COURSE OVERVIEW EE0250

Electric Distribution System Equipment

TRANSFORMERS, SWITCHGEARS, CIRCUIT BREAKERS, RELAYS, CAPACITORS, SURGE ARRESTERS, CABLES & METERS: Installation, Operation, Testing, Optimization, Maintenance & Troubleshooting

Course Title

Electric Distribution System Equipment: TRANSFORMERS, SWITCHGEARS, CIRCUIT BREAKERS, RELAYS, CAPACITORS, SURGE ARRESTERS, CABLES & METERS: *Installation, Operation, Testing, Optimization, Maintenance & Troubleshooting*



Course Date/Venue

Session 1: January 31-February 04, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar
Session 2: July 25-29, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar



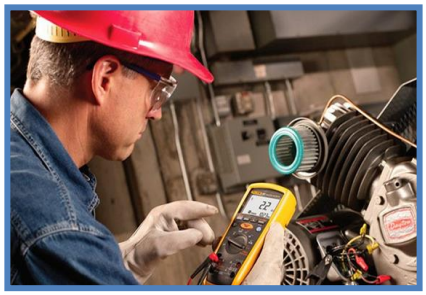
Course Reference

EE0250

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 utilizes lectures, student participation, videos, LCD slides, a workbook, and the International Electrical Testing Association (NETA) "Maintenance Testing Specifications." This course addresses the main elements of Electric Distribution Equipment Maintenance: safety; equipment and system principles and operation; inspection, test, evaluation, and maintenance procedures; and electrical maintenance programs.

Discussion of electric safety procedures includes safety awareness, minimum approach distances, care and use of personal protective equipment, lockout-tagout, safety grounding, step and touch potentials, and special hazards of electric power distribution equipment. This course covers electrical safety training as required by OSHA (Occupational Safety and Health Administration – USA) for qualified electrical workers.

The types of equipment and systems presented include cables and buses, switchgear circuit breakers, liquid-filled and cast-coil/dry-type transformers, instrument transformers, meters and protective relays, surge arresters, and capacitors.

Discussions include equipment operation and descriptions of the various inspection, testing, evaluation, and maintenance procedures available for the equipment and the test equipment and outage requirements for the various procedures.

The course will include references to British (BS), European (IEC), and United States (ANSI, IEEE, NEC) engineering standards. Participants are encouraged to bring their system single-line diagrams and recent problems for discussion during and after class. Practical electrical inspection, test, evaluation, and maintenance training based on NETA Maintenance Testing Specifications and the course instructor's 30 years experience in the electric power field will be presented.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on installation, operation, testing, optimization, maintenance and troubleshooting of electric distribution system equipment
- Explain standards and regulations as well as electric power and dielectric principle
- Analyze low and medium voltage cable and buses and discuss a general overview of MV and LV equipments
- Describe MV and LV switchgears and circuit breakers and review power and instrument transformers
- Review surge arrestors, capacitors, meters and protective relays
- Employ electrical safety and employ electrical maintenance program
- Perform exercises with troubleshooting electrical circuits V4.1 simulator

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 electric distribution system equipment for those who are involved with the planning, implementation, and/or supervision of electrical preventive maintenance (EPM) programs of electric power equipment in industrial plants, process plants, oil/gas fields, refineries, petrochemical plants, utilities and commercial facilities. You should be interested in learning how electrical power distribution equipment and systems operate and how to maintain and troubleshoot the equipment safely and effectively.

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 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:



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 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's** and **Bachelor's** 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.

Accommodation

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

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

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 – 0845	***Standards & Regulations***
0845 – 0930	***Electric Power & Dielectric Principle*** *Electric & Magnetic Fields & the Electric Power System ● Behavior of Dielectric (Insulation) Materials ● Conducting & Insulating Materials*
0930 – 0945	*Break*
0945 – 1100	***Electric Power & Dielectric Principles (cont'd)*** *Conducting & Insulating Materials (cont'd) ● Three-Phase Power Calculations ● Short-Circuit Currents ● Calculations & Equipments & Materials Stress*
1100 – 1230	***Electric Power & Dielectric Principles (cont'd)*** *Electrical Problems & Corrective Actions ● Excess Heat & Voltage ● Deterioration & Contamination ● Partial Discharge (Corona)*
1230 – 1245	*Break*
1245 – 1420	***Low & Medium Voltage Cables & Buses*** *Types ● Construction ● Applications ● Ratings ● Cable Joints ● Bus Bars & Buses Accessories ● Inspections ● Tests ● Evaluations ● Common Failure Modes & Failure Location ● Cable/Bus Safety*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***General Overview of MV & LV Equipments*** *Types & Applications*
0830 – 0930	***MV & LV Switchgears & Circuit Breakers*** *LV Switchgears Types & Ratings ● LV Switchgear Circuit Breakers – Types & Ratings ● Overcurrent Sensing ● Typical Time-Current-Curves (Tccs) ● LV Circuit Breakers Selectivity*
0930 – 0945	*Break*
0945 – 1100	***MV & LV Switchgears Circuit Breakers (cont'd)*** *Types & Ratings of MV Switchgears ● MV Switchgear Circuit Breakers - Types, Ratings & Operating Mechanisms ● Protection Relays*
1100 – 1130	***MV & LV Switchgear Circuit Breakers (cont'd)*** *Inspections & Tests*
1130 – 1230	***Power Transformers*** *Transformers Principles & Parameters ● Types & Applications ● Connections (Vector Group) ● Two-Winding ● Zigzag Grounding ● Auto-Transformers & Tertiaries*
1230 – 1245	*Break*
1245 – 1420	***Power Transformers (cont'd)*** *Tap Changers ● De-Energized Tap Changers (DETC) ● Load Tap Changers (OLTC) & Controls ● Built-on Protections (Buchholz & Similar Relays) ● Cooling Systems ● Fire Fighting*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Power Transformers (cont'd)*** *Parallel Operation of Transformers ● Accessories● Failure Modes & Detection ● Inspections & Tests ● Factory Tests ● Field Tests ● Oil & Gas Analysis*
0930 – 0945	*Break*
0945 – 1100	***Instrument Transformers*** *Characteristics & Functions ● Types & Ratings ● Connections ● Inspections & Tests ● Common Failure Modes & CT/VT Safety*
1100 – 1200	***Surge Arrestors*** *Types & Ratings ● Inspections & Tests*
1200 – 1230	***Capacitors*** *Types of Banks & Their Connection ● Power Factor Correction ● Connection Points ● Harmonic Considerations ● Inspection & Testing*
1230 – 1245	*Break*
1245 – 1420	***Meters & Protective Relays*** *Types of Meters & Applications ● Types & Application of Protective Relays ● Typical Connection Diagrams ● Measurement Transducers*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

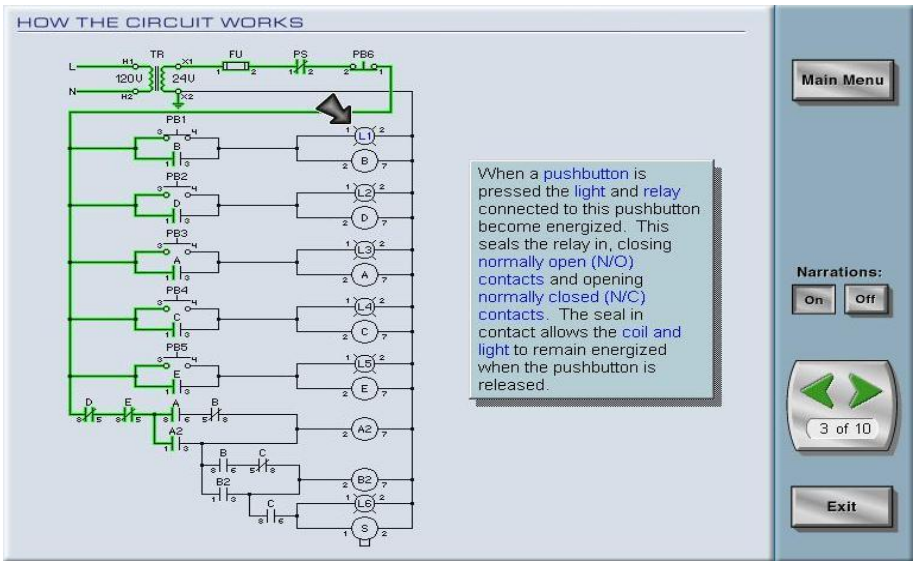
0730 – 0800	***Meters & Protective Relays (cont'd)*** *Inspection & Tests ● Meter/Relay Cautions & Safety*
0800 – 0930	***Electrical Safety*** *Hazards Working Near or on Energized Electrical Equipment ● Electrical Shock & Effects ● Arc Flash ● Safeguards for Preventing Shock*
0930 – 0945	*Break*
0945 – 1100	***Electrical Safety (cont'd)*** *De-Energized & Energized Works ● Permit to Work ● Tools & Test equipment Use & Care of Safety Grounding Sets ● Use & Care of Electrical Personal Protective Equipment ● Tools & Test Equipment*
1100 – 1230	***Electrical Safety (cont'd)*** *Safety Distances ● "Qualified Electrical Workers" as Defined by OSHA ● Minimum Approach Distances for Non-Qualified and Qualified Electrical Workers ● Proper Lockout-Tagout Procedures*
1230 – 1245	*Break*
1245 – 1420	***Electrical Safety (cont'd)*** *Equipment Safety Interlocks ● Step & Touch Potential (Definition & Hazards)*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

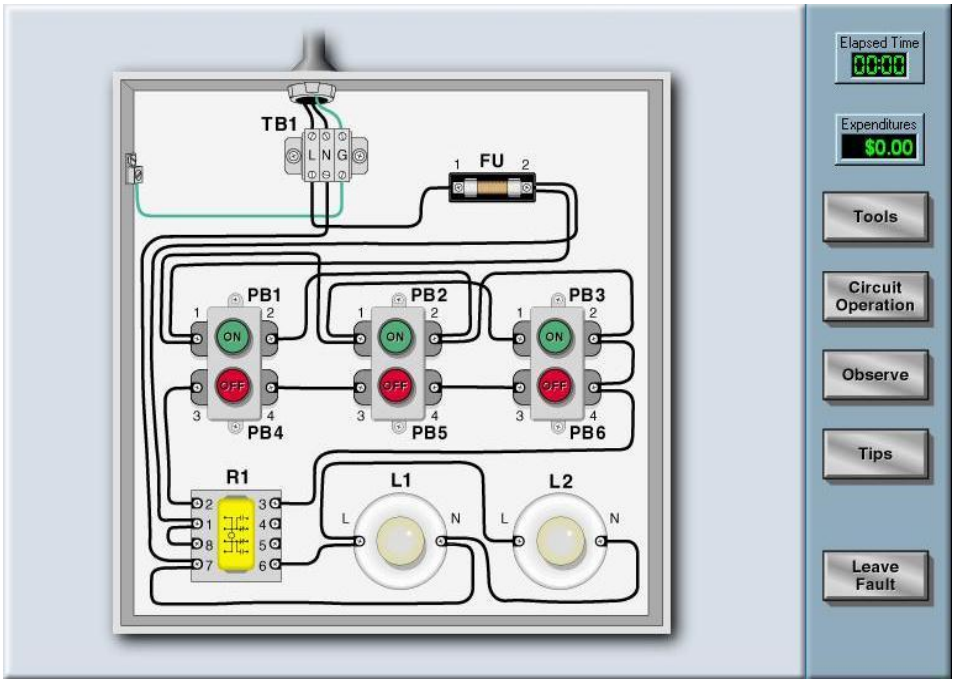
0730 – 0930	***Electrical Maintenance Program*** *Maintenance Actions ● Testing Intervals ● International Electrical Testing Association (NETA) Specifications*
0930 – 0945	*Break*
0945 – 1100	***Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator***
1100 – 1230	***Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator (cont'd)***
1230 – 1245	*Break*
1245 – 1345	***Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator (cont'd)***
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*

Simulator (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 simulator “Simutech Troubleshooting Electrical Circuits V4.1”.







Simutech Troubleshooting Electrical Circuits V4.1

Course Coordinator

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