



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

Session 1: February 04-08, 2024/Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey
Session 2: March 03-07, 2024/Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, 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.





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.

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: -

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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.

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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. Pan Marave, PE, MSc, BEng, is a Senior Electrical & Instrumentation Engineer with over 40 years of extensive experience in Oil, Gas, Petrochemical, Refinery & Power industries. His expertise includes CEMS Operations and Maintenance, ABB 11KV Distribution Switchgear, Operation & Maintenance of Rotork make MOVS, Maintaining Instrument Air Compressors, Circuit Breaker, HV Switchgear Maintenance, HV/LV Electrical Authorisation, Basic Electricity, Electrical & Special Hazards, Personnel Protection, HV/LV Equipment, Motor Controllers, Electrical Switching Practices, Emergency Planning, Safety Management, Safety Instrumented Systems (SIS), Safety Integrity Level (SIL), Emergency Shutdown (ESD); DCS, SCADA & PLC; Measurement (Flow, Temperature, Pressure); Process Analyzers & Analytical Instrumentation; Process Control, Instrumentation & Safeguarding; Process Controller, Control Loop & Valve Tuning; Industrial Distribution Systems; Industrial Control & Control Systems, Power Systems Protection & Relaying; Earthing, Bonding, Grounding, Lightning & Surge Protection; Electric Power Substation & Systems; Electrical Engineering Principles; Motor Control Circuit; Electrical Fault Analysis; Electrical Networks & Distribution Cables; Circuit Breakers, Switchgears, Transformers, Hazardous Areas Classification and Detailed Engineering Drawings, Codes & Standards. Furthermore, he is also well-versed in Microprocessors Structure, Lead Auditor (ISO 9000:2000), ISO 9002, Quality Assurance, and Projects & Contracts Management.

Presently, Mr. Marave is the **Technical Advisor of Chamber of Industry & Commerce** in Greece. Prior to this, he gained his thorough practical experience through several positions as the **Technical Instructor, Engineering Manager, Electronics & Instruments Head, Electrical, Electronics & Instruments Maintenance Superintendent, Assistant General Technical Manager and Engineering Supervisor** of various international companies such as the **Alumil Mylonas, Athens Papermill, Astropol** and the **Science Technical Education**.

Mr. Marave is a **Registered Professional Engineer** and has **Master's and Bachelor's** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York and Pratt Institute of New York (USA)** respectively. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and an active member of the **Technical Chamber** and the **Institute of Electrical and Electronics Engineer (IEEE)** in Greece. He has presented and delivered **numerous international** courses, conferences, trainings and workshops worldwide.

Accommodation

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





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

Istanbul	US\$ 6,000 per Delegate + VAT . This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	US\$ 6,000 per Delegate. This rate includes H-STK® (Howard Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 – 0900	Introduction <i>Overview of course • Why have a UPS</i>
0900 – 0915	<i>Break</i>
0915 – 1100	Types & Duration of Power System Disturbances <i>Sags • Surges and Spikes • Power Quality</i>
1100 – 1230	Review of Electronic Components <i>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</i>
1230 – 1245	<i>Break</i>
1245 – 1420	Introduction to UPS's <i>Power Conditioners • Uninterruptible Power Systems • Power Quality Source Alternatives • Power Disturbance Cost Comparisons</i>
1420 – 1430	Recap <i>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</i>
1430	<i>Lunch & End of Day One</i>





Day 2

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

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 Suppressor • 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

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 <i>Primary Batteries • Secondary Batteries</i>
1100 - 1230	Lead Acid Batteries <i>Chemistry • Different types • Capacity Factors • S-Curves • Battery Safety & Maintenance • Float & Equalize Voltages • Load Testing • Testing & Troubleshooting of Faulty Batteries</i>
1230 - 1245	<i>Break</i>
1245 - 1420	Nickel Cadmium & Lithium Ion Batteries <i>Chemistry • Battery Types • Capacity Factors • Battery Safety & Maintenance • Float & Equalize Voltages • Load Testing • Testing & Troubleshooting of Faulty Batteries</i>
1420 - 1430	Recap <i>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</i>
1430	<i>Lunch & End of Day Four</i>

Day 5

0730 - 0830	UPS Alignment & Maintenance Procedures <i>Battery Charger & Rectifier Operation • Battery Charger PCB Operation & Alignment Procedures • Battery Safety Procedures</i>
0830 - 0930	Troubleshooting and Maintenance of UPS Systems <i>Manufacturers Recommendations • Tools & Equipment • Electrical Safety • Mechanical Requirements of Component Replacement</i>
0930 - 0945	<i>Break</i>
0945 - 1200	Case Studies <i>Selection & Sizing • Batteries</i>
1200 - 1215	<i>Break</i>
1215 - 1345	Case Studies (cont'd) <i>UPS's • Batteries & UPS's</i>
1345 - 1400	Summary, Course Conclusion, Open Forum & Closure
1400 - 1415	POST-TEST
1415 - 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>



Practical Sessions

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



Course Coordinator

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