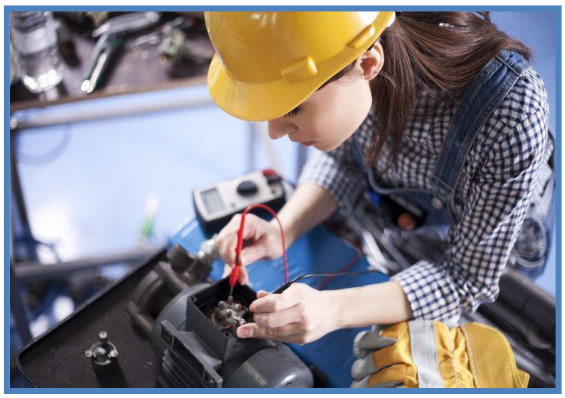
COURSE OVERVIEW EE0880
Electric Motor Testing, Operation, Maintenance, Protection & Troubleshooting

Course Title
Electric Motor Testing, Operation, Maintenance, Protection & Troubleshooting

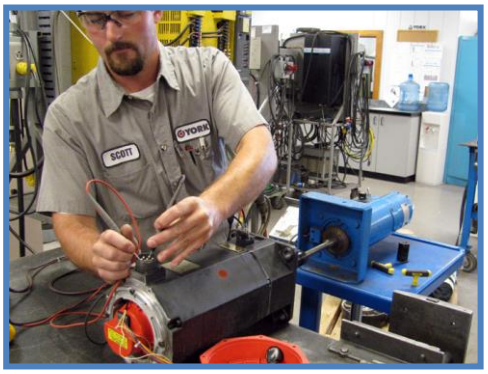


Course Date/Venue
October 20-24, 2024/Club B Meeting Room, Ramada Plaza by Wyndham Istanbul City Center, Istanbul, Turkey

Course Reference
EE0880

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.

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

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.

Course Fee

US$ 6,000 per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), 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 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:-

- 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.

- 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. Ahmed Abozeid is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of **Onshore** & **Offshore** experience within the **Oil** & **Gas** and **Power** industries. His wide expertise covers **Electrical Motors & Variable Speed Drives**, **Motor** Speed Control, **Motors**, **Power Stations**, **Motor** Failure Analysis & Testing, **AC** Converters Section, **AC** & **DC Transmission HV Cable** Design, **Cable** Splicing & Termination, **Cable** Jointing Techniques, **High Voltage** Electrical Safety, **HV/MV Cable Splicing**, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power System** Safe Operation, High Voltage Safety, **High Voltage Transformers**, Safe Operation of **High Voltage & Low Voltage Power Systems**, **Electric Distribution System Equipment**, **ABB 11KV Distribution Switchgear**, **Rotork Operation & Maintenance**, **Power System Protection and Relaying**, Power Electronic Converters, Control Valve, **Flowmetering & Custody Transfer**, **Meters Calibration**, Installation & Inspection, **Crude Metering & Measurement Systems**, **Flow Meter Maintenance Troubleshooting**, Electromagnetic Compatibility (**EMC**), **Machinery** Fault Diagnosis, **Bearing** Failure Analysis **Process Control & Instrumentation**, **Process Control Measurements**, **Control System Commissioning & Start-Up**, **Control System & Monitoring**, **Power Station Control System**, **Instrumentation Devices**, **Process Control & Automation**, **PID Controller**, Distributed Control Systems (**DCS**), Programmable Logic Controllers (**PLC**), **ABB PLC & DCS System**, **Gas Analyzers**, **Simulation Testing**, **Load Flow**, **Short Circuit**, **Smart Grid**, **Vibration Sensors**, **Cable Installation & Commissioning**, **Calibration Commissioning** and **Site Filter Controller**. Further, he is also well-versed in **Fundamentals of Electricity**, **Electrical Standards**, **Electrical Power**, **PLC**, **Electrical Wiring**, Machines, **Transformers**, **Electro-Mechanical Systems**, **Automation & Control Systems**, **Voltage Distribution**, **Power Distribution**, **Filters**, **Automation System**, **Electrical Variable Speed Drives**, **Power Systems**, **Power Generation**, **Power Transformers**, **Diesel Generators**, **Power Stations**, **Uninterruptible Power Systems** (**UPS**) and **Battery Chargers**. He is currently the **Project Manager** wherein he manages, plans and implements projects across different lines of business.

Mr. Ahmed worked as the **Electrical Manager**, **Electrical Power & Machine Expert**, **Electrical Process Leader**, **Team Leader**, **Electrical Team Leader**, **Technical Instructor**, and **Instructor/Trainer** from various companies such as the Lafarge Nigeria, Egyptian Cement Company, ECC Training Center, Alrajhi Construction & Building Company and Ameria Cement Company, just to name a few.

Mr. Ahmed has a **Bachelor's** degree in **Electrical Engineering**. Further, he is a **Certified Instructor/Trainer, Certified TQUK Level 3 Vocational Achievement (RQF) Assessor** and has delivered numerous trainings, seminars, courses, workshops 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: ***Sunday, 20th 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*
0930 – 0945	*Break*
0945 – 1100	***Fundamentals of Motor Technology & Construction (cont'd)*** *Induction/Synchronous/Wound Rotor Types • Basic Construction & Physical Configuration, Windings • Principles of Operation & Performance*
1100 – 1230	***Three Phase Ac Induction Motors*** *Components • Theory of Operation • Induction Motor Design • Duty Cycles • Insulation & Cooling Requirements*
1230– 1245	*Break*
1245 – 1420	***Three Phase Ac Induction Motors (cont'd)*** *Starting Methods • Selecting motors • Types of Faults, Fault Finding & Testing of AC Machines • Testing Instrumentation*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2: ***Monday, 21st of October 2024***

0730 – 0930	***Energy Losses & Efficiency of Three Phase AC Induction Motors*** *Standards • Types of Losses • Tests for Measurement & Computation of Losses & Efficiency • Dynamometers*
0930 – 0945	*Break*
0945 – 1100	***Energy Losses & Efficiency of Three Phase AC Induction Motors (cont'd)*** *Principles of Load Application By Braking • Torque Measurement Basics • Types of Practical Dynamometers*
1100 – 1230	***Motor Failure Analysis*** *Frequent Starts • High Inertia • Inadequate Cooling • Congestion on Fan Cover • Improper Spacing at End of Motor*
1230 – 1245	*Break*
1245 – 1420	***Motor Failure Analysis (cont'd)*** *Incorrect Belt Alignment • Solid Belt Guards • Excessive Loading Causing Bearing Clearance Problems • Insulation Failures • Bearing Current Problems*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3: ***Tuesday, 22nd of October 2024***

0730 – 0930	***Testing*** *Insulation Life and Resistance • Polarization Index • DC Hipot • DC Ramp Test • AC Hipot • Capacitance Test*
0930 – 0945	*Break*

0945 – 1100	***Testing (cont'd)*** *Dissipation Factor • Partial Discharge • Surge Test • Mechanical Testing • Online Testing*
1100 – 1230	***Bearing Failure Analysis*** *Bearing Failures • Grease & Greasing • Belt Drive Aspects • Balance • Storage Issues • Service Factor Loading*
1230 – 1245	*Break*
1245 – 1420	***Protection of Motors*** *Thermal Overload • Time Constraints • Early Relays & New Digital Relays • Starting & Stalling Conditions • Over Current / Overload • Under-Voltage / Over-Voltage*
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 Three*

Day 4: Wednesday, 23rd of October 2024

0730 – 0930	***Protection of Motors (cont'd)*** *Under Frequency • Pole Slip / Out of Step • Loss of Excitation • Inadvertent Energization • Over Fluxing • Stall Protection / Acceleration Time / Start Up Supervision /Time Between Starts*
0930 – 0945	*Break*
0945 – 1100	***Protection of Motors (cont'd)*** *Unbalanced Supply Voltages • Negative Sequence Currents • De-Rating Factors • Earth Faults – Core Balance, Residual Stabilising Resistors • Calculation of Protective Relay Settings*
1100 – 1230	***Motor Control*** *Power Circuit • Control Circuit • Full Online Voltage Starting • Reduced Voltage Starting: Delta-Star, Resistance, Reactor, Autotransformer, Soft Start*
1230 – 1245	*Break*
1245– 1420	***Motor Control (cont'd)*** *Braking • Speed Control • Reversing*
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 Four*

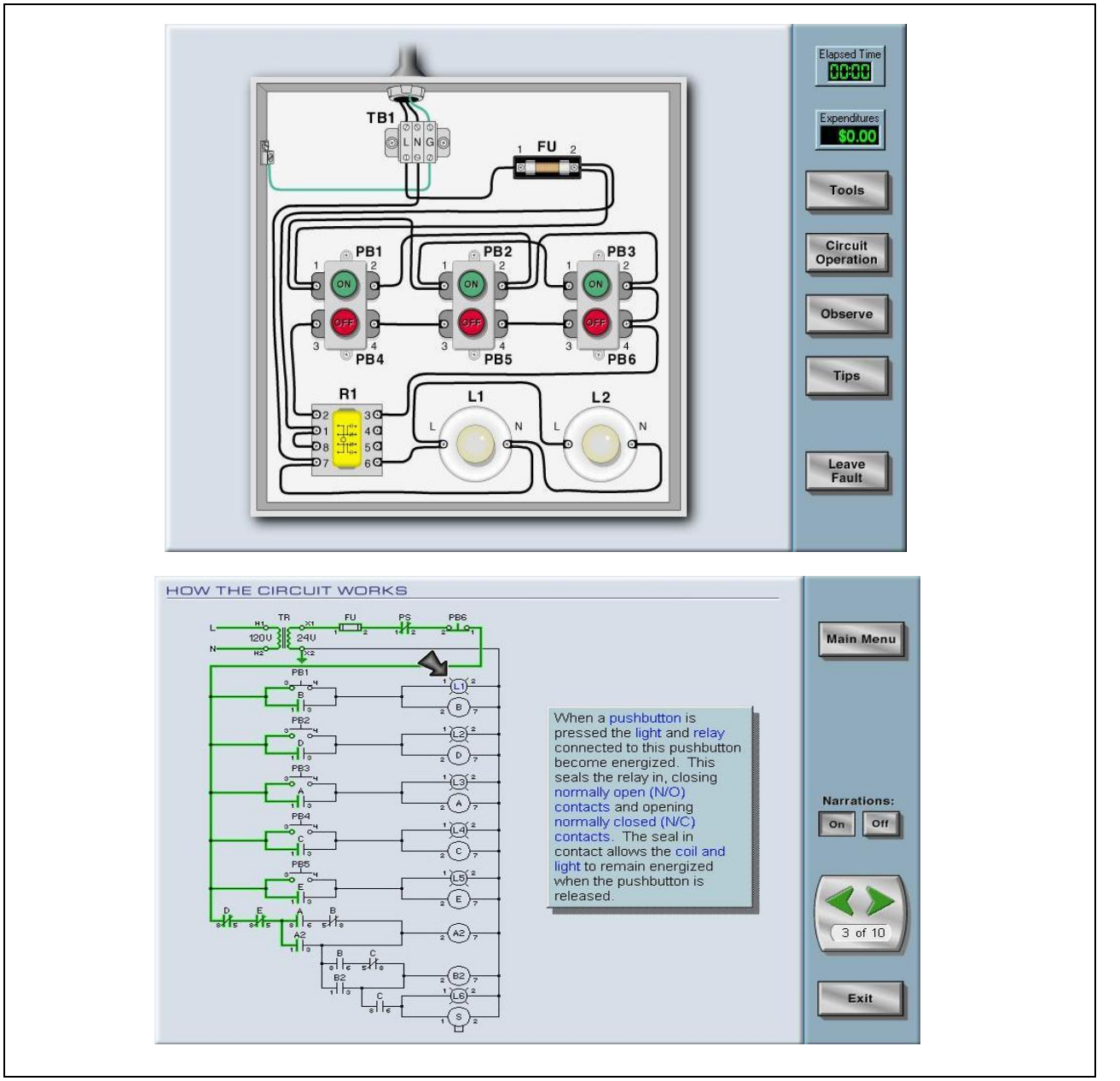
Day 5: Thursday, 24th of October 2024

0730 – 0930	***Control System for AC Variable Speed Drives*** *Overall Control System • Power Supply for the Control System • Dc Bus Charging System • VSD Control Loops (Open Loop/Closed Loop)*
0930 – 0945	*Break*
0945 – 1100	***Control System for AC Variable Speed Drives (cont'd)*** *Vector Control • Current Feedback in Ac Variable Speed Drives • Speed Feedback from Motor*
1100 – 1230	***Installation & Fault Finding*** *General Installation & Environmental Requirements • Power Supply Connections & Earthing • Where to Install Contactors in Power Circuit • Installation of Ac Converters into Metal Enclosures*

1230– 1245	*Break*
1245 – 1330	***New Technologies and Developments***
1330 - 1345	*Summary, Open Forum and Closing*
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*

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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