

COURSE OVERVIEW EE0398

Electric & Control System Commissioning, Start-up, Testing & Troubleshooting (NETA, ANSI, IEC & NEC)

Course Title

Electric & Control System Commissioning, Start-up, Testing & Troubleshooting (NETA, ANSI, IEC & NEC)

Course Date/Venue

Session 1: February 18-22, 2024/Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar

Session 2: March 03-07, 2024/Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey



Course Reference

EE0398

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Description



This practical 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.

Today's electrical and control systems utilize thousands of separate parts, manufactured by hundreds of different manufacturers, installed by several different trades. It takes skilled professional, adept at all facets of the design and construction process, to ensure that the complete system meets and operates according to the design intent. The commissioning process ensures that systems operate at their highest efficiency, as intended by design. The process of commissioning includes testing and balancing, tuning control loops, point-to-point wiring verification, and testing of safety and backup systems.



The start-up of any electrical and control system for the first time, regardless of its size, type or industry, is a very special occurrence and poses some unique challenges to electrical and control personnel. Proper start-up and commissioning of power distribution and control equipment is vital to the long-term health of an electrical system. Improper installation and commissioning are the leading causes of premature failures. Inexperience and poor planning will inevitably result in prolonged delays in the start-up which can lead to costly productivity losses.



Commissioning is often a critical component of the design and installation process, and can distinguish whether a project will succeed or fail. Commissioning can help ensure proper equipment operation, user acceptance and intended energy savings in both new construction and renovation projects.

This course provides invaluable information to anyone who wishes to know and understand the role of Acceptance Testing, Commissioning and Start-Up of Electrical Power Distribution and Control Systems. The importance of planning and preparation for the project, from engineering to commissioning and start-up, will be emphasized. This course deals with safety considerations and testing and start-up procedures for all the components of any electrical and control system. By reviewing electrical testing specifications developed by **NETA**, **ANSI**, **IEC** and **NEC**, participants can create a commissioning program designed to meet their facility's needs. It will also help them decide what can be done by in-house personnel and what is best left to an accredited electrical maintenance professional. The course will provide the delegates with a solid understanding of theory and standards. The course will also make the delegates aware of issues concerning the proper application, installation, risk assessment and maintenance of electrical and control systems with a strong emphasis on safety.

Course Objectives

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

- Apply and gain an in depth knowledge on electrical & control system commissioning, start-up, testing & troubleshooting
- Discuss the electrical theory, electrical drawings and test requirements
- Define component testing procedures and explain tests for major components of electrical & control system
- Identify the commissioning of generators, motors, Variable Frequency Drives (VFDS), Variable Speed Drives Constant Frequency (VSCF), transformers, switchgear, cables, battery system/UPS, protective relay systems, electrical distributed control system, power management system & control systems
- Explain substation equipment commissioning, transformer commissioning and distribution switchgear commissioning
- Discuss NETA Acceptance testing specifications

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 covers systematic techniques and methodologies on start-up, commissioning and testing of electrical systems and equipment for electrical maintenance engineers, supervisors, foremen and other technical staff. Further, the course is suitable for project, commissioning, testing, utility and inspection engineers and technical personnel. Instrumentation, control and mechanical engineers who are dealing with electrical systems and equipment will also find this course very beneficial.

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.

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:



Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **35 years** of extensive experience in the **Power, Petroleum, Petrochemical** and **Utilities**. He specializes in **HV/LV Equipment, High Voltage Electrical Safety, LV & HV Electrical System, HV Equipments Inspection & Maintenance, HV Switchgear Operation & Maintenance, LV Distribution Switchgear & Equipment, HV Switchgear Maintenance, HV/LV Electrical Authorisation, Hazardous Area Classification, Power Quality, Disturbance Analysis, Blackout, Power Network, Power Distribution, Power Systems Control, Power Systems Security, Power Electronics, ETAP, Electrical Substations, Tariff Design & Structure Analysis, Engineering Drawings, Codes & Standards, P&ID Reading, Interpretation & Developing, PLC, SCADA, DCS, Process Control, Instrumentation, Automation, Power Generation, Process Control Instrumentation, SIS, SIL, ESD, Alarm Management Systems, Fieldbus Systems and Fiber Optics** as well as the service pricing of these. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of **Security & Control of Power Transmission Distribution & High Voltage Systems** and he further takes part in the **Load Records Evaluation & Transmission Services Pricing**.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management and also in Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens, Electricity Authority** and **ACETO** industries where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays, MV VFD, PLC** and **SCADA** System with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like Load Management Concepts, **PLC** Programming, Installation, Operation and Troubleshooting, **AC Drives** Theory, Application and Troubleshooting, Industrial Power Systems Analysis, **AC & DC Motors, Electric Motor Protection, DCS SCADA, Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality** Standards, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer** and **Switchgear** Application, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics, Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD, Master & Bachelor** degrees in **Electrical and Instrumentation Engineering** from the **University of Wisconsin Madison, USA**. Further, he has numerous papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, **HV Substation Automation** and Power System Stability.

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

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 – 0930	Introduction <i>Management of Commissioning Projects • About NETA • Certification of Test Technicians • Certification Test Examples</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Applicable Rules & Standards <i>NETA – ANSI Standards • NETA – Frequency of Tests • ANSI IEC 62337 • NEC 2011</i>
1100 – 1230	Electrical Theory <i>Basic Electrical Theory & Commonly Used Formulae • Time-Current Characteristics • Electrical Definitions and Acronyms • Ground Fault Systems • Coordination Studies • Short Circuit Studies • Device Evaluations</i>
1230– 1245	<i>Break</i>
1245 – 1420	Understanding Electrical Drawings <i>IEEE Device Numbers • Drawing Symbols • Single lines Drawings • 3-Line Drawings • AC/DC Trip & Control Schematics • Wiring Diagrams • General System Design, Lay-out and Drawings</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	Test Requirements <i>Development of Test Regime • Outline of Typical Tests • Interpretation of Test Results • Troubleshooting</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Component Testing Procedures <i>Types of Commonly Used Test Equipment • Insulation Resistance Testing • Contact Resistance Testing • Current Injections, CT Testing • DC Voltage Testing Techniques • AC Voltage Testing Techniques</i>
1100 – 1230	Tests for Major Components of Electrical & Control System <i>Testing of Motors and Generators • Variable Frequency Drives (VFDS)</i>
1230 – 1245	<i>Break</i>
1245 – 1420	Tests for Major Components of Electrical & Control System (cont'd) <i>Variable Speed Drives Constant Frequency (VSDF) • Transformers • Switchgear</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 Two</i>

Day 3

0730 – 0930	Tests for Major Components of Electrical & Control System (cont'd) <i>Cables and Accessories • Battery System • Protective Relay Systems</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Tests for Major Components of Electrical & Control System (cont'd) <i>Programmable Logic Controllers (PLC) • Distributed Control Systems (DCS)</i>
1100 – 1230	Tests for Major Components of Electrical & Control System (cont'd) <i>Electrical Distributed Control System • Power Monitoring</i>
1230 – 1245	<i>Break</i>
1245 – 1420	Tests for Major Components of Electrical & Control System (cont'd) <i>Power Management System • Control Relays/Timers/Switches • Fieldbus</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 Three</i>

Day 4

0730 – 0900	Commissioning & Start-up <i>Terminology • Objectives • Specifications • Documentation • Safety and Training • Case Studies</i>
0900 – 0915	<i>Break</i>
0915 – 1100	Commissioning of Generators, Motors, VFDS, VSDF, Transformers, Switchgear, Cables, Battery System/UPS, Protective Relay Systems & Control Systems <i>Development of Procedures • Documentation • Interpretation of Results • Troubleshooting</i>
1100 – 1230	Substation Equipment Commissioning <i>Ground Grid Design, Grounding (step & Touch Potentials, Earth Resistivity, Bonding Resistance) • Testing Ground Grids and Soil Resistivity • High Voltage Towers and Switches • Outdoor SF6 Breakers • Other Substation Equipment</i>

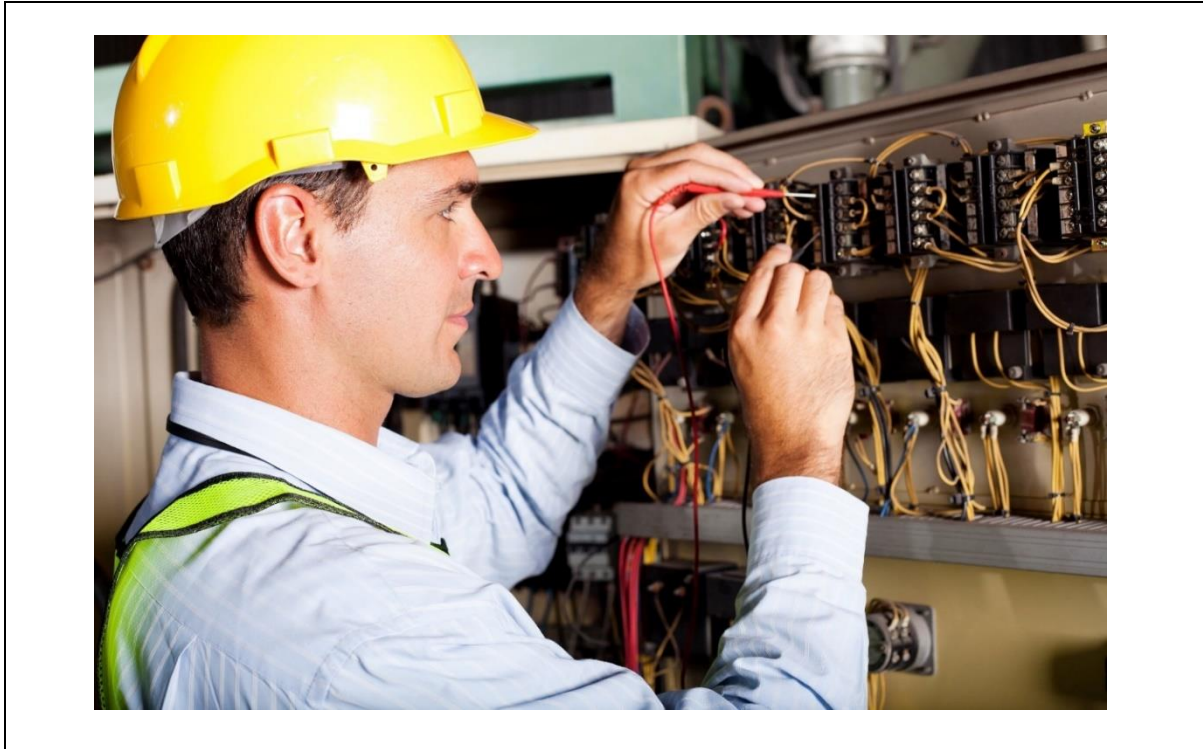
1230 - 1245	Break
1245 - 1420	Transformer Commissioning General Construction, Operation & Safety • Field Assembly and Vacuum Filling of Power Transformers • Handling Transformer Oil, Tapchangers • Transformer Protective Devices, Bushings, Auxiliary Devices Alarms & Trips • NETA Recommended Commissioning Tests
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

0730 - 0930	Distribution Switchgear Commissioning General Construction, Operation & Safety • Metal Clad Switchgear Construction & Safety Features • Commissioning Switchgear • Breaker Construction & Safety Features • Capacitors • Current Transformers • Instrument Transformers, Test Switches, Metering and Relaying Devices • NETA Recommended Acceptance Test
0930 - 0945	Break
0945 - 1100	NETA Acceptance Testing Specifications NETA Acceptance Testing Procedures of Electrical Equipment
1100 - 1230	Start-up, Acceptance and Hand Over Systems and Their Integration • Energizing Sequence • Safety Considerations • Load Checks • Documentation • Correction of Defects • Spare Parts • Warranty • Final Acceptance • Training for Operations and Maintenance Personnel
1230 - 1245	Break
1245 - 1345	Case Studies
1345 - 1400	Course Conclusion Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
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

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