



**COURSE OVERVIEW EE0250-4D**

**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**

October 28-31, 2024/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

**Course Duration/Credits**

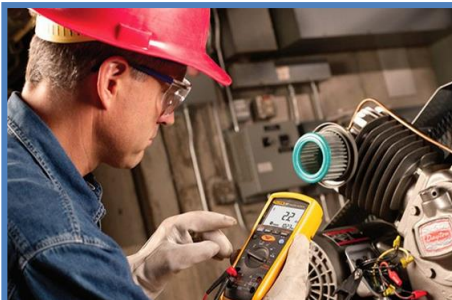
Four days/2.4 CEUs/24 PDHs



**Course Reference**

EE0250-4D

**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.***



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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

### **Who Should Attend**

This course provides an overview of all significant aspects and considerations of 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\$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

### Course 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 **2.4 CEUs** (Continuing Education Units) or **24 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

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British Accreditation Council (BAC)

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

### Accommodation

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





**Course 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 **45 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**.

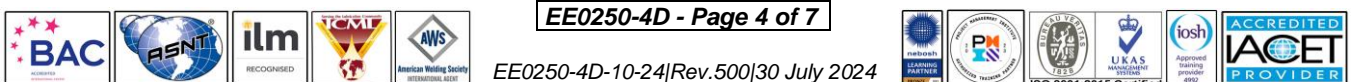
Mr. Marave is a **Registered Professional Engineer** and has **Master's** and **Bachelor's** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York** and **Pratt Institute of New York (USA)** respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal 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.

**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 Program**

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

**Day 1: Monday, 28<sup>th</sup> of October 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0845	<b>Standards &amp; Regulations</b>
0845 – 0930	<b>Electric Power &amp; Dielectric Principle</b> Electric & Magnetic Fields & the Electric Power System • Behavior of Dielectric (Insulation) Materials • Conducting & Insulating Materials
0930 – 0945	Break
0945 – 1100	<b>Electric Power &amp; Dielectric Principles (cont'd)</b> Conducting & Insulating Materials (cont'd) • Three-Phase Power Calculations • Short-Circuit Currents • Calculations & Equipments & Materials Stress
1100 – 1230	<b>Electric Power &amp; Dielectric Principles (cont'd)</b> Electrical Problems & Corrective Actions • Excess Heat & Voltage • Deterioration & Contamination • Partial Discharge (Corona)
1230 – 1245	Break
1245 – 1420	<b>Low &amp; Medium Voltage Cables &amp; Buses</b> Types • Construction • Applications • Ratings • Cable Joints • Bus Bars & Buses Accessories • Inspections • Tests • Evaluations • Common Failure Modes & Failure Location • Cable/Bus Safety
1420 – 1430	<b>Recap</b> 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: Tuesday, 29<sup>th</sup> of October 2024**

0730 – 0830	<b>General Overview of MV &amp; LV Equipments</b> Types & Applications
0830 – 0930	<b>MV &amp; LV Switchgears &amp; Circuit Breakers</b> 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	<b>MV &amp; LV Switchgears Circuit Breakers (cont'd)</b> Types & Ratings of MV Switchgears • MV Switchgear Circuit Breakers - Types, Ratings & Operating Mechanisms • Protection Relays • Inspections & Tests
1100 – 1230	<b>Power Transformers</b> Transformers Principles & Parameters • Types & Applications • Connections (Vector Group) • Two-Winding • Zigzag Grounding • Auto-Transformers & Tertiaries • Tap Changers • De-Energized Tap Changers (DETC) • Load Tap Changers (OLTC) & Controls • Built-on Protections (Buchholz & Similar Relays) • Cooling Systems • Fire Fighting • Parallel Operation of Transformers • Accessories • Failure Modes & Detection • Inspections & Tests • Factory Tests • Field Tests • Oil & Gas Analysis





1230 – 1245	Break
1245 – 1420	<b>Instrument Transformers</b> Characteristics & Functions • Types & Ratings • Connections • Inspections & Tests • Common Failure Modes & CT/VT Safety
1420 – 1430	<b>Recap</b> 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: Wednesday, 30<sup>th</sup> of October 2024**

0730 – 0930	<b>Surge Arrestors</b> Types & Ratings • Inspections & Tests
0930 – 0945	Break
0945 – 1100	<b>Capacitors</b> Types of Banks & Their Connection • Power Factor Correction • Connection Points • Harmonic Considerations • Inspection & Testing
1100 – 1200	<b>Meters &amp; Protective Relays</b> Types of Meters & Applications • Types & Application of Protective Relays • Typical Connection Diagrams • Measurement Transducers • Inspection & Tests • Meter/Relay Cautions & Safety
1200 – 1230	<b>Electrical Safety</b> Hazards Working Near or on Energized Electrical Equipment • Electrical Shock & Effects • Arc Flash • Safeguards for Preventing Shock • De-Energized & Energized Works • Permit to Work • Tools & Test equipment Use & Care of Safety Grounding Sets • Use & Care of Electrical Personal Protective Equipment
1230 – 1245	Break
1245 – 1420	<b>Electrical Safety (cont'd)</b> Tools & Test equipment • Safety Distances • “Qualified Electrical Workers” as Defined by OSHA • Minimum Approach Distances for Non-Qualified and Qualified Electrical Workers • Proper Lockout-Tagout Procedures • Equipment Safety Interlocks • Step & Touch Potential (Definition & Hazards)
1420 – 1430	<b>Recap</b> 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: Thursday, 31<sup>st</sup> of October 2024**

0730 – 0930	<b>Electrical Maintenance Program</b> Maintenance Actions • Testing Intervals • International Electrical Testing Association (NETA) Specifications
0930 – 0945	Break
0945 – 1100	<b>Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator</b>
1100 – 1230	<b>Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator (cont'd)</b>



1230 - 1245	Break
1245 - 1345	<b>Practical Exercises with Troubleshooting Electrical Circuits V4.1 Simulator (cont'd)</b>
1345 - 1400	<b>Course Conclusion</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1400 - 1415	<b>POST-TEST</b>
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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