



COURSE OVERVIEW EE0880-4D
Electric Motor Testing, Operation, Maintenance, Protection & Troubleshooting

Course Title

Electric Motor Testing, Operation, Maintenance, Protection & Troubleshooting

Course Date/Venue

October 14-17, 2024/Meeting Plus 5, City Centre Rotana Doha, Doha, Qatar

Course Reference

EE0880-4D

Course Duration/Credits

Four days/2.4 CEUs/24 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.

It is estimated that electrical drives and other rotating equipment consume about 50% of the total electrical energy consumed in the world today (and this figure increases to 70% if you only consider industry.) The cost of maintaining electric motors can be a significant amount in the budget item of manufacturing and mining industries.

This course gives you a thorough understanding of electric motor's testing, operation, protection, control and maintenance and gives you the tools to maintain and troubleshoot electric motors.

You will gain a fundamental understanding of the protection, control and maintenance of electric motors and drives. Typical applications of electric motors in manufacturing, materials handling, process control is covered in detail. The concluding section of the course gives you the fundamental tools in troubleshooting motors confidently and effectively.





Course Objectives

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

- Apply and gain an in-depth knowledge on electric motor testing, operation, protection, maintenance and troubleshooting
- Specify protection requirements for motors and maintain electric motors
- Identify the speed control requirements for motors and discuss the essentials of motors and drives
- Enumerate the main issues with testing of motors to prevent motor bearing failure
- Troubleshoot and fix faults on motors and drives
- Discuss interface control circuits of motors with PLC's/DCS's
- Reduce downtime on electric motors and improve plant safety
- Develop plant throughput and reduce spares usage and requirements

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 motor testing, operation, protection, maintenance and troubleshooting electrical engineers and for those associated with the use of electric motors in the industrial or automation environment. The course will also benefit those who are working in system design as well as site commissioning, maintenance and troubleshooting.

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 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.

Course Fee

US\$ 5,000 per Delegate 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. Grant Stead, is a **Senior Electromechanical Engineer** with over **35 years** of integrated industrial experience and academic experience within **Power & Water Utilities** and Other **Energy Sectors**. His wide expertise includes **Power System Equipment, Electric Power System Operation, Fundamentals of Power System Equipments & Stability, Power System Planning & Economics, Electrical Power Instruments & Control System, Power Flow Analysis** of Electrical Power Systems, **Power System Generation and Distribution, UPS & Battery Operation & Maintenance, UPS Classification, Online & Off-line UPS Operation, UPS Battery Features, Battery Charger, UPS System Application, UPS Parallel Operation & Strategies, UPS System Performance Evaluation, Control Loop Strategies, UPS Converters & Inverters, UPS & Battery Charger Systems, Battery Chargers Construction & Troubleshooting, Battery Design & Operation, Battery Charger & UPS System Prevention Maintenance, Circuit Breakers & Switchgears, Electricity & Electrical Codes, Electrical Installations, Electric Motors, Maintenance, Grounding and Safety** for Electrical Power Substation, **Electrical Generator & Power Transformer, Electrical Power System Protection Relays, Hydraulics & Fluid Mechanics, Engineering Services, Electrotechnology, Fitting & Machining, Airconditioning Repair & Maintenance, Trenching Machines, Compressors and Diesel Engines**. He is also well-versed in Occupational Safety, Coaching & Mentoring, Project Management, Human Resources Management, Procurement Skills, Finance & Infrastructure Maintenance, Health & Safety and Quality Control, Time Management, Leadership and Management Skills, Supervising & Treambuilding Skills, Seven Habits of Highly Effective People, MS Office, Performance Manager, Budgeting & Financial Control and Presentation Skills. Currently, he is the **Operations Manager** of Damelin College wherein he manages the accredited learnership courses as per the required standards by the Sector Education and Training Authority (SETA) ensuring the proper assessment and moderation of all assessments.

During his career life, Mr. Stead worked with several prestigious companies and institutions occupying numerous challenging management and technical positions such as being the **Engineering Manager, Plant Maintenance Engineer, Operations Manager, Maintenance Planner, Maintenance Manager, Reliability Engineer and Maintenance Supervisor** for various international companies and institution.

Mr. Stead has a **Bachelor's** degree in **Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer**, a Registered in South African Council for Education (**SACE**) and a **Certified Assessor & Moderator** with the Education Training & Development Practices Sector Education & Training Authority (**ETDP SETA**). He has further delivered numerous trainings, courses, workshops, seminars and conferences internationally.



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, 14th of October 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Fundamentals of Motor Technology & Construction Basic Principles of Rotating Electric Machines • Fundamental Principles of Speed Control • Efficiency, Torque, Inertia, Horsepower/Power Factor • Torque-Speed Curves • Induction/Synchronous/Wound Rotor Types • Basic Construction & Physical Configuration, Windings • Principles of Operation & Performance
0930 – 0945	Break
0945 – 1100	Three Phase AC Induction Motors Components • Theory of Operation • Induction Motor Design • Duty Cycles • Insulation & Cooling Requirements
1100 – 1230	Three Phase AC Induction Motors (cont'd) Starting Methods • Selecting motors • Types of Faults, Fault Finding & Testing of AC Machines • Testing Instrumentation
1230 – 1245	Break
1245 – 1420	Energy Losses & Efficiency of Three Phase AC Induction Motors Standards • Types of Losses • Tests for Measurement & Computation of Losses & Efficiency • Dynamometers • Principles of Load Application By Braking • Torque Measurement Basics • Types of Practical Dynamometers
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

Day 2: Tuesday, 15th of October 2024

0730 – 0930	Motor Failure Analysis Frequent Starts • High Inertia • Inadequate Cooling • Congestion on Fan Cover • Improper Spacing at End of Motor
0930 – 0945	Break
0945 – 1100	Motor Failure Analysis (cont'd) Incorrect Belt Alignment • Solid Belt Guards • Excessive Loading Causing Bearing Clearance Problems • Insulation Failures • Bearing Current Problems
1100 – 1230	Testing Insulation Life and Resistance • Polarization Index • DC Hipot • DC Ramp Test • AC Hipot • Capacitance Test • Dissipation Factor • Partial Discharge • Surge Test • Mechanical Testing • Online Testing
1230 – 1245	Break
1245 – 1420	Bearing Failure Analysis Bearing Failures • Grease & Greasing • Belt Drive Aspects • Balance • Storage Issues • Service Factor Loading
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two





Day 3: Wednesday, 16th of October 2024

0730 – 0930	Protection of Motors <i>Thermal Overload • Time Constraints • Early Relays & New Digital Relays • Starting & Stalling Conditions • Over Current / Overload • Under-Voltage / Over-Voltage • Under Frequency • Pole Slip / Out of Step • Loss of Excitation • Inadvertent Energization • Over Fluxing</i>
0930 – 0945	Break
0945 – 1100	Protection of Motors (cont'd) <i>Stall Protection / Acceleration Time / Start Up Supervision /Time Between Starts • Unbalanced Supply Voltages • Negative Sequence Currents • De-Rating Factors • Earth Faults – Core Balance, Residual Stabilising Resistors • Calculation of Protective Relay Settings</i>
1100 – 1230	Motor Control <i>Power Circuit • Control Circuit • Full Online Voltage Starting • Reduced Voltage Starting: Delta-Star, Resistance, Reactor, Autotransformer, Soft Start</i>
1230 – 1245	Break
1245 – 1420	Motor Control (cont'd) <i>Braking • Speed Control • Reversing</i>
1420 – 1430	Recap <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow</i>
1430	Lunch & End of Day Three

Day 4: Thursday, 17th of October 2024

0730 – 0930	Control System for AC Variable Speed Drives <i>Overall Control System • Power Supply for the Control System • Dc Bus Charging System • VSD Control Loops (Open Loop/Closed Loop)</i>
0930 – 0945	Break
0945 – 1100	Control System for AC Variable Speed Drives (cont'd) <i>Vector Control • Current Feedback in Ac Variable Speed Drives • Speed Feedback from Motor</i>
1100 – 1230	Installation & Fault Finding <i>General Installation & Environmental Requirements • Power Supply Connections & Earthing • Where to Install Contactors in Power Circuit • Installation of Ac Converters into Metal Enclosures</i>
1230 – 1245	Break
1245 – 1330	New Technologies & Developments
1330 – 1345	Summary, Open Forum and Closing
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	Presentation of Course Certificates
1430	Lunch & End of Course



Simulators (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 “Troubleshooting Electrical Circuits V4.1 Simulator” and “Lab Volt Testing Device”.



Troubleshooting Electrical Circuits V4.1 Simulator

Lab Volt Testing Device

Course Coordinator

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