COURSE OVERVIEW EE0905

CTs and VTs Maintenance

Course Title
CTs and VTs Maintenance

Course Date/Venue
Session 1: June 22-26, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
Session 2: December 08-12, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE0905

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

The high efficiency and reliability of power transformers have contributed to the domination of power networks since the beginning of the last century. Transformers play also a key role in the interconnection of power systems at different voltage levels. Without transformers, it would simply not be possible to use electric power in many of the ways it is used today. Consequently, transformers occupy prominent positions in the electric power system, being the vital links between power generating stations and points of electric power utilization.

This course is designed to provide participants with a detailed and up-to-date overview of power transformers. It covers the routine tests of power transformer; the awareness on the type tests and special tests of power transformer; the oil immersed transformers; the measurements of insulation resistance in power transformer; the capacitance and power factor for transformers; the partial discharge techniques used in power transformers; and the transformer life assessment and its result.

Course Objectives

Upon the successful completion of the course, participants will be able to:-

- Gain a better overview and background of power transformers
- Analyze the routine tests of power transformer
- Increase awareness on the type tests and special tests of power transformer
- Become familiar with oil immersed transformers
- Understand the measurements of insulation resistance in power transformer
- Carry out and illustrate the measurement of voltage ration
- Acquire in-depth knowledge on the capacitance & power factor for transformers
- Review and improve the partial discharge techniques used in power transformers
- Perform transformer life assessment and be able to explain its result

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 power transformers for engineers and technicians who need a sound understanding of power transformer operation and maintenance.

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$ 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 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: -

- 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.

- 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.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

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. Herman Eksten, PE, PgDiP, is a **Senior Electrical Engineer** with over **40 years** of extensive experience **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries and **Water & Utilities** specializing in **Electrical Safety**, Certified **HV Electrical Safety**, **Low Voltage Electrical Safety**, **Electrical Circuits**: Series and Parallel Connection, **Electrical Faults & Protective Devices**, **Renewable Energy Integration**, **Smart Grid** & **Renewable Integration**, **Renewable Energy** Storage Systems, **Renewable Energy** Economics & Finance, Risk Control Methods, **LOTO – Breakers** Operation in Electricity Substation, **LOTO** Principles and Procedures, **Arc Flash Risk Assessment**, Safety in **Power Electronic Equipment & Lasers**, **Circuit Breakers & Switchgears**, **Switchgear Assets Management**, **Circuit Breakers Control Circuits**, **Substation Maintenance** Techniques, **High Voltage Operation, Electrical Protection**, **Overhead Lines & Substation**, **Power Supply**, **High Voltage Substation**, **Electrical Protection Design**, **Earthing & Lightning Protection Design, Underground Equipment**, **Distribution Network Maintenance & Construction**, **Transformers Operation & Maintenance**, **Electric Power System, Power Plant Management**, **Substation Commissioning & Troubleshooting**, **Cable Splicing & Termination, Electrical Installation & Maintenance**, **Power Generation Operation & Control, Switchgear Life Assessment**, **Structured Cabling, Electric Power System, Power System Stability, Power System Planning & Economics**, **Power Flow** Analysis, **Combined Cycle Power Plant**, **UPS & Battery System, Variable Speed Drives,** and **HV Motors & Transformers**. He is currently the **Lead Electrical Engineer** of **SNC-LAVALIN** wherein he is responsible for basic designs and successful implementation of electrical engineering to plant overhead lines and substations.

During his career life, Mr. Eksten held various positions such as the **Lead Electrical Engineer**, **Operations Manager**, **Project Engineer**, **Technical Specialist**, **Customer Executive**, **District Manager**, **Electrical Protection Specialist**, **High-Voltage Operator** and **Apprentice Electrician** for FOX Consulting, UHDE (ThyssenKrupp Engineering), TWP Projects/Consulting (EPMC-Mining), ISKHUS Power, Rural Maintenance (PTY) Energia de Mocambique Lda., Vigeo (PTY) Ltd and ESKOM.

Mr. Eksten is a **Registered Professional Engineering Technologist** and has a Postgraduate Diploma in Management Development Programme and a National Higher Diploma (NHD) in Electrical Power Engineering. Further, he is a **Certified Instructor/Trainer**, a Senior member of the South African Institute Electrical Engineers (**SAIEE**) and holds a Certificate of Registration Membership Scheme from the Engineering Council of South Africa (**ESCA**). He has further delivered numerous trainings, courses, seminars, 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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction of Power Transformers*** *Historical Survey of Transformer Development and Applications ● Transformer Design and Construction ● Defining Transformer Life Expectancy ● The Insulation System ● Life Time of Transformer ● Transformer's Oil Types and Advantage/Disadvantage of Each Type*
0930 – 0945	*Break*
0945 – 1100	***Testing of Power Transformer (Routine Tests)*** *Measurement of Voltage Ration and Check of Vector Relationship ● Measuring of Winding Resistance ● Measuring of Impedance Voltage and Load Loss ● Measuring of No-Load Loss and Current*
1100 - 1230	***Testing of Power Transformer (Routine Tests) (cont'd)*** *Dielectric Tests ● Separate- Source Voltage Withstand Test ● Induced Over - Voltage Withstand Test ● Partial Discharge Measurement ● Test on On - Load Tap Charger*
1230 – 1245	*Break*
1245 – 1420	***Testing of Power Transformers (Type Tests and Special Tests)*** *Temperature Rise Test ● Measurement of Zero Sequence Impedance ● Measurement of Voltage & Current Harmonics*
1420 - 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Testing of Power Transformers (Type Tests and Special Tests) (cont'd)*** *Measurement of Insulation Resistance ● Measurement of Capacitance and (tan) ● Lightning Impulse Test*
0930 – 0945	*Break*
0945 – 1100	***Testing of Power Transformers (Type Tests and Special Tests) (cont'd)*** *Switching Impedance Test ● Measurement of Acoustic Sound Level ● Frequency Response Analysis (FRA) ● Dielectric Frequency Response (DFR) ● Degree of Polymerization (DP)*
1100 - 1230	***Oil Immersed Transformers*** *Application Field ● Categories of Equipments ● Transformer Classification*
1230 – 1245	*Break*
1245 – 1420	***Oil Immersed Transformers (cont'd)*** *Specification for Uninhabited Insulation Mineral Oil ● Main Standards Used for Routine Tests ● Recommended Limits for Unused Mineral Insulating Oils Field in New Power Transformer*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Oil Immersed Transformers (cont'd)*** *Oil Functions ● Dissolved Gas Analysis (DGA) ● Incipient Fault Detection in Oil Immersed Transformer and Faults Types*
0930 – 0945	*Break*
0945 – 1100	***Measurements of Insulation Resistance*** *Introduction of Insulation Resistance Measurements ● Two Windings Measurements ● Three Windings Measurements*
1100 – 1230	***Measurements of Insulation Resistance (cont'd)*** *Measurement Analysis ● Measurement Instruments*
1230 – 1245	*Break*
1245 – 1420	***Measurement of Voltage Ration*** *Introduction ● Measuring Circuit ● Measurements Analysis ● Measurements Instruments*
1420 - 1430	***Recap***
1415 – 1530	*Lunch & End of Day Three*

Day 4

0730 – 0900	***Capacitance & Power Factor (C & (tan)*** *Introduction ● Measurement Instruments ● Bushing Capacitance ● Power Factor Measurements*
0900 – 0915	*Break*
0915 – 1045	***Capacitance & Power Factor (C & (tan) (cont'd)*** *Tap Insulation Capacitance ● Hot Collar Technique ● Transformer Capacitance ● Two Windings Transformer Test Procedures ● Three Windings Transformer Test Procedures*
1045 – 1100	*Break*
1100 – 1230	***Capacitance & Power Factor (C & (tan) (cont'd)*** *General Test Procedures for Windings ● Losses and Cos θ Variation with Test Voltage ● Test of Oil Insulation Power Factor ● Transformer Exciting Current Measurements*
1230 – 1245	*Break*
1245 - 1420	***Partial Discharge Techniques*** *Introduction ● What is Partial Discharge? ● Why Test for Partial Discharge?*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 - 0930	***Partial Discharge Techniques (cont'd)*** *Occurrence of Discharge ● Physical Background of Partial Discharge ● Type of Partial Discharge ● Magnitude of Discharge*
0900 – 0930	*Break*
0930 – 1100	***Partial Discharge Techniques (cont'd)*** *Characteristic of Discharge Patterns ● Partial Discharge Test Facility ● Partial Discharge with Induced Voltage ● Actual Detection Circuits*
1100 – 1230	***Partial Discharge Techniques (cont'd)*** *How to Calibrate the Partial Discharge System? ● How to Measure Partial Discharge? ● Partial Discharge Methods Available ● On – Site Partial Discharge Measurements*

1230 – 1245	*Break*
1245 – 1400	***Course Conclusion & Summary*** ***Transformer Life Assessment (Analysis of All Testing Results)***
1400 - 1415	***POST-TEST***
1415 – 1430	*Presentation of Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org