



COURSE OVERVIEW EE0060-IH **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

As per proposal/NMDC Training Center, Abu
Dhabi, UAE and Online Virtual Training

Course Reference

EE0060-IH

Course Duration/Credits

Five days/3.25 CEUs/32.5 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 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

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 Fee

As per proposal

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.

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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 **3.25 CEUs** (Continuing Education Units) or **32.5 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.

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.

Virtual Training (If Applicable)

If this course is delivered online as a Virtual Training, the following limitations will be applicable:-

Certificates	Only soft copy certificates will be issued to participants through Haward's Portal. This includes Wallet Card Certificates if applicable
Training Materials	Only soft copy Training Materials (PDF format) will be issued to participant through the Virtual Training Platform
Training Methodology	80% of the program will be theory and 20% will be practical sessions, exercises, case studies, simulators or videos
Training Program	The training will be for 4 hours per day starting at 0930 and ending at 1330
H-STK Smart Training Kit	Not Applicable
Hands-on Practical Workshops	Not Applicable
Site Visit	Not Applicable
Simulators	Only software simulators will be used in the virtual courses. Hardware simulators are not applicable and will not be used in Virtual Training

Course Instructor(s)

Subject to availability, one of the following instructors will conduct the course:-



(1) **Mr. Sydney Thoresson, PE, BSc**, is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience within the **Petrochemical, Utilities, Oil, Gas and Power** industries. His specialization highly evolves in **Process Control Instrumentation, Process Instrumentation & Control, Process Control, Instrumentation, Troubleshooting & Problem Solving, Instrumentation Engineering, Process Control (PCI) & Safeguarding, Instrument Calibration & Maintenance, Instrumented Safety Systems, High Integrity Protection Systems (HIPS), Process Controller, Control Loop & Valve Tuning, Compressor Control & Protection, Control Systems, Programmable Logic Controllers (PLC),**



SCADA System, PLC & SCADA - Automation & Process Control, **PLC & SCADA** Systems Application, Technical **DCS/SCADA, PLC-SIMATIC S7 300/400**: Configuration, Programming and Troubleshooting, **PLC, Telemetry and SCADA** Technologies, Cyber Security of Industrial Control System (**PLC, DCS, SCADA & IED**), Basics of **Instrumentation Control System, DCS, Distributed Control System** - Operations & Techniques, Distributed Control System (**DCS**) Principles, Applications, Selection & Troubleshooting, Distributed Control Systems (**DCS**) especially in **Honeywell DCS, H&B DCS, Modicon, Siemens, Telemecanique, Wonderware and Adroit**, Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Emergency Shutdown** System, Variable Frequency Drive (**VFD**), **Process Control & Safeguarding, Field Instrumentation, Instrumented Protective Devices** Maintenance & Testing, Instrumented Protective Function (**IPF**), **Refining & Rotating Equipment, Equipment Operations, Short Circuit Calculation, Voltage Drop Calculation, Lighting Calculation, Hazardous Area Classification, Intrinsic Safety, Liquid & Gas Flowmetering, Custody Measurement, Ultrasonic Flowmetering, Loss Control, Gas Measurement, Flowmetering & Custody Measurement, Multiphase Flowmetering, Measurement and Control, Mass Measuring System Batching (Philips), Arc Furnace Automation-Ferro Alloys, Walking Beam Furnace, Blast Furnace, Billet Casting Station, Cement Kiln Automation, Factory Automation and Quality Assurance Accreditation (ISO 9000 and Standard BS 5750)**. Further, he is also well-versed in **Electrical Safety, Electrical Hazards Assessment, Electrical Equipment, Personal Protective Equipment, Log-Out & Tag-Out (LOTO), ALARP & LOPA Methods, Confined Workspaces, 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 and Generator Protection**. He is currently the **Projects Manager** wherein he manages projects in the field of electrical and automation engineering and in-charge of various process hazard analysis, fault task analysis, FMEA and HAZOP study.

During Mr. Thoresson's career life, he has gained his thorough and practical experience through various challenging positions and dedication as the **Contracts & Projects Manager, Managing Director, Technical Director, Divisional Manager, Plant Automation Engineer, Senior Consulting Engineer, Senior Systems Engineer, Consulting Engineer, Service Engineer and Section Leader** from several international companies such as **Philips, FEDMIS, AEG, DAVY International, BOSCH, Billiton and Endress/Hauser**.

Mr. Thoresson is a **Registered Professional Engineering Technologist** and has a **Bachelor's degree in Electrical & Electronics Engineering** and a **National Diploma in Radio Engineering**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and an active member of the **International Society of Automation (ISA)** and the **Society for Automation, Instrumentation, Measurement and Control (SAIMC)**. He has further delivered numerous trainings, courses, seminars, conferences and workshops worldwide.



OR,



(2) **Mr. Pan Marave, PE, MSc, BEng**, is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience in **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise includes **CEMS Operations and Maintenance, ABB 11KV Distribution Switchgear, Operation & Maintenance of Rotork make MOVS, Maintaining Instrument Air Compressors, Circuit Breaker, HV Switchgear Maintenance, HV/LV Electrical Authorisation, Basic Electricity, Electrical & Special Hazards, Personnel Protection, HV/LV Equipment, Motor Controllers, Electrical Switching Practices, Emergency Planning, Safety Management, Safety Instrumented Systems (SIS), Safety Integrity Level (SIL), Emergency Shutdown (ESD); DCS, SCADA & PLC; Measurement (Flow, Temperature, Pressure); Process Analyzers & Analytical Instrumentation; Process Control, Instrumentation & Safeguarding; Process Controller, Control Loop & Valve Tuning; Industrial Distribution Systems; Industrial Control & Control Systems, Power Systems Protection & Relaying; Earthing, Bonding, Grounding, Lightning & Surge Protection; Electric Power Substation & Systems; Electrical Engineering Principles; Motor Control Circuit; Electrical Fault Analysis; Electrical Networks & Distribution Cables; Circuit Breakers, Switchgears, Transformers, Hazardous Areas Classification and Detailed Engineering Drawings, Codes & Standards**. Furthermore, he is also well-versed in Microprocessors Structure, Lead Auditor (**ISO 9000:2000**), **ISO 9002**, Quality Assurance, and Projects & Contracts Management.

Presently, Mr. Marave is the **Technical Advisor** of **Chamber of Industry & Commerce** in Greece. Prior to this, he gained his thorough practical experience through several positions as the **Technical Instructor, Engineering Manager, Electronics & Instruments Head, Electrical, Electronics & Instruments Maintenance Superintendent, Assistant General Technical Manager** and **Engineering Supervisor** of various international companies such as the **Alumil Mylonas, Athens Papermill, Astropol** and the **Science Technical Education**.

Mr. Marave is a **Registered Professional Engineer** and has **Master** and **Bachelor** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York** and **Pratt Institute of New York (USA)** respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and an active member of the **Technical Chamber** and the **Institute of Electrical and Electronics Engineer (IEEE)** in Greece. He has presented and delivered **numerous international** courses, conferences, trainings and workshops worldwide.

OR,



(3) **Mr. Herman Eksten, PE, PgDiP**, is a **Senior Electrical Engineer** with over **30 years** of extensive experience within the **Petrochemical, Oil & Gas** and **Power** industries specializing in **Electrical Safety, Certified HV Electrical Safety, Low Voltage Electrical Safety, Electrical Circuits: Series and Parallel Connection, Electrical Faults & Protective Devices, Risk Control Methods, LOTO – Breakers Operation in Electricity Substation, LOTO Principles and Procedures**,





Arc Flash Risk Assessment, Safety in Power Electronic Equipment & Lasers, Circuit Breakers & Switchgears, Switchgear Assets Management, Circuit Breakers Control Circuits, Substation Maintenance Techniques, High Voltage Operation, Electrical Protection, Overhead Lines & Substation, Power Supply, High Voltage Substation, Electrical Protection Design, Earthing & Lightning Protection Design, Underground Equipment, Distribution Network Maintenance & Construction, Transformers Operation & Maintenance, Electric Power System, Power Plant Management, Substation Commissioning & Troubleshooting, Cable Splicing & Termination, Electrical Installation & Maintenance, Power Generation Operation & Control, Switchgear Life Assessment, Structured Cabling, Electric Power System, Power System Stability, Power System Planning & Economics, Power Flow Analysis, Combined Cycle Power Plant, UPS & Battery System, Variable Speed Drives, and HV Motors & Transformers. He is currently the **Lead Electrical Engineer** of **SNC-LAVALIN** wherein he is responsible for basic designs and successful implementation of electrical engineering to plant overhead lines and substations.

During his career life, Mr. Eksten held various positions such as the **Lead Electrical Engineer, Operations Manager, Project Engineer, Technical Specialist, Customer Executive, District Manager, Electrical Protection Specialist, High-Voltage Operator** and **Apprentice Electrician** for FOX Consulting, UHDE (ThyssenKrupp Engineering), TWP Projects/Consulting (EPMC-Mining), ISKHUS Power, Rural Maintenance (PTY) Energia de Mocambique Lda., Vigeo (PTY) Ltd and ESKOM.

Mr. Eksten is a **Registered Professional Engineering Technologist** and has a Postgraduate Diploma in Management Development Programme and a National Higher Diploma (NHD) in Electrical Power Engineering. Further, he is a **Certified Instructor/Trainer**, a Senior member of the South African Institute Electrical Engineers (**SAIEE**) and holds a Certificate of Registration Membership Scheme from the Engineering Council of South Africa (**ESCA**). He has further delivered numerous trainings, courses, seminars, workshops and conferences internationally.

OR,



(4) **Mr. Fred Du Plessis** is a **Senior Electrical Engineer** with over **30** 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.

OR,



(5) **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 Utilities**. He specializes in **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 Teleperm 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 Practices, 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, 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, Instrumentation & Control 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 & 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**.

OR,



(6) Dr. Alaa Abdel Kerim, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience in **Electrical Safety**, **HV Cable Design**, **Cable Splicing & Termination**, **Cable Jointing Techniques**, **High Voltage Electrical Safety**, **Electrical Drawing & Schematics**, **Electrical Power**, **Electrical Wiring**, **Machines**, **Transformers**, **Motors**, **Power Stations**, **Substation Site Inspection**, **HV/MV Cable Splicing**, **High Voltage Circuit Breaker Inspection & Repair**, **Cable & Over Head Power Line**, **High Voltage Power System Safe Operation**, **High Voltage Safety**, **High Voltage Transformers**, **Safe Operation of High Voltage & Low Voltage Power Systems**, **Fundamentals of Electricity**, **Electrical Standards**, **Practical High Voltage Safety Operating Procedures**, **Modern Power System Protective Relaying**, **Electrical & Control System Testing**, **Design**, **Commissioning**, **Operation and Maintenance of Switchgears**, **Transformers**, **Substations**, **Medium & High Voltage Equipment and Circuit Breakers**, **Electrical Motors & Variable Speed Drives**, **Power System Equipment**, **Distribution Network System**, **Electric Distribution System Equipment**, **Practical Troubleshooting of Electrical Equipment & Control Circuits**, **Electrical & Control System Testing & Commissioning**, **LV/MV/HV Circuit Breakers Inspection & Maintenance**, **Electrical Power Substation Maintenance**, **Power Stations**, **Uninterruptible Power Systems (UPS)**, **Battery Chargers** and **AC & DC Transmission**, **DCS**, **PLC**, **SCADA**, **Siemens SIMATIC S7 Maintenance & Configuration**, **Siemens Simatic S7 PLC**, **Siemens WINCC**, **Siemens SIMATIC & WinCC**, **Siemens**, **PLC Simatic S7-400/S7-300/S7-200**, **HMI**, **Automation System**, **Process Control & Instrumentation**, **Hydrocarbon**, **Level & Flow Measurements**, **Analytical Instrumentation**, **Find Control Elements**, **Control Loop Operation**, **Data Acquisition & Transmission**, **Electronics Technology**, **Power Systems Control**, **Power Systems Security**, **Power Transmissions**, **Power Generation**, **Electrical Substations** and **MV/LV Electrical System**.

During his career life, Dr. Alaa has been practically and academically involved in different **Power System** and **Instrumentation international companies** and **Universities** as a **Senior Professor & Consultant**, **Instrumentation Engineer** and **Electrical Engineer**. His recent practical applications experience includes the design, supply, installation, operation of full **DCS**, **SCADA**, **PLC**, **HMI Automation System** for **Sumid Line Petroleum**, **Siemens USA**, **AREVA USA** to name a few. His experience also includes electrical coordination, protection level adjustments and electrical testing.



Dr. Alaa has a **PhD** degree in **Electrical Engineering** from the **Technical University of Gdansk, Poland** and has **Master** and **Bachelor** degrees in **Electrical Machine & Power Engineering** from **Cairo University** and **Helwan University**, respectively. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings and workshops worldwide.

OR,



(7) **Mr. Ahmed Abozeid** is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of **Onshore & Offshore** experience within the **Oil & Gas** and **Power** industries. His wide expertise covers **HV Cable Design, Cable Splicing & Termination, Cable Jointing Techniques, High Voltage Electrical Safety, HV/MV Cable Splicing, High Voltage Circuit Breaker Inspection & Repair, High Voltage Power System Safe Operation, High Voltage Safety, High Voltage Transformers, Safe Operation of High Voltage & Low Voltage Power Systems, Electric Distribution System Equipment, ABB 11KV Distribution Switchgear, Rotork Operation & Maintenance, Power System Protection and Relaying, Electrical Motors & Variable Speed Drives, Motor Speed Control, Power Electronic Converters, Control Valve, Flowmetering & Custody Transfer, Meters Calibration, Installation & Inspection, Crude Metering & Measurement Systems, Flow Meter Maintenance Troubleshooting, AC Converters Section, Electromagnetic Compatibility (EMC), Motor Failure Analysis & Testing, Machinery Fault Diagnosis, Bearing Failure Analysis Process Control & Instrumentation, Process Control Measurements, Control System Commissioning & Start-Up, Control System & Monitoring, Power Station Control System, Instrumentation Devices, Process Control & Automation, PID Controller, Distributed Control Systems (DCS), Programmable Logic Controllers (PLC), ABB PLC & DCS System, Gas Analyzers, Simulation Testing, Load Flow, Short Circuit, Smart Grid, Vibration Sensors, Cable Installation & Commissioning, Calibration Commissioning and Site Filter Controller. Further, he is also well-versed in **Fundamentals of Electricity, Electrical Standards, Electrical Power, PLC, Electrical Wiring, Machines, Transformers, Motors, Power Stations, Electro-Mechanical Systems, Automation & Control Systems, Voltage Distribution, Power Distribution, Filters, Automation System, Electrical Variable Speed Drives, Power Systems, Power Generation, Power Transformers, Diesel Generators, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers and AC & DC Transmission**. He is currently the **Project Manager** wherein he manages, plans and implements projects across different lines of business.**

Mr. Ahmed worked as the **Electrical Manager, Electrical Power & Machine Expert, Electrical Process Leader, Team Leader, Electrical Team Leader, Technical Instructor**, and **Instructor/Trainer** from various companies such as the **Lafarge Nigeria, Egyptian Cement Company, ECC Training Center, Alrajhi Construction & Building Company and Ameria Cement Company**, just to name a few.

Mr. Ahmed has a **Bachelor's** degree in **Electrical Engineering**. Further, he is a **Certified Instructor/Trainer, Certified TQUK Level 3 Vocational Achievement (RQF) Assessor** and has delivered numerous trainings, seminars, courses, workshops and conferences internationally.

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

Day 2

0730 – 0930	Switchgear Asset Management Equipment Register • CBM and RCM Process • Switchgear Diagnostic Techniques • Tripping Devices & Maintenance & Testing
0930 – 0945	Break
0945 – 1130	Circuit Breakers Control Circuits Philosophy, Types & Application of Protective Relays • Control System Structure, Instrument Transformers • Current & Voltage Transformers • Panels, Signalling, Interlocking
1130 – 1230	Circuit Breakers Control Circuits (cont'd) Typical Connection Diagrams • Primary & Back-up Relaying • Fault Calculation • System Earthing • Circuit Breakers Characteristics • Selectivity, Sensitivity, Speed • Reliability
1230 – 1245	Break
1245 – 1420	Circuit Breakers Control Circuits (cont'd) Evaluation of Protection Relaying • Setting of Protection • Fault Clearance • Redundant Control Circuits
1420 – 1430	Recap
1430	End of Day Two

Day 3

0930 – 1015	Case Study Circuit Breaker Settings • Selectivity, Sensitivity, Speed
0930 – 0945	Break
0945 – 1130	Circuit Breaker Diagnostic Techniques Diagnostic Techniques



1130 – 1230	Switchgear Vital Equipments <i>Batteries Condition and Monitoring • Discussions</i>
1230 – 1245	<i>Break</i>
1245 – 1420	LV/MV/HV Substation Bus Arrangement, Incoming & Outgoing Circuits <i>Automatic Switching During Normal or Abnormal Conditions, Bus Protection & Circuit Breaker System • Bus Differential & Breaker Failure Relay, Zone Selection Logic & CT Requirements</i>
1420 – 1430	Recap
1430	<i>End of Day Three</i>

Day 4

0730 – 0930	Substation Maintenance Techniques <i>Description • Structures • Fuses, Arresters, Switches • Substation Compound • Switchgear Maintenance Practices • Metal Clad Switchgear • Maintenance Details</i>
0930 – 0945	<i>Break</i>
0945 – 1130	Substation Maintenance Techniques (cont'd) <i>Metal Clad Switchgear Maintenance Details • Discussions</i>
1130 – 1230	Substation Maintenance Techniques (cont'd) <i>Maintenance & Repair Fundamentals</i>
1230 – 1245	<i>Break</i>
1245 – 1420	Substation Maintenance Techniques (cont'd) <i>Maintenance & Repair Procedures</i>
1420 – 1430	Recap
1430	<i>End of Day Four</i>

Day 5

0730 – 0930	Maintenance Work Orders <i>Process Development</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Maintenance Work Orders (cont'd) <i>Procedures</i>
1100 – 1200	Maintenance Work Orders (cont'd) <i>Problems Encounters • Samples, Discussions</i>
1200 – 1215	<i>Break</i>
1215 – 1345	Fundamentals of Computerized Maintenance (CMMS)
1345 – 1400	Course Conclusion
1400 – 1415	POST-TEST
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>End of Course</i>



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

Who will Provide the Equipment/Software/Simulators
Haward Technology