

## COURSE OVERVIEW LE0537 Advanced Transformer Oil Analysis

### Course Title

Advanced Transformer Oil Analysis

### Course Date/Venue

November 24-28, 2024/Boardroom 1, Elite  
Byblos Hotel Al Barsha, Sheikh Zayed Road,  
Dubai, UAE

### Course Reference

LE0537

### 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 fault free operation of power transformers is a factor of major economic importance and safety in power supply utilities and industrial consumers of electricity. In the current economic climate, Industries/Supply Utilities tighten their control on capital spending and make cutbacks in maintenance, an increased awareness is placed on the reliability of the existing electric power supply. Down time is at a premium. Often, the loading is increase on present units, as this will defer purchasing additional plant capacity. Th us, the stress on the transformer increases. The net total effect of the thermal, electrical and mechanical stress brought on by increased service needs to be monitored to ensure reliability.



Regular sampling and testing of insulation oil taken from transformers is a valuable technique in a preventative maintenance program. If a proactive approach is adopted based on the condition of the transformer oil, the life of the transformer can be extended.

Transformer oil testing is a proven loss prevention technique that shall be a part of any condition based predictive maintenance program. Essentially, an early warning system, transformer oil testing allows management to identify maintenance priorities, plan work assignment schedules, and order necessary parts and materials.



In this course, you will start by refreshing the basic of transformers, transformer oil properties and specification and you will learn if your transformer oil is within specifications and the principle of the analysis method used for the transformer oil analysis and their relevant standard methods used.

This course will also cover the working principles of transformers including its applications, operation and performance parameters; the chemistry of transformer oil, characteristic properties and specification, physical properties, electrical properties, storage, handling and transport as well as compatibility and contaminants; the insulating of oils, fluids and gases; the principles of transformer oil testing instrumentation; the transformer oil testing; and the presentation of results.

### **Course Objectives**

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

- Apply and gain an in-depth knowledge on transformer oil analysis
- Discuss the working principles of transformers including its applications, operation and performance parameters
- Describe the chemistry of transformer oil, characteristic properties and specification, physical properties and stability characteristics
- Identify the electrical properties and carryout proper storage, handling and transport
- Recognize the compatibility and contaminants and deterioration of insulating oil testing
- Carryout combustible gas analysis and insulating liquid sampling procedures
- Employ principles of transformer oil testing instrumentation covering UV/VIS spectrophotometers, spectrophotometer architecture, sources, filters and detectors
- Identify the design and performance criteria of instrumentation, fourier transform instruments and filter instrumentation
- Discuss atomic absorption spectroscopy, flame ASS, nebulizer/burner systems, atomization, interferences and graphite furnace ASS
- Determine gas chromatographs, selection of carrier gases and gas chromatography columns
- Explain column stationary phases, injectors and detectors and gas chromatography-mass spectrometry
- Illustrate electrochemical techniques, electrodeless (non-contact) measurement and pH probes, calibration, measurement and maintenance
- Employ transformer oil testing and results presentation



**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, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

**Who Should Attend**

This course provides an overview of all significant aspects and considerations of transformer oil analysis for for engineers and other technical staff who need a sound understanding of transformer oil analysis.

**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.

**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. Karl Thanasis**, PEng, MSc, MBA, BSc, is **International Expert** in **Analytical Laboratory & Senior Mechanical & Maintenance Engineer** with over **30 years** of extensive industrial experience. His wide expertise includes **Transformer, Transformers Oil Testing, Insulating Oil, Distribution of Data, Laboratory Equipment, Laboratory Quality Management Systems, Water Analysis & Reporting, Water Sampling & Testing, Water Analyzer, Internal Quality Control for Microbiologists, Analytical Techniques, Piping & Pipeline, Maintenance, Repair, Shutdown, Turnaround & Outages, Maintenance & Reliability Management, Mechanical Maintenance Planning, Scheduling & Work Control, Advanced Techniques in Maintenance Management, Predictive & Preventive Maintenance, Maintenance & Operation Cost Reduction Techniques, Reliability Centered Maintenance (RCM), Machinery Failure Analysis, Rotating Equipment Reliability Optimization & Continuous Improvement, Material Cataloguing, Mechanical & Rotating Equipment Troubleshooting & Maintenance, Root Cause Analysis & Reliability Improvement, Condition Monitoring, Root Cause Failure Analysis (RCFA), Steam Generation, Steam Turbines, Power Generator Plants, Gas Turbines, Combined Cycle Plants, Boilers, Process Fired Heaters, Air Preheaters, Induced Draft Fans, All Heaters Piping Work, Refractory Casting, Heater Fabrication, Thermal & Fired Heater Design, Heat Exchangers, Heat Transfer, Coolers, Power Plant Performance, Efficiency & Optimization, Storage Tank Design & Fabrication, Thermal Power Plant Management, Boiler & Steam System Management, Pump Operation & Maintenance, Chiller & Chiller Plant Design & Installation, Pressure Vessel, Safety Relief Valve Sizing & Selection, Valve Disassembling & Repair, Pressure Relief Devices (PSV), Hydraulic & Pneumatic Maintenance, Advanced Valve Technology, Pressure Vessel Design & Fabrication, Pumps, Turbo-Generator, Turbine Shaft Alignment, Lubrication, Mechanical Seals, Packing, Blowers, Bearing Installation, Couplings, Clutches and Gears. Further, he is also versed in **Wastewater Treatment** Technology, **Piping** System, Water Movement, Water Filtering, Mud Pumping, **Sludge Treatment and Drying, Aerobic Process of Water Treatment** that includes **Aeration, Sedimentation and Chlorination Tanks**. His strong background also includes **Design and Sizing** of all **Waste Water Treatment Plant Associated Equipment** such as **Sludge Pumps, Filters, Metering Pumps, Aerators and Sludge Decanters**.**

Mr. Thanasis has acquired his thorough and practical experience as the **Project Manager, Plant Manager, Area Manager - Equipment Construction, Construction Superintendent, Project Engineer and Design Engineer**. His duties covered **Plant Preliminary Design, Plant Operation, Write-up of Capital Proposal, Investment Approval, Bid Evaluation, Technical Contract Write-up, Construction and Sub-contractor Follow up, Lab Analysis, Sludge Drying and Management of Sludge Odor and Removal**. He has worked in various companies worldwide in the **USA, Germany, England and Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA and Greece** and has a **Master and Bachelor** degrees in **Mechanical Engineering with Honours** from the **Purdue University and SIU in USA** respectively as well as an **MBA** from the **University of Phoenix in USA**. Further, he is a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management (ILM)** a **Certified Instructor/Trainer** and has delivered numerous trainings, courses, seminars, workshops and conferences worldwide.





**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, 24<sup>th</sup> of November 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Working Principles of Transformers</b> Applications of Transformer • Principles of Operation • Definition of a Few Basic Parameters of Transformer • Performance Parameters
0930 – 0945	Break
0945 – 1100	<b>Insulating Oil</b> Chemistry of Transformer Oil • Characteristic Properties and Specification • Physical Properties • Stability Characteristics
1100 – 1230	<b>Insulating Oil (cont'd)</b> Electrical Properties • Storage, Handling and Transport of Transformer Oil • Compatibility and Contaminants
1230 - 1245	Break
1245 - 1420	<b>Insulating Oils, Fluids &amp; Gases</b> Deterioration of Insulating Oil • Insulating Oil Testing • Combustible Gas Analysis of Insulating Oil • Less Flammable Insulating Fluids • Insulating Liquid Sampling Procedures
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day One

**Day 2: Monday, 25<sup>th</sup> of November 2024**

0730 – 0930	<b>Principles of Transformer Oil Testing Instrumentation</b> UV/VIS Spectrophotometers • Spectrophotometer Architecture • Sources, Filters and Detectors
0930 – 0945	Break
0945 – 1100	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> IR Instrumentation • Instrumentation: Design and Performance Criteria • Fourier Transform Instruments • Filter Instrumentation
1100 – 1230	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> Atomic Absorption Spectroscopy • Introduction • Flame AAS • Nebulizer/Burner Systems • Atomisation and Interferences • Graphite Furnace AAS
1230 - 1245	Break
1245 - 1420	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> ICP – OES: Inductively Coupled Plasma - Optical Emission Spectroscopy • Principles of Optical Emission Spectroscopy • Atomic Spectroscopy Sources • Techniques and Instruments • Analytical Performance • Applications of ICP-OES
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day Two





**Day 3: Tuesday, 26<sup>th</sup> of November 2024**

0730 – 0930	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> Gas Chromatographs • Selection of Carrier Gases • Gas Chromatography Columns • Column Stationary Phases • Injectors and Detectors • Gas Chromatography – Mass Spectrometry
0930 – 0945	Break
0945 – 1100	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> Gas Chromatographs • Selection of Carrier Gases • Gas Chromatography Columns • Column Stationary Phases • Injectors and Detectors • Gas Chromatography – Mass Spectrometry
1100 – 1230	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> Gas Chromatographs • Selection of Carrier Gases • Gas Chromatography Columns • Column Stationary Phases • Injectors and Detectors • Gas Chromatography – Mass Spectrometry
1230 - 1245	Break
1245 - 1420	<b>Principles of Transformer Oil Testing Instrumentation (cont'd)</b> Electrochemical Techniques • Principals of Conductivity • Immersed Electrodes – 2 an 4 Electrode Cells • Electrodeless (Non-contact) Measurement • pH Probes – Theory, Calibration, Measurement and Maintenance
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day Three

**Day 4: Wednesday, 27<sup>th</sup> of November 2024**

0730 – 0930	<b>Transformer Oil Tests</b> Appearance • Color • Corrosive Sulphur • Density • Specific Gravity
0930 – 0945	Break
0945 – 1100	<b>Transformer Oil Tests (cont'd)</b> Dielectric Breakdown Voltage • Dissolved Gas Analysis • Furfural and Related Compounds • Interfacial Tension
1100 – 1230	<b>Transformer Oil Tests (cont'd)</b> Kinematic Viscosity • Oxidation Stability • Sediment, Sludge
1230 - 1245	Break
1245 - 1420	<b>Transformer Oil Tests (cont'd)</b> Suspended Particles in Oil, Visual • Water Content
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day Four

**Day 5: Thursday, 28<sup>th</sup> of November 2024**

0730 – 0930	<b>Transformer Oil Tests (cont'd)</b> Trace Analysis • PCB's
0930 – 0945	Break
0945 – 1100	<b>Results Presentation</b> Statistic Basics • Distributions of Data
1100 – 1230	<b>Results Presentation (cont'd)</b> Significant Figures • Introduction to Measurement Uncertainty
1230 - 1245	Break
1245 – 1345	<b>Results Presentation (cont'd)</b> Using Confidence Limits • Outlier Testing
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course





**Practical Sessions**

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



**Course Coordinator**

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