COURSE OVERVIEW EE0130
Maintenance and Troubleshooting of Industrial UPS Systems & Battery Power Supplies

Course Title
Maintenance and Troubleshooting of Industrial UPS Systems & Battery Power Supplies

Course Date/Venue
July 13-17, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
EE0130

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.

As the theory behind all UPS systems is the same, the course will discuss the UPS system in general regardless of the UPS brand, bearing in mind the tremendous number of UPS manufacturers nowadays. Hence, whatever the brand or manufacturer of your UPS system this course is the right course for you.

The course will cover everything the user and maintainer need to know about UPS and batteries. It enumerates the types and duration of power system disturbances and learn the basic concepts of an Uninterruptible Power System (UPS) including the three general types of UPS's and the three types of static UPS's and discuss the electronic components of a UPS system as well as the proper testing and troubleshooting of these power components including the functions of single phase rectifiers & inverters, three phase rectifiers & inverters including the testing and troubleshooting of these single/three phase rectifiers and inverters.

This course is designed to provide delegates with detailed explanation of the theory of operation and circuit board operation of single phase systems and review the Silicon Controlled Rectifier (SCR) and Constant Voltage Transformer (CVT) theories related to the general theory of operation of three phase systems including its circuit functions and operation & Printed Circuit Board (PCB) operation.

The concepts of primary and secondary batteries, lead acid batteries and nickel cadmium batteries including the safety and maintenance, testing and troubleshooting of faulty batteries including UPS alignment and maintenance by noting manufacturer's recommendations, making use of appropriate tools and equipment, electrical safety, mechanical requirements of component replacement for UPS systems and the major brands of UPS such as GUTOR, ABB etc will also be discussed during the course.

Course Objectives

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

- Maintain and troubleshoot various types of industrial UPS and batteries in a professional manner
- Enumerate the types and duration of power system disturbances and learn the basic concepts of an Uninterruptible Power System (UPS) including the three general types of UPS's and the three types of static UPS's
- Discuss the electronic components of a UPS system as well as the proper testing and troubleshooting of these power components
- Identify the functions of single phase rectifiers & inverters, three phase rectifiers & inverters including the testing and troubleshooting of these single/three phase rectifiers and inverters
- Give a detailed explanation of the theory of operation and circuit board operation of single phase systems
- Review the Silicon Controlled Rectifier (SCR) and Constant Voltage Transformer (CVT) theories related to the general theory of operation of three phase systems including its circuit functions and operation & Printed Circuit Board (PCB) operation
- Describe industrial UPS covering the essential differences between commercial and industrial UPS systems, EMI/RFI and electrical surge levels, IT applications and industrial applications, environmental considerations, fully electronic, industrial static switch
- Identify industrial UPS and batteries and chargers as well as match UPS service life to the critical process service life
- Discuss inverter technologies in industrial UPS including ferroresonant inverter and PWM inverters
- Carryout the concepts of primary and secondary batteries, lead acid batteries, nickel cadmium and lithium ion batteries including the safety and maintenance, testing and troubleshooting of faulty batteries
- Apply proper UPS alignment and maintenance procedures including battery charger and rectifier operation, battery charger PCB operation and alignment procedures as well as battery safety procedures
- Troubleshoot and maintain UPS systems by noting manufacturer's recommendations, making use of appropriate tools and equipment and observing electrical safety
- Explain the mechanical requirements of component replacement for UPS systems
- Identify the major brands of UPS such as GUTOR, ABB etc.

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 industrial UPS system for engineers and other technical staff who are involved in maintenance and troubleshooting of UPS systems and battery power supplies.

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)

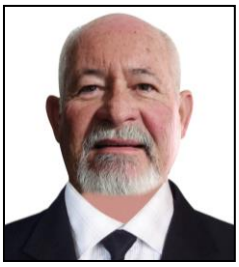
  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** 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.

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. Ken Steel is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience. His expertise widely covers **Electrical Motors Testing**, **Heat Tracing** & Insulation Installation & Testing, **HV Terminations**, **High & Low Voltages** on Overhead Cranes, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear, HV Cable** Design, **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, **Cable** Splicing & Termination, **High Voltage** Electrical Safety, **LV**, **MV & HV Cable** Installations & Properties, **LV Substation**, **MV & LV Cable**, **UPS Systems**, **MV & LV** Direct on Line Motor Drives, **MV & LV** VSD Motor Drives, **MV & LV** Soft Starter Motor Drives, **LV Two Speed Motor Drives**, Underground **Transformer Oil Containment Tank**, **Electrical & Instrumentation Construction** Installation, 1500KW, 1000KW, 1752KW **Diesel Power Plant Installation**, **110KV Overhead Line**, **110KV Outdoor Switchgear**, 110KV/10KV 6500KVA **Transformer**, **Transformer Substation**, 1600KVA 10KV/0.4KV & 2 Off 1000KVA **Diesel Generators**, 1600KVA 10KV/0.4KV & 1650KVA **Diesel Generator**, **110KV/35KV/10KV Substation**, 110KV/10KV **Transformers**,110KV & 2 Off 6KV **Overhead Lines**, 34.5KV,13.8KV ,4.16KV & 480V **Switchgear**, 4.16KV & 480V MCC, **Transformers & Motor Drives** Substations, **Diesel Driven Generators**, **Overhead Cranes**, **Overhead Cranes & HVAC Units**, **AC & DC Drives**, **Data Logger**, **Electrical, Instrumentation & Mechanical** Installation Maintenance, Slab Mills, Pre Heat Ovens, Hydraulic Shears, Stamping Machine, Gearboxes, Rollers, Pumps, Valves, Electro Magnets & Pump House Operation, Boilers Construction And Commissioning, Valve Calibration & Testing, Level Gauges, Pressure & Flow Transmitters Installation & Calibration, Pressure & Leak Testing of Boilers, Leak Testing, SMP, Elect, I&C, F&G, HVAC & Utility Services, Nitrogen Leak Test Operations, Steam Blowing Activities, SMP, Elect, I&C, F&G, HVAC & Utility Services, PTW Issue (PA/AC), Installation & Mechanical Piping and Hydro Testing & Leak Testing of Lines Installation.

During Mr. Steel's career life, he has gained his practical experience through several significant positions and dedication as the **3GP PBF & Boilers SC Commission Support**, **SC Site Execution Superintendent**, **E&I Construction Superintendent**, **High Voltage Construction Supervisor**, **Control & Power Construction Supervisor**, **Electrical & Instrumentation Supervisor**, **Electrical Technician**, **Construction Support Electrical Engineer**, **E&I Engineer**, **Electrical/Instrumentation Site Supervisor**, **Q.A/Q.C Inspector**, **Electrical/ Instrumentation Technician**, **Maintenance Fitter Instrumentation Technician**, **Millwright**, **Apprentice Millwright** and **Senior Instructor/Lecturer** for Tengiz Chevron Oil Kazakhstan, Al Jubail Saudi Arabia, Escravos Delta state Nigeria, Lurgi S.A, SuD Chemie Sasol Catalysts, J C Groenewalds Construction (LTA), Tycon (Goodyear S.A.), Dragline Construction and Iscor Vanderbijlpark.

Mr. Steel has a **Diploma** in **Electronics Mechanic**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Accommodation

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

Course Fee

US$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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 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, 13th of July 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Introduction*** *Overview of course • Why have a UPS*
0900 – 0915	*Break*
0915 – 1100	***Types & Duration of Power System Disturbances*** *Sags • Surges and Spikes • Power Quality*
1100 – 1230	***Review of Electronic Components*** *Volts/Ohms and Amps • Phase Relationships • Resistors/Capacitors/ Inductors/RLC Circuits in Series and Parallel • Diodes/Transistors/Thyristors/SCR's/TRIACs/IGBT's/Op Amps • Testing & Troubleshooting of Power Components*
1230 – 1245	*Break*
1245 – 1420	***Introduction to UPS's*** *Power Conditioners • Uninterruptible Power Systems • Power Quality Source Alternatives • Power Disturbance Cost Comparisons*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2:	Monday, 14th of July 2025
0730 – 0930	***Three General Types of UPS's*** *Kinetic (Motor Generator Sets) • Flywheel • Static & Components*
0930 – 0945	*Break*
0945 – 1100	***Three Types of Static UPS's*** *Traditional UPS • Static UPS • Static UPS with Bypass*
1100 – 1230	***UPS Topologies*** *Single Phase Rectifiers • Single Phase Inverters • Three Phase Rectifiers • Three Phase Inverters • Testing & Troubleshooting of Single/Three Phase Rectifiers & Inverters*
1230 – 1245	*Break*
1245 – 1420	***Single Phase Systems*** *Theory of Operation • Single Phase - Circuit Board Operation • Shorting Board • Sync Board • Oscillator Board • Frequency Detector • Logic Board • Voltage & Current Sense*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3:	Tuesday, 15th of July 2025
0730 – 0830	***Three Phase Systems - General Theory of Operation*** *Silicon Controlled Rectifier (SCR) Theory • Constant Voltage Transformer (CVT) Theory*
0830 – 0930	***Three Phase Systems - Circuit Functions & Operation*** *Inverter • Static Switch • Automatic Transfer Switch • Manual Bypass Switch • General Precautions & Safety • Testing & Maintenance of Each Circuit*
0930 – 0945	*Break*
0945 – 1230	***Three Phase System - Printed Circuit Board (PCB) Operation*** *Frequency Detector • Logic Board • Disconnect • Noise Suppresser • Voltage & Current Sense • Three Phase Control • Gate Transformer • Frequency Meter • Auto-Retransfer • Crest Factor Interface & Relay Boards*
1230 – 1245	*Break*
1245 – 1420	***Industrial UPSs*** *The Essential Differences Between Commercial & Industrial UPS Systems • EMI/RFI & Electrical Surge Levels • IT Applications vs. Industrial Applications • Environmental Considerations • Fully Electronic, Industrial Static Switch • Industrial UPS Batteries & Chargers • Matching UPS Service Life to the Critical Process Service Life*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4:	Wednesday, 16th of July 2025
0730 – 0930	***Industrial UPS- Inverter Technologies*** *Ferroresonant Inverters • PWM (Pulse-Width-Modulated) Inverters • Sizing an Industrial UPS System for Non-Linear Loads*
0930 – 0945	*Break*
0945 - 1100	***Introduction to Batteries*** *Primary Batteries • Secondary Batteries*
1100 – 1230	***Lead Acid Batteries*** *Chemistry • Different types • Capacity Factors • S-Curves • Battery Safety & Maintenance • Float & Equalize Voltages • Load Testing • Testing & Troubleshooting of Faulty Batteries*
1230 – 1245	*Break*
1245 – 1420	***Nickel Cadmium & Lithium Ion Batteries*** *Chemistry • Battery Types • Capacity Factors • Battery Safety & Maintenance • Float & Equalize Voltages • Load Testing • Testing & Troubleshooting of Faulty Batteries*
1420 - 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5:	Thursday, 17th of July 2025
0730 – 0830	***UPS Alignment & Maintenance Procedures*** *Battery Charger & Rectifier Operation • Battery Charger PCB Operation & Alignment Procedures • Battery Safety Procedures*
0830 – 0930	***Troubleshooting and Maintenance of UPS Systems*** *Manufacturers Recommendations • Tools & Equipment • Electrical Safety • Mechanical Requirements of Component Replacement*
0930 – 0945	*Break*
0945 – 1200	***Case Studies*** *Selection & Sizing • Batteries*
1200 – 1215	*Break*
1215 – 1345	***Case Studies (cont'd)*** *UPS's • Batteries & UPS's*
1345 – 1400	***Summary, Course Conclusion, Open Forum & Closure***
1400 – 1415	***POST-TEST***
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

Reem Dergham, Tel: +974 4423 1327, Email: reem@haward.org