COURSE OVERVIEW EE0421-4D
Electrical Transformers & Switchgears
Faults, Inspection, Testing, Maintenance & Troubleshooting

Course Title
Electrical Transformers & Switchgears *Faults, Inspection, Testing, Maintenance & Troubleshooting*

Course Reference
EE0421-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	Febuary 12-15, 2024	Boardroom, Warwick Hotel Doha, Doha, Qatar
2	May 13-16, 2024	Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
3	August 05-08, 2024	Al Aziziya Hall, The Proud Hotel Al Khobar, Al Khobar, KSA
4	November 04-07, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Description

This practical and highly-interactive course includes various practical sessions and. Theory learned 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 Electrical Transformers and Switchgears: Faults, Inspection, Testing, Maintenance and Troubleshooting. It covers the electrical transformers and switchgears and their role in power distribution and protection; the principles of transformer operation, construction, components, ratings and specifications; the types of transformers, common faults and failure modes in transformers; the transformer cooling methods, transformer insulation degradation and transformer protection schemes; the pre-installation inspection of transformers, visual and mechanical inspections, electrical tests and transformer oil testing; and the transformer maintenance strategies, condition monitoring techniques and transformer temperature, vibration and noise monitoring.

During this interactive course, participants will learn the switchgears and their functions, types of switchgears, components of switchgears and switchgear ratings and specifications; the common faults and failure modes in switchgears, insulation breakdown, flashover, circuit breaker failures and maloperations, overcurrent and short circuit faults; the switchgear inspection, testing, maintenance and troubleshooting; the lubrication, cleaning and tightening practices; and the diagnostic techniques for switchgear components, emergency repairs and fault rectification.

Course Objectives

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

- Inspect, test, maintain and troubleshoot electrical transformers and switchgears faults in a professional manner
- Discuss electrical transformers and switchgears and their role in power distribution and protection
- Explain the principles of transformer operation, construction, components, ratings and specifications
- Identify the types of transformers, common faults and failure modes in transformers
- Carryout transformer cooling methods, transformer insulation degradation and transformer protection schemes
- Apply pre-installation inspection of transformers, visual and mechanical inspections, electrical tests and transformer oil testing
- Employ transformer maintenance strategies, condition monitoring techniques and transformer temperature, vibration and noise monitoring
- Identify switchgears and their functions, types of switchgears, components of switchgears and switchgear ratings and specifications
- Recognize common faults and failure modes in switchgears, insulation breakdown, flashover, circuit breaker failures and maloperations, overcurrent and short circuit faults
- Employ switchgear inspection, testing, maintenance and troubleshooting
- Apply lubrication, cleaning and tightening practices as well as diagnostic techniques for switchgear components, emergency repairs and fault rectification

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 inspection, testing, maintenance and troubleshooting of electrical transformers and switchgears faults for electrical engineers, electrical technicians and other maintenance and project technical staff who are involved in the design testing, commissioning, maintenance, repair and troubleshooting of power transformer and medium voltage switchgears.

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

Doha	**US$ 5,500** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	**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.
Al Khobar	**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.
Dubai	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training 1Kit), 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 **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 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. William Hardi is a **Senior Electrical Engineer** with almost **35** years of extensive experience within the **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise widely covers in the areas of **Power System Analysis**, **Power System Generation and Distribution**, **Electric Power System** Design, Maintenance, Testing & Troubleshooting, **Transformer Protection**, **Transformer** Problem and Failure Investigations, **Power System Operation and Control**, Fault Analysis in **Power Systems**, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear, HV Cable** Design, **Cable** Splicing & Termination, **High Voltage Electrical Safety**, **Medium & High Voltage Equipment**, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power** System, **HV Equipment** Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, Resin / **Heat Shrink & Cold Shrink** Joints, **HV/LV Equipment**, **LV & HV Electrical System**, **LV**, **MV & HV Cable** Installations & Properties, ORHVS for Responsible and Authorized Person **High Voltage Regulation**, **Transformers** Maintenance, inspections & repairs, Commissioning of **LV & HV Equipment**, Oil Purification and **High Voltage Maintenance**, HT Switch Gear -Testing, Safe Operating, Maintenance, Inspection & Repairs on **LV & HT Cables** - Testing (Pulse & Megger), Line Patrol in **Low Voltage & Distribution**, **Transmission**, **Operating Principles up to 132KV**, Abnormal Conditions & Exceptions, Commissioning & Testing, **Transformer Inspections & Repairs**, **Live Line Work up to 33KV**, **Basic Power System Protection**, **High Voltage** Operating Preparedness Phasing (**110V to 132KV**), **HV Operating & Fault** Finding (up to 132KV), Maintenance & Construction Supervision, Line Construction & Maintenance up to **132KV**, **VSD/VFD** Installations & Testing, **Electrical Panel Design**, **VSD/VFD Installations & Testing**, Instrument Installation and wiring, Programmable Logic Controller (**PLC**), **PLC for Process Control & Automation**, **ABB Drives and other PLC Starters**, **PLC** Starters – Commissioning & fault-finding, , **AC/DC Supplies & Change Over Systems**, **AC & DC Winders** and VLF Testing, Soft Starters – **VSD's** etc.,

During Mr. Hardi career life, he has gained his practical experience through several significant positions and dedication as the **Branch Manager**, **Maintenance Manager**, **Project Manager**, **Site Superintendent**, **Construction Supervisor**, **Shift Supervisor**, **Maintenance & Production Shift Supervisor**, **HT Specialist, Electrical & Instrumentation Supervisor**, **High Voltage Specialist & Commissioning Supervisor**, **Electrical Supervisor**, **Principal Technical Official**, **Winder & Conveyor Technician** and **Instructor/Trainer** from various companies, like the Armcoil Africa, JR Compressors, ELGER Electrical, Saaiplaas 3 Shaft, ESCOM and Target Mining.

Mr. Hardi is a **Qualified Electrician** certified by the Engineering Trades Training Board. Further, he is a **Certified Instructor/Trainer** and has delivered various trainings, seminars, conferences, workshops and courses globally.

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	***Introduction to Transformers & Switchgears*** *Electrical Transformers & Switchgears ● Role in Power Distribution & Protection ● Types & Classifications of Transformers & Switchgears ● Relevant Standards & Regulations*
0930 – 0945	*Break*
0945 – 1030	***Transformer Basics & Construction*** *Principles of Transformer Operation ● Transformer Construction & Components ● Transformer Ratings & Specifications*
1030 – 1230	***Transformer Basics & Construction (cont'd)*** *Types of Transformers (Power, Distribution, Instrument, Etc.) ● Transformer Cooling Methods*
1230 – 1245	*Break*
1245 – 1420	***Transformer Faults & Failure Modes*** *Common Faults & Failure Modes in Transformers ● Transformer Insulation Degradation ● Overheating & Thermal Faults ● Short Circuits & Electrical Faults ● Transformer Protection Schemes*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Transformer Inspection & Testing*** *Pre-Installation Inspection of Transformers ● Visual & Mechanical Inspections ● Electrical Tests (Turns Ratio, Insulation Resistance, Etc.) ● Transformer Oil Testing (Dissolved Gas Analysis, Moisture Content, Etc.) ● Interpretation & Analysis of Test Results*
0930 – 0945	*Break*
0945 – 1100	***Transformer Maintenance & Condition Monitoring*** *Transformer Maintenance Strategies (Preventive, Predictive, Corrective) ● Maintenance of Transformer Accessories (Bushings, Tap Changers, Etc.) ● Importance of Condition Monitoring Techniques*
1100 – 1230	***Transformer Maintenance & Condition Monitoring (cont'd)*** *Monitoring Transformer Temperature, Vibration & Noise ● Use of Diagnostic Tools & Equipment*
1230 – 1245	*Break*
1245 – 1420	***Switchgear Basics & Construction*** *Switchgears & Their Functions ● Types of Switchgears (Low Voltage, Medium Voltage, High Voltage) ● Components of Switchgears (Circuit Breakers, Disconnect Switches, Relays, Etc.) ● Arc Interruption & Quenching Techniques ● Switchgear Ratings & Specifications*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

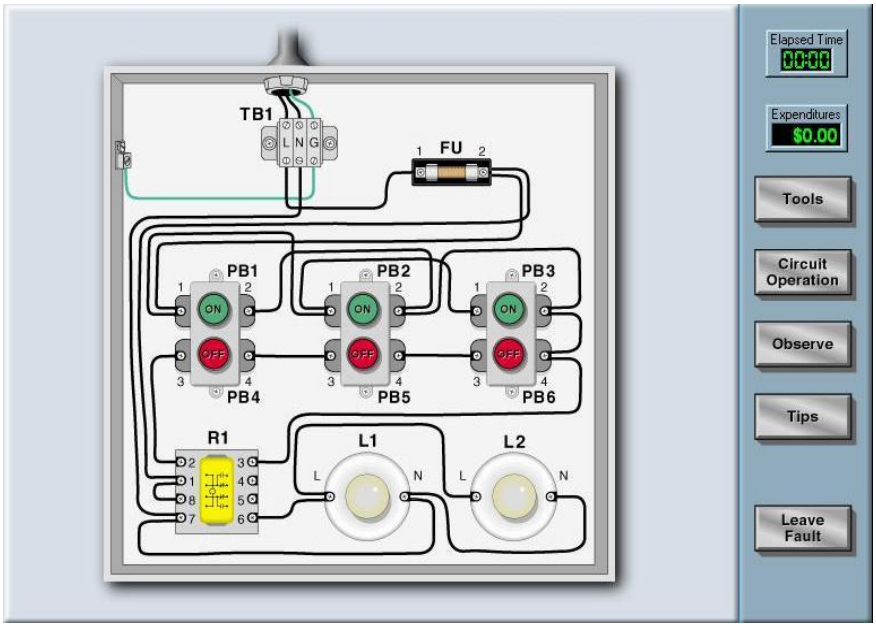
0730 – 0930	***Switchgear Faults & Failure Modes*** *Common Faults & Failure Modes in Switchgears ● Insulation Breakdown & Flashover ● Circuit Breaker Failures & Maloperations*
0930 – 0945	*Break*
0945 – 1100	***Switchgear Faults & Failure Modes (cont'd)*** *Overcurrent & Short Circuit Faults ● Switchgear Coordination & Selectivity*
1100 – 1230	***Switchgear Inspection & Testing*** *Pre-Installation Inspection of Switchgears ● Visual & Mechanical Inspections ● Electrical Tests (Contact Resistance, Insulation Resistance, Etc.)*
1230 – 1245	*Break*
1245 – 1420	***Switchgear Inspection & Testing (cont'd)*** *Protection Relay Testing & Calibration ● Testing of Auxiliary Devices (Alarms, Meters, Trip Circuits, Etc.)*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

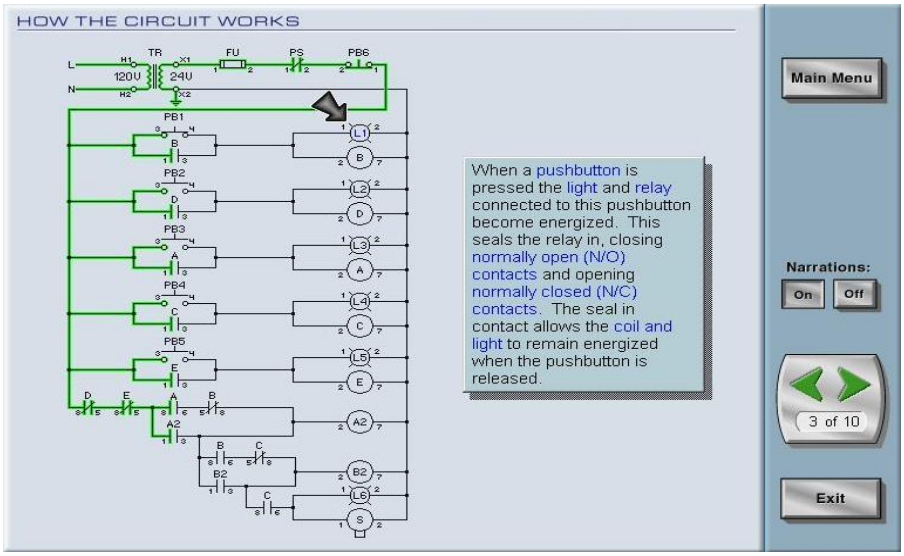
Day 4

0730 – 0930	***Switchgear Maintenance & Troubleshooting*** *Maintenance Procedures for Switchgears ● Lubrication, Cleaning, & Tightening Practices*
0930 – 0945	*Break*
0945 – 1100	***Switchgear Maintenance & Troubleshooting (cont'd)*** *Troubleshooting Common Switchgear Issues ● Diagnostic Techniques for Switchgear Components*
1100 – 1230	***Switchgear Maintenance & Troubleshooting (cont'd)*** *Emergency Repairs & Fault Rectification*
1230 – 1245	*Break*
1245 – 1345	***Case Studies & Practical Exercises*** *Analyzing Real-World Case Studies Related to Transformer & Switchgear Faults ● Practical Exercises for Transformer Testing, Maintenance, & Troubleshooting ● Group Discussions & Knowledge Sharing ● Q&A Session for Clarifications & Further Discussions*
1345 – 1400	***Course Conclusion***
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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