Network, TT Web & Voicemail, Off-site ATM Network, IT Maintenance, Say2000i, IP Phone, National Address & ID Automation, Electricity Distribution Network, Customs Network & Maintenance, LAN & WAN Network, UYAP Network, Network Routing Protocols, Multicast Protocols, Network Management Protocols, Mobile & Wireless Networks and Digital Signal Processing. Currently, he is the Technical Advisor of Izmir Altek.

During his career life, Dr. Tay worked with various companies such as the **KOC Sistem, Meteksan Sistem, Altek BT, Yasar University, Dokuz Eylul University, METU** and occupied significant positions like the **Aegean Region Manager, Group Leader, Technical Services Manager, Field Engineer, Research Assistant, Instructor, Technical Advisor** and the **Dr. Instructor**.

Dr. Tay has **PhD, Master's and Bachelor's** degree in **Electrical & Electronic Engineering** from the **Dokuz Eylul University** and the **Middle East Technical University (METU)** respectively. Further, he is a **Certified Instructor/Trainer, Technical Trainer (Australia), Trainer for Data-Communication System (England & Canada), a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)**, a **Certified CISCO (CCSP, CCDA, CCNP, CCNA, CCNP) Specialist, a Certified CISCO IP Telephony Design Specialist, CISCO Rich Media Communications Specialist, CISCO Security Solutions & Design Specialist and Information Systems Security (INFOSEC) Professional**. He has delivered and presented innumerable training courses and workshops worldwide.





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, 15th of July 2024

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 – 1130	Energized Work Policies & Procedures • Recognition • Work Zones (Controlled Areas) • Work Clearances • Planning a Job • Proper Tools
1130 – 1200	De-Energized Work Policies & Procedures • Voltage Detection Equipment • Lock & Tag Out • Grounds/Grounding • Personal Grounds
1200 – 1230	Electrical Switching Practices Loads • Transformers • Capacitors • Air Switches
1230 – 1245	Break
1245 – 1420	Fundamentals of ABB Circuit Breakers Types of Breakers & Construction • Ratings & Tripping Characteristics Switchgear in a Network Context • SF6 & Vacuum CB • Operating Mechanisms
1420 – 1430	Recap
1430	Lunch & End of Day One

Day 2: Tuesday, 16th of July 2024

0730 – 0930	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
0930 – 0945	Break
0945 – 1100	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
1100 – 1130	ABB Protection Relaying Setting or Protection • Fault Clearance • Redundant Control Circuits
1130 – 1200	ANN Switchgear Asset Management Equipment Register • CBM & RCM Process • Switchgear Diagnostic Techniques • Tripping Device, Maintenance & Testing
1200 – 1230	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



1230 – 1245	Break
1245 - 1420	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
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3: Wednesday, 17th of July 2024

0730 – 0930	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
0930 – 0945	Break
0945 – 1100	Numerical Relays Hardware Architecture of ABB Numerical Relays • Digital Signal Processors • Modern Microprocessor-Based Relays • Optical Communications • Review Types of Available ABB Protection Relays
1100 – 1130	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
1130 – 1200	Feeder Overcurrent Protection Protective Relaying Requirements for Radial Systems • Protective Relaying Requirements for Ringl Systems
1200 - 1230	Distribution Protection & Breaker Failure Distribution Systems • Selective Coordination • Protection Zones & Reach • Minimizing Customer Impact • Symmetrical Components Review
1230 – 1245	Break
1245 – 1420	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
1420 – 1430	Recap
1430	Lunch & End of Day Three

Day 4: Thursday, 18th of July 2024

0730 – 0830	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
0830 – 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

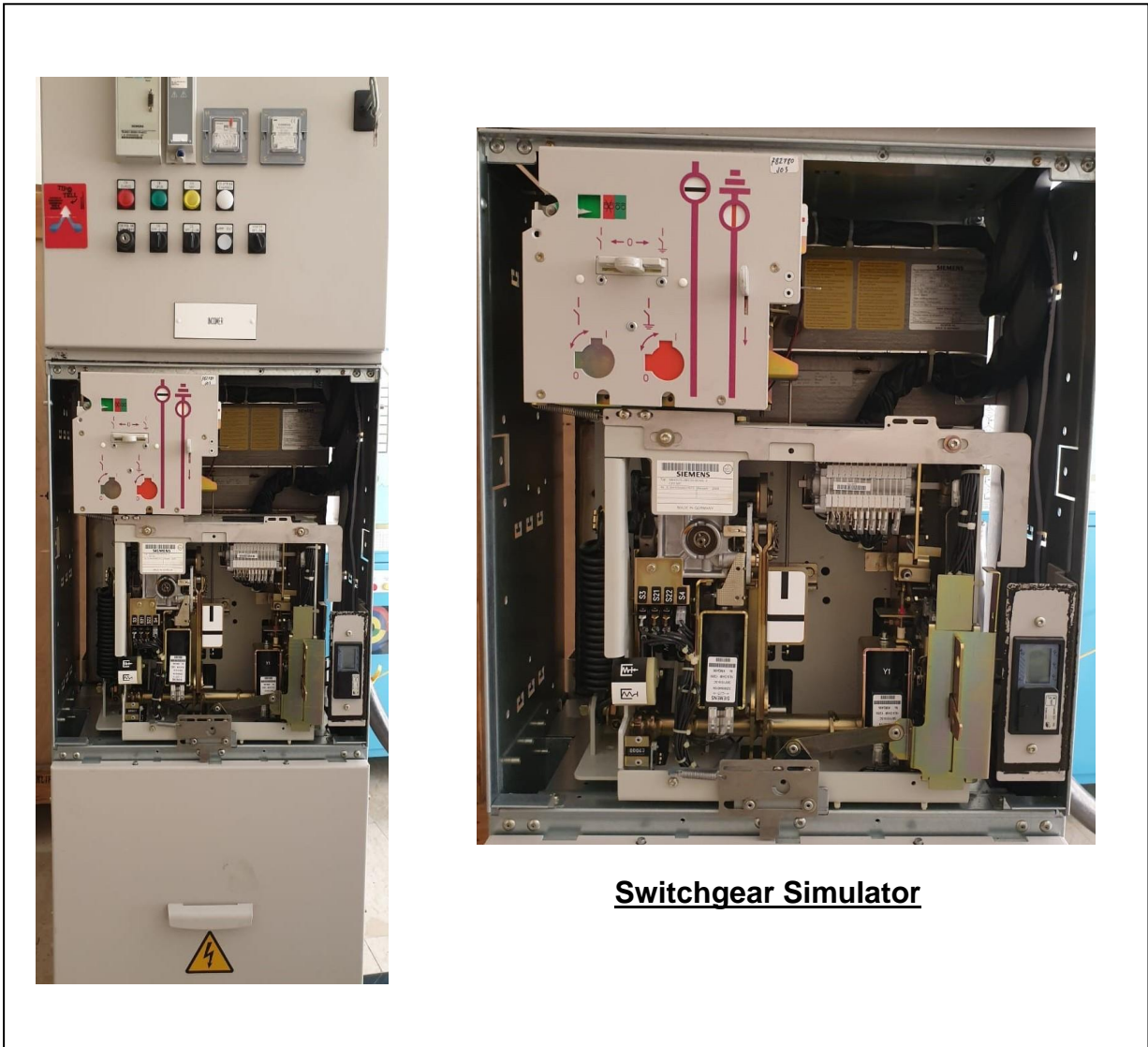


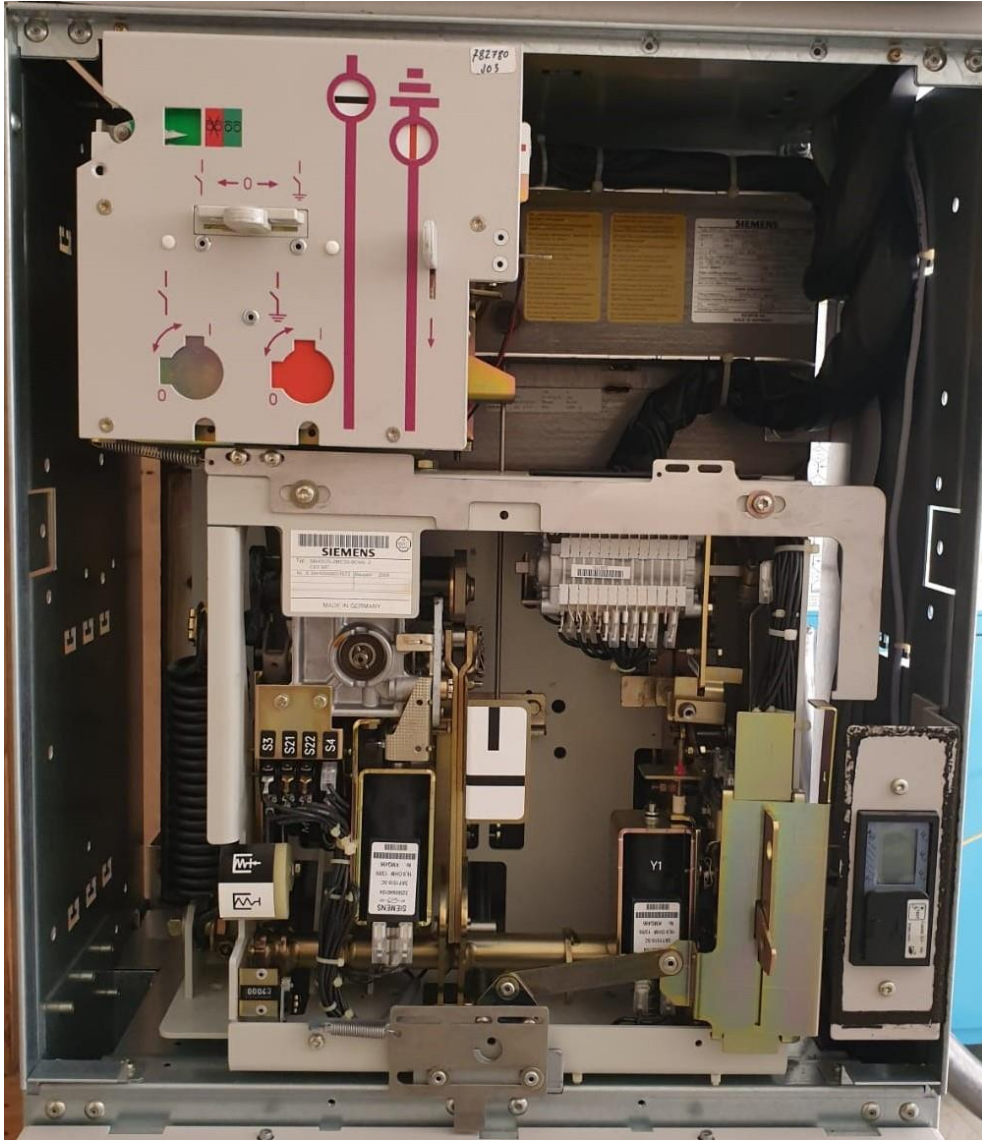
0945 – 1130	Power Quality & Distribution Protection
1130 – 1230	ABB Medium Voltage Fuses, Current Limiting Switching Device, ABB Vacuum Interrupters & Medium Voltage Surge Arrestors
1230 – 1245	Break
1245 – 1345	Configure ABB Relay Use the Input/Output Matrix • Program the Default & Control Display • 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



GE Multilin Relay 469 Simulator



GE Multilin Relay 750 Simulator

Course Coordinator

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