



## COURSE OVERVIEW EE0468 Condition Monitoring of Motors and Transformers

### Course Title

Condition Monitoring of Motors and Transformers

### Course Date/Venue

Session 1: April 07-11, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Session 2: September 28-October 02, 2025/ Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE



### Course Reference

EE0468

### 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 is designed to provide participants with a detailed and up-to-date overview of the concept of Motor and Distribution Transformer Protection (*Theoretical & Practical Aspects*). It covers the need for motor protection, basic operation of motors and their structure; the common types of motor faults, damages and the principles of motor protection; the causes of thermal overload and the measures to protect the motor from it; the earth fault protection and rectifying earth faults; the causes, impacts and preventive measures of short circuits; setting up short circuit protection and conducting tests; configuring and testing a long start protection relay and unbalance protection; and setting up and testing blocked rotor protection relay and load loss protection relay.



During this interactive course, participants will learn the role of RTD sensors in motor protection; installing, using and troubleshooting RTD sensors; the implications of the number of starts on motor operation and longevity; configuring and testing start controls; the basic operation and structure of transformers, common types of faults and the principles of transformer protection; the causes and impacts of voltage issues in transformers and how to protect against them; setting up and testing voltage protection, overcurrent protection, protection relays and REF relay; the directional earth fault and definitional protection mechanisms, their necessity and implementation; the restricted earth fault (REF) protection, when it is used and how it is set up; the methods and best practices of CT and PT testing; and the motor and transformer operation and maintenance.



### Course Objectives

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

- Apply and gain an in-depth knowledge on the theoretical and practical aspects of motor and distribution transformer protection
- Discuss the need for motor protection, basic operation of motors and their structure, common types of motor faults and damages and the principles of motor protection
- Recognize the causes of thermal overload and the measures to protect the motor from it
- Carryout earth fault protection and identify and rectify earth faults
- Explore the causes, impacts and preventive measures of short circuits as well as set up short circuit protection and conduct tests
- Configure and test a long start protection relay and unbalance protection
- Set up and test blocked rotor protection relay and load loss protection relay
- Identify the role of RTD sensors in motor protection and install, use and troubleshoot RTD sensors
- Discuss the implications of the number of starts on motor operation and longevity and configure and test start controls
- Recognize the basic operation and structure of transformers, common types of faults and the principles of transformer protection
- Identify the causes and impacts of voltage issues in transformers and how to protect against them
- Set up and test voltage protection, overcurrent protection, protection relays and REF relay
- Discuss directional earth fault and definitional protection mechanisms, their necessity and implementation
- Identify restricted earth fault (REF) protection, when it is used and how it is set up
- Employ methods, and best practices of CT and PT testing including motor and transformer operation and maintenance

### 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 the theoretical and practical aspects of motor and distribution transformer protection for electrical engineers, power system engineers, protection engineer, maintenance engineers, plant and facility managers, power system technicians, electrical technologists, electrical supervisors, electricians, utility engineers and technicians, electrical contractors, electrical system operators and those who are work in the field of electrical engineering, power systems, or related industries and are involved in the design, operation, maintenance, or protection of motors and distribution transformers.

### 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.

### Course Accreditations

Certificates are accredited by the following international accreditation organizations: -

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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.
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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.

### 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. 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, **Electrical Generator & Power Transformers, Circuit Breakers, Switchgears, Transformers, Circuit Breaker, HV Switchgear Maintenance, Motor Controllers, Motor Control Circuit, HV/LV Electrical Authorisation, Basic Electricity, Electrical & Special Hazards, Personnel Protection, HV/LV Equipment, 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 Generation & Transmission Power Systems Protection & Relaying, Earthing, Power System Protective Relay, Bonding, Grounding, Lightning & Surge Protection, Electric Power Substation & Systems, Electrical Engineering Principles, Electrical Fault Analysis, Electrical Networks & Distribution Cables, 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.



### 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	<b>Introduction to Motor Protection:</b> Understanding the Need for Motor Protection, Basic Operation of Motors and their Structure, Common Types of Motor Faults and Damages and the Principles of Motor Protection
0930 - 0945	Break
0945 - 1130	<b>Introduction to Motor Protection (cont'd):</b> Understanding the Need for Motor Protection, Basic Operation of Motors and their Structure, Common Types of Motor Faults and Damages and the Principles of Motor Protection
1130 - 1230	<b>Thermal Overload Protection (49):</b> Understanding the Concept of Thermal Overload, its Causes, and the Measures to Protect the Motor from it. Practical Session Includes Setting Up and Testing a Thermal Overload Relay
1230 - 1245	Break
1245 - 1420	<b>Thermal Overload Protection (49) (cont'd):</b> Understanding the Concept of Thermal Overload, its Causes, and the Measures to Protect the Motor from it. Practical Session Includes Setting Up and Testing a Thermal Overload Relay
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**

0730 - 0930	<b>Earth Fault Protection (50N/51N):</b> Theoretical Discussion on Earth Faults, Their Impacts and Protection Methods. Practical Demonstrations on How to Identify and Rectify Earth Faults
0930 - 0945	Break
0945 - 1100	<b>Short Circuit Protection (50/51):</b> Exploring the Causes, Impacts and Preventive Measures of Short Circuits. Practical Training Includes Setting up Short Circuit Protection and Conducting Tests
1100 - 1230	<b>Long Start Protection (48):</b> Understanding the Concept of Long Start, its Detrimental Effects, and Protective Measures. Practical Exercise Includes Configuring and Testing a Long Start Protection Relay
1230 - 1245	Break
1245 - 1420	<b>Unbalance Protection (46):</b> Learning About Phase Unbalance, its Causes, and Effects. Practical Training Includes Setting Up and Testing Unbalance Protection
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**

0730 - 0930	<b>Blocked Rotor Protection (51LR-51S):</b> Theory on What a Blocked Rotor is and How to Protect a Motor from it. Practical Session Involves Setting Up and Testing a Blocked Rotor Protection Relay
0930 - 0945	Break
0945 - 1100	<b>Loss of Load Protection (37):</b> Understanding the Scenarios of Load Loss and How to Protect a Motor. Practical Training Includes Setting Up and Testing a Load Loss Protection Relay
1100 - 1230	<b>RTD Sensors Protection (49/38):</b> Exploring the Role of RTD Sensors in Motor Protection. Hands-on Training on How to Install, Use and Troubleshoot RTD Sensors
1230 - 1245	Break
1245 - 1420	<b>Number of Starts:</b> Understanding the Implications of the Number of Starts on Motor Operation and Longevity. Practical Session on Configuring and Testing Start Controls
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 4**

0730 - 0930	<b>Introduction to Transformer Protection:</b> Understanding the Basic Operation and Structure of Transformers, Common Types of Faults and the Principles of Transformer Protection
0930 - 0945	Break
0945 - 1100	<b>Over Voltage &amp; Under Voltage Protection:</b> Learning About the Causes and Impacts of Voltage Issues in Transformers and How to Protect Against them. Practical Training on Setting Up and Testing Voltage Protection
1100 - 1230	<b>Over Current Protection:</b> Understanding Overcurrent Scenarios, their Causes, and Effects on Transformers. Hands-on Training Includes Setting Up and Testing Overcurrent Protection
1230 - 1245	Break
1245 - 1420	<b>Directional Earth Fault &amp; Definitional Protection:</b> Discussing these Specific Protection Mechanisms, Their Necessity, and Implementation. Practical Training Includes Setting Up and Testing these Protection Relays
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 5**

0730 - 0930	<b>Restricted Earth Fault Protection:</b> Detailed Understanding of REF Protection, when it is Used and How it is Set Up. Practical Training Includes Setting Up and Testing a REF Relay
0930 - 0945	Break
0945 - 1130	<b>CT &amp; PT Testing:</b> Learning About the Importance, Methods, and Best Practices of CT and PT Testing. Hands-On Practical Training Includes Conducting Actual CT and PT Tests





1130 – 1230	<b>Maintenance Issues &amp; Troubleshooting:</b> Discussion on Common Issues Encountered in Motor and Transformer Operation and Maintenance. Hands-On Troubleshooting Practice with Guided Demonstrations
1230 - 1245	Break
1245 – 1345	<b>OMIFCO Questionnaire &amp; Discussion:</b> Exploring Specific Issues and Queries Related to OMIFCO, Addressing Doubts, and Discussing Solutions. Participants will Answer a Questionnaire to Assess Learning and to Highlight any Areas Requiring Further Discussion
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
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”.



**Guided Troubleshooting**

Does the door operate properly?

Yes No

Observations

Minimize

Tools Observe Tips Elapsed Time 00:00 Expenditures \$0.00 Leave Fault

**Simutech Troubleshooting Electrical Circuits V4.1**

**Course Coordinator**

Mari Nakintu, Tel: +971 2 30 91 714, Email: [mari1@haward.org](mailto:mari1@haward.org)