COURSE OVERVIEW EE1036
Protection System for 32/132 KV Substations

Course Title
Protection System for 32/132 KV Substations

H-STK© INCLUDED

Course Date/Venue
Session 1: May 19-23, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: November 19-23, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

3.0 CEUs (30 PDHs) AWARD

Course Reference
EE1036

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

The electric power substation, whether generating station or transmission and distribution, remains one of the most challenging and exciting fields of electric power engineering. Recent technological developments have had tremendous impact on all aspects of substation design, operation, maintenance, safety, and grounding, testing and troubleshooting. A substation is a high – voltage electric system facility. It is used to switch generators, equipment, and circuits or lines in and out of a system. It is also used to change AC voltages from one level to another, and/or change alternating current to direct current or direct current to alternating current. Some substations are small with little more than a transformer and associated switches.

Others are very large with several transformers and dozens of switches and other equipment. Substations generally contain one or more transformers, and have switching, protection and control equipment.

In a large substation, circuits breakers are used to interrupt any short-circuit or overload currents that may occur on the network. Smaller distribution stations may use Autoreclosers or even fuses for protection of branch circuits.

A typical substation will contain line termination structures, high-voltage switchgear, one or more power transformers, low voltage switchgear, surge protection, controls, and metering. Other devices such as power factor correction capacitors and voltage regulators may also be located at substation.

This course will introduce you to the equipment that makes up an electric substation. It will explain how each type of equipment operates and guide you through the control and wiring diagrams that control equipment operation. At this course you will learn about the latest diagnostic testing techniques for assessing the condition of substation equipment such as transformers, circuit breakers, load tap changers, switches, and associated equipment. Knowledge of equipment condition allows you to target your maintenance efforts to reduce equipment failures and improve substation reliability. The course will show you how to apply predictive diagnostic testing to reduce equipment failures and extend equipment life.

Applying predictive maintenance (PdM) methods can reduce your costs and improve the performance of your maintenance program. This course will show you methods and case studies that illustrate how to incorporate these new methods and testing techniques to improve reliability and optimize your existing maintenance program. You will study the latest testing technologies and how to apply them to determine the condition of oil and gas insulated transformers, circuit breakers, and other electrical equipment. Learn how these modern techniques allow determination of equipment condition without taking the equipment out of service.

Electrical substation safety is an important issue in utility networks as well as large industrial installations and requires adequate attention in the stages of system planning, design, installation, operation and maintenance. A number of serious accidents including fatalities occur every year in industrial establishments due to accidents involving electricity, resulting in huge financial losses and wasted man-hours. In this course, we will take a look at the theoretical aspects of safety as well as the practical and statutory issues.

Good substation grounding is very important for effective relaying and insulation of equipment; but the safety of the personnel is the governing criterion in the design of substation grounding. It usually consists of a bare wire grid, lain in the ground; all equipment grounding points, tanks, support structures, fences, shielding wires and poles, and so forth, are securely connected to it. The grounding resistance is reduced enough that a fault from high voltage to ground does not create such high potential gradients on the ground, and from the structures to ground, to present a safety hazard. Good overhead shielding is also essential for outdoor substations, so as to virtually eliminate the possibility of lighting directly string the equipment. Shielding is provided by overhead ground wires stretched across the substation or tall grounded poles. This course will discuss how to maintain, test, and inspect a proper grounding system for the electrical power substation.

Course Objectives

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

- Apply and gain an advanced knowledge on EHV, HV and MV substation, arrangement, control protection and communication system
- Present the different types of high, extra-high and medium voltage electrical substations, configuration schemes used in power generation, transmission and distribution, application and technical economic comparison
- Design, install, commission, test, operate, control and maintain HV/MV substations in a professional manner
- Identify the various types of substations covering its parts, equipment and major components
- Recognize overcurrent protection for phase and earth faults as well as the recommended grading intervals
- Enumerate test requirements and component testing procedures
- Employ proper commissioning covering pre and cold commissioning, start-up, hot commissioning, start of production, performance test and acceptance of plant
- Carryout megger testing and substation grounding system
- Discuss the qualifications of testing organizational and personnel covering the division of responsibility and power system studies
- Recognize substation electrical equipment covering MCC, DB's, UPS preliminary function and block overview
- Illustrate medium voltage switchgear and oil circuit breakers
- Employ insulation testing and maintenance covering insulation-resistance meters and polarization of index

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 HV/MV substation for advanced technical staff who are involved in the design, installation, commissioning, maintenance, testing, control and operation of electrical substation equipment. This includes industrial, utility or plant engineers, maintenance supervisors, consulting engineers, electric utility engineers and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Ahmed Abozeid is a **Senior Electrical Engineer** with over **25 years** of **Onshore** & **Offshore** experience within the **Oil** & **Gas, Refinery**, **Petrochemical** and **Power** industries. His wide expertise covers **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**, Practical Troubleshooting of **Electrical Equipment & Control Circuits**, **Electrical & Control System** Testing & Commissioning, **LV/MV/HV Circuit Breakers** Inspection & Maintenance, Electrical **Power Substation** Maintenance, 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**, **Motor** Speed Control, Power Electronic Converters, 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 **Project Manager**, **Electrical Power & Machine Expert**, **Electrical Process Leader**, **Electrical Team Leader**, **Control Systems Engineer**, **Senior Instructor/Consultant**, **Technical Instructor/Consultant**, **Maintenance Engineer**, **Shift Engineer** and **Junior Engineer** 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**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), a **Recognized Consultant Engineer**, and has delivered numerous trainings, seminars, courses, workshops and conferences internationally.

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.

Accommodation

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

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	***Types of Substations***
0930 – 0945	*Break*
0945 – 1030	***Substations Parts & Equipment***
1030 – 1100	***Major Components***
1100 – 1230	***Overcurrent Protection for Phase & Earth Faults***
1230 – 1245	*Break*
1245 – 1420	***Recommended Grading Intervals*** *Relay Connections ● Earth Fault Protection ● Overcurrent Protection (Relay Connections, Residual Voltage, Sensitive Wattmetric Protection) ● Transformers Function*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Test Requirements*** *Division of Responsibility ● Power System Studies ● Test Report ● Test Instrument Calibration*
0830 – 0930	***Component Testing Procedures*** *Test Equipment Used (Instrumentation & Control Systems in the Process Industry: Specific Phases & Milestone)*

0930 – 0945	*Break*
0945 – 1100	***Commissioning*** *Pre-commissioning ● Cold Commissioning ● Start-up ● Hot Commissioning ● Start of Production ● Performance Test ● Acceptance of Plant ● Process Industry*
1100 – 1230	***Commissioning (cont'd)*** *General Preparations before Acceptance of Plant ● Completion of Erection ● Mechanical Checks & Tests ● Testing Procedures ● Cables ● High Potential Testing ● Procedure*
1230 – 1245	*Break*
1245 – 1420	***Megger Test*** *Bucholtz Relay ● Temperature Relay's ● Transformer Ratio Test ● Transformer Vector Test ● Positive Sequence Impedance Test (Short Circuit Test) ● Restricted Earth Fault*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Substation Grounding Systems*** *Reasons for Substation Grounding System ● Substation Earthing Calculation ● The Layout of the Substation ● Principle of Substation Layouts*
0930 – 0945	*Break*
0945 – 1100	***Substation Grounding Systems (cont'd)*** *Components of a Substation ● Understanding Electrical Drawings ● The Schematic Diagram (Main & Circuit) ● Racking & Routing*
1100 – 1230	***Substation Grounding Systems (cont'd)*** *Installation Detail ● Panel Layout ● Other Electrical Documents ● Standardization of Symbols ● Sample Schemetics*
1230 – 1245	*Break*
1245 – 1420	***Qualifications of Testing Organizational & Personnel*** *Division of Responsibility ● Power System Studies*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Substation Electrical Equipment*** *MCC*
0930 – 0945	*Break*
0945 – 1100	***Substation Electrical Equipment (cont'd)*** *DB's*
1100 – 1230	***Substation Electrical Equipment (cont'd)*** *UPS Preliminary Functions*
1230 – 1245	*Break*
1245 – 1420	***Substation Electrical Equipment (cont'd)*** *Block Overview*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Basic Fault Calculations*** *Need for Protection ● Faults, Types & Effects ● Simple Calculations of Short Circuits*
0930 – 0945	*Break*
0945 – 1100	***Medium Voltage Switchgear***
1100 – 1230	***Oil Circuit Breakers*** *Air Blast Circuit Breakers ● Operating Mechanisms ● SF6 & Vacuum Circuit Breakers ● SF6 Gas Analysis*
1230 – 1245	*Break*
1245 – 1345	***Insulation Testing & Maintenance*** *Insulation-Resistance Meters ● Polarization Index*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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