



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 Reference

EE0250



Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	April 27-May 01, 2025	Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA
2	July 06-10, 2025	TBA Meeting Room, Taksim Square Hotel, Istanbul, Turkey
3	October 27-31, 2025	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

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

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 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: -

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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 **3.0 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.

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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.



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 **40 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'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.



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.

Course Fee

Al Khobar	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.
Istanbul	US\$ 6,000 per Delegate + VAT . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	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

Accommodation

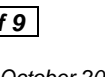
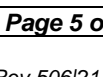
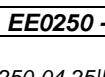
Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

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	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 – 0845	Standards & Regulations
0845 – 0930	Electric Power & Dielectric Principle <i>Electric & Magnetic Fields & the Electric Power System • Behavior of Dielectric (Insulation) Materials • Conducting & Insulating Materials</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Electric Power & Dielectric Principles (cont'd) <i>Conducting & Insulating Materials (cont'd) • Three-Phase Power Calculations • Short-Circuit Currents • Calculations & Equipments & Materials Stress</i>
1100 – 1230	Electric Power & Dielectric Principles (cont'd) <i>Electrical Problems & Corrective Actions • Excess Heat & Voltage • Deterioration & Contamination • Partial Discharge (Corona)</i>
1230 – 1245	<i>Break</i>





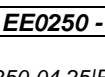
1245 - 1420	Low & Medium Voltage Cables & Buses Types • Construction • Applications • Ratings • Cable Joints • Bus Bars & Buses Accessories • Inspections • Tests • Evaluations • Common Failure Modes & Failure Location • Cable/Bus Safety
1420 - 1430	Recap Using this Course Overview, the Instructor(s) 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





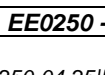
1245 - 1420	Meters & Protective Relays <i>Types of Meters & Applications • Types & Application of Protective Relays • Typical Connection Diagrams • Measurement Transducers</i>
1420 - 1430	Recap <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch & End of Day Three</i>

Day 4

0730 - 0800	Meters & Protective Relays (cont'd) <i>Inspection & Tests • Meter/Relay Cautions & Safety</i>
0800 - 0930	Electrical Safety <i>Hazards Working Near or on Energized Electrical Equipment • Electrical Shock & Effects • Arc Flash • Safeguards for Preventing Shock</i>
0930 - 0945	<i>Break</i>
0945 - 1100	Electrical Safety (cont'd) <i>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</i>
1100 - 1230	Electrical Safety (cont'd) <i>Safety Distances • "Qualified Electrical Workers" as Defined by OSHA • Minimum Approach Distances for Non-Qualified and Qualified Electrical Workers • Proper Lockout-Tagout Procedures</i>
1230 - 1245	<i>Break</i>
1245 - 1420	Electrical Safety (cont'd) <i>Equipment Safety Interlocks • Step & Touch Potential (Definition & Hazards)</i>
1420 - 1430	Recap <i>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</i>
1430	<i>Lunch & End of Day Four</i>

Day 5

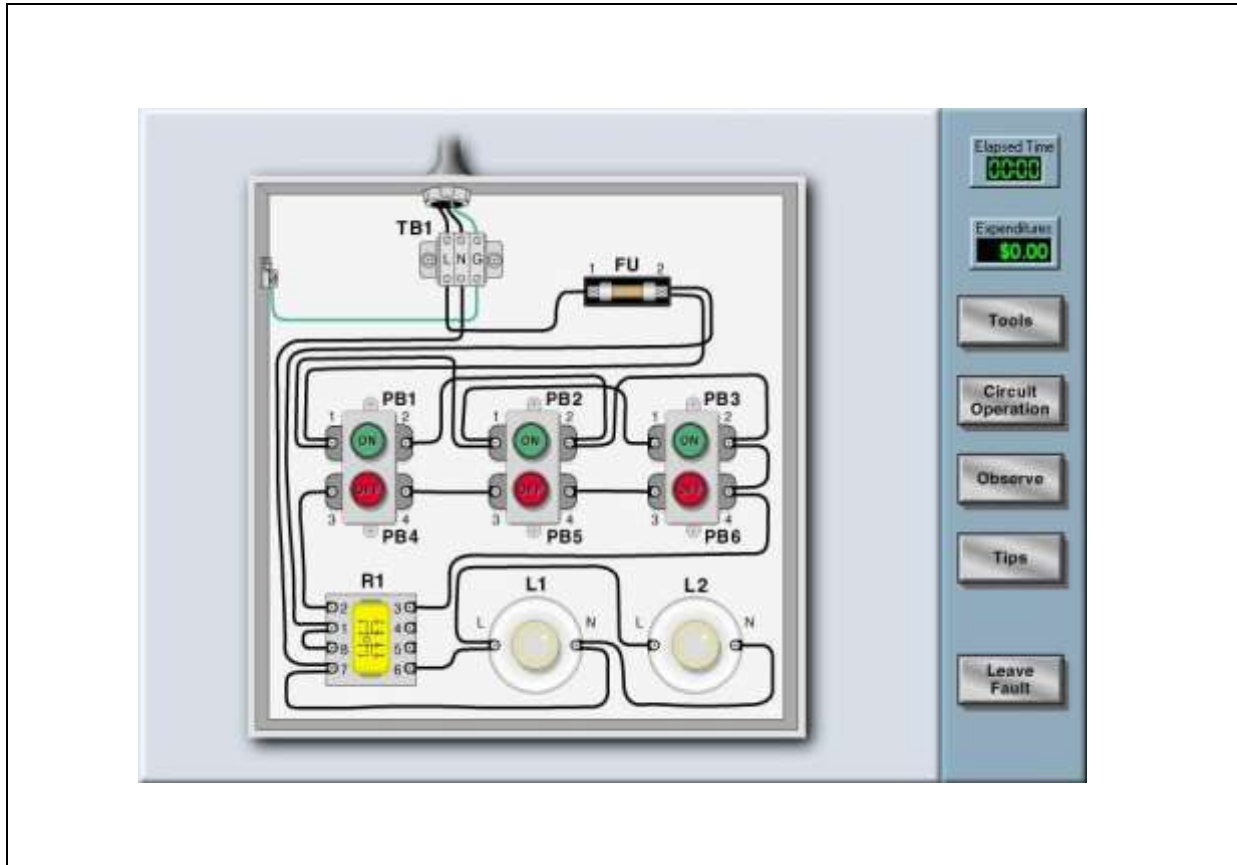
0730 - 0930	Electrical Maintenance Program <i>Maintenance Actions • Testing Intervals • International Electrical Testing Association (NETA) Specifications</i>
0930 - 0945	<i>Break</i>
0945 - 1100	Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator
1100 - 1230	Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator (cont'd)
1230 - 1245	<i>Break</i>
1245 - 1345	Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator (cont'd)
1345 - 1400	Course Conclusion <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course</i>
1400 - 1415	POST-TEST
1415 - 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>

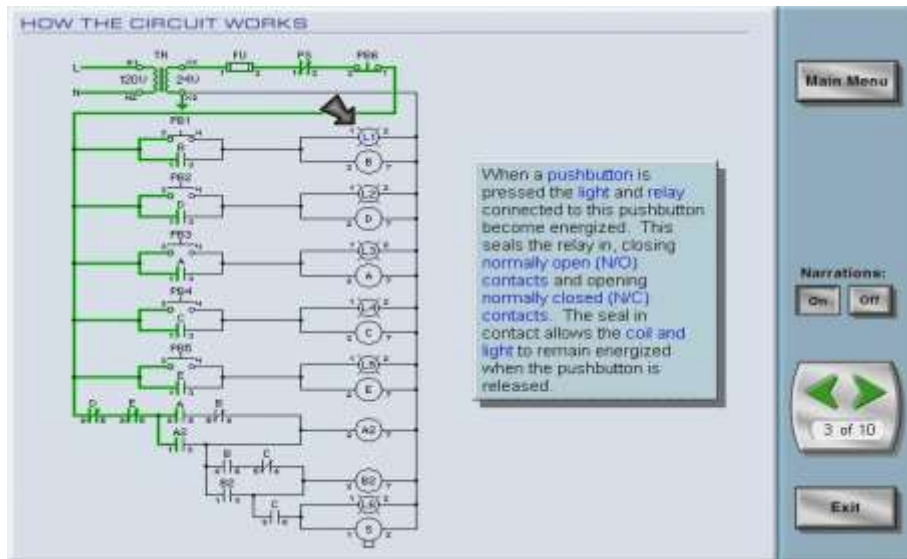




Simulator (Hands-on Practical Sessions)

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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