

# **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 includes various practical sessions and exercises. Theory learnt will be applied using our state-of-theart 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.

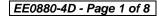
You will gain a fundamental understanding of the protection, control and maintenance of electric motors and drives. Typical applications of electric motors in manufacturing, materials handling, process control is covered in detail. The concluding section of the course gives you the fundamental tools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

Simulators (Hardware & Software) & Videos 20%

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:-



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.



# 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.

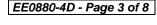


















# **Course Instructor(s)**

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 & Switchegears, Electricity & Electrical Installations. Electric Motors. Electrical Codes. 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.



















<u>Course Program</u>
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:

Monday 14th of October 2024

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

Tuesday, 15th of October 2024 Dav 2:

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	Motor Failure Analysis
0730 - 0930	Frequent Starts • High Inertia • Inadequate Cooling • Congestion on Fan Cover •
	Improper Spacing at End of Motor
0930 - 0945	Break
	Motor Failure Analysis (cont'd)
0945 - 1100	Incorrect Belt Alignment • Solid Belt Guards • Excessive Loading Causing Bearing
	Clearance Problems • Insulation Failures • Bearing Current Problems
	Testing
1100 - 1230	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
	Bearing Failure Analysis
1245 - 1420	Bearing Failures • Grease & Greasing • Belt Drive Aspects • Balance • Storage
	Issues • Service Factor Loading
	Recap
1420 - 1430	<i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics</i>
	that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

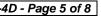






















Day 3: Wednesday, 16th of October 2024

Protection of Motors  Thermal Overload • Time Constraints • Early Relays & New Digital Relays of Starting & Stalling Conditions • Over Current / Overload • Under-Vol Over-Voltage • Under Frequency • Pole Slip / Out of Step • Loss of Excitation Inadvertent Energization • Over Fluxing  0930 - 0945 Break	tage /
0730 – 0930 Starting & Stalling Conditions • Over Current / Overload • Under-Vol Over-Voltage • Under Frequency • Pole Slip / Out of Step • Loss of Excitation Inadvertent Energization • Over Fluxing	tage /
Over-Voltage • Under Frequency • Pole Slip / Out of Step • Loss of Excitation Inadvertent Energization • Over Fluxing	0 .
Inadvertent Energization • Over Fluxing	on •
0930 – 0945 Break	
Protection of Motors (cont'd)	
Stall Protection / Acceleration Time / Start Up Supervision /Time Between Sta	rts •
0945 - 1100 Unbalanced Supply Voltages • Negative Sequence Currents • De-Rating Fact	ors •
Earth Faults - Core Balance, Residual Stabilising Resistors • Calculati	on of
Protective Relay Settings	
Motor Control	
1100 - 1230 Power Circuit • Control Circuit • Full Online Voltage Starting • Reduced V	oltage
Starting: Delta-Star, Resistance, Reactor, Autotransformer, Soft Start	
1230 – 1245 Break	
1245 – 1420 <i>Motor Control (cont'd)</i>	
Braking • Speed Control • Reversing	
Recap	
1420 – 1430 Using this Course Overview, the Instructor(s) will Brief Participants about the	opics
that were Discussed Today & Advise Them of the Topics to be Discussed Tomorro	w
1430 Lunch & End of Day Three	

Day 4: Thursday, 17th of October 2024

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System for AC Variable Speed Drives
ontrol System • Power Supply for the Control System • Dc Bus Charging
VSD Control Loops (Open Loop/Closed Loop)
System for AC Variable Speed Drives (cont'd)
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or
ion & Fault Finding
nstallation & Environmental Requirements • Power Supply Connections
ing • Where to Install Contactors in Power Circuit • Installation of Ac
s into Metal Enclosures
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, Open Forum and Closing
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End of Course















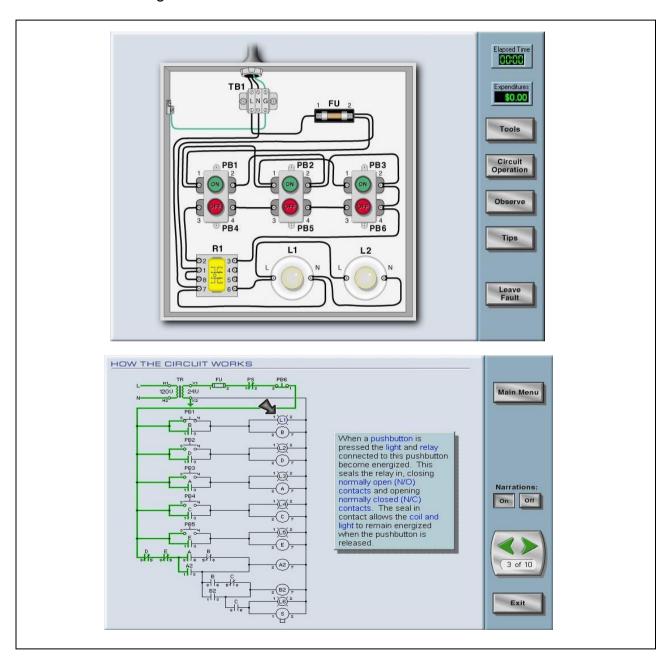






# Simulators (Hands-on Practical Sessions)

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".

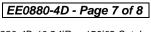






















**Troubleshooting Electrical Circuits V4.1 Simulator** 



# **Course Coordinator**

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