

**COURSE OVERVIEW EE0419**

**Electrical Faults, Causes, Analysis, Detection & Remedies for Safe Operation, Maintenance of Electrical Switchgear**

**Course Title**

Electrical Faults, Causes, Analysis, Detection & Remedies for Safe Operation, Maintenance of Electrical Switchgear

**Course Date/Venue**

June 28-July 02, 2025/TBA Meeting Room, Double Tree by Hilton Doha – Al Saad, Doha, Qatar

**Course Reference**

EE0419

**Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs

**Course Description**



***This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt in the class will be applied using our state-of-the-art simulators.***



This course is designed to provide participants with a detailed and up-to-date overview of Electrical Faults, Causes, Analysis, Detection & Remedies for Safe Operation, Maintenance of Electrical Switchgear. It covers the purpose and types of electrical switchgear; the components and configurations of switchgear systems and safety considerations in operating and maintaining switchgear; the common electrical faults encountered in switchgear; the causes and consequences of electrical faults; and the fault analysis techniques, visual inspection and condition assessment.



Further, the course will also discuss the electrical testing methods, thermographic imaging, vibration analysis and online monitoring systems; the early fault detection, switchgear monitoring systems, protective relay systems, circuit breakers, fault detection and alarm systems and remote monitoring options; the safety protocols for working with electrical switchgear; and the lockout/tagout procedures and personnel safety; and the regular maintenance and inspections, lubrication, cleaning, tightening of switchgear components, record-keeping and documentation.

During this interactive course, participants will learn the fault isolation and identification techniques; repairing and replacing faulty components, restoring electrical insulation, ARC flash mitigation strategies and effective grounding and earthing techniques; the pre-commissioning checks and inspections, functional testing of switchgear components and testing and calibrating protective relays; the control interlocking systems; the commissioning documentation and procedures; the emergency response procedures for electrical faults; identifying critical faults requiring immediate action and troubleshooting techniques for fault localization; the rapid repairing and recovering strategies; and the post-fault analysis and investigation.

### **Course Objectives**

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

- Apply and gain an in-depth knowledge on electrical faults, causes, analysis, detection and remedies for safe operation, maintenance of electrical switchgear
- Discuss the purpose and types of electrical switchgear as well as identify the components and configurations of switchgear systems and safety considerations in operating and maintaining switchgear
- Identify the common electrical faults encountered in switchgear and the causes and consequences of electrical faults
- Apply fault analysis techniques, visual inspection and condition assessment
- Carryout electrical testing methods, thermographic imaging, vibration analysis and online monitoring systems
- Employ early fault detection, switchgear monitoring systems, protective relay systems, circuit breakers and fault detection and alarm systems and remote monitoring options
- Implement safety protocols for working with electrical switchgear including lockout/tagout procedures and personnel safety
- Apply regular maintenance and inspections, lubrication, cleaning, tightening of switchgear components, record-keeping and documentation
- Carryout fault isolation and identification techniques, repair and replace faulty components, restoring electrical insulation, ARC flash mitigation strategies and effective grounding and earthing techniques
- Perform pre-commissioning checks and inspections, functional testing of switchgear components and testing and calibration of protective relays
- Verify control interlocking systems and apply commissioning documentation and procedures
- Apply emergency response procedures for electrical faults, identify critical faults requiring immediate action and troubleshoot techniques for fault localization
- Employ rapid repair and recover strategies including post-fault analysis and investigation

### 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 electrical faults, causes, analysis, detection and remedies for safe operation, maintenance of electrical switchgear for electrical engineers, electrical technicians, electrical inspectors, electrical maintenance personnel, electricians, electrical safety professionals and facility managers.

### 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\$ 6,000** per Delegate. 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**

Haward's certificates are accredited by the following international accreditation organizations:

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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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

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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.

### 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 **45 years** of extensive experience in **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise includes **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.



**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, 28<sup>th</sup> of June 2026**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0945	<b>Introduction to Electrical Switchgear</b> Definition & Purpose of Electrical Switchgear • Types of Electrical Switchgear (LV, MV, HV) • Components & Configurations of Switchgear Systems • Safety Considerations in Operating & Maintaining Switchgear
0945 – 1000	Break
1000 – 1200	<b>Common Electrical Faults in Switchgear</b> Common Electrical Faults Encountered in Switchgear • Short Circuits, Overloads, Insulation Failures & Earth Faults
1200 – 1215	Break
1215 – 1300	<b>Common Electrical Faults in Switchgear (cont'd)</b> Causes & Consequences of Electrical Faults
1300 – 1420	<b>Common Electrical Faults in Switchgear (cont'd)</b> Importance of Fault Detection & Prevention
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

**Day 2: Monday, 29<sup>th</sup> of June 2026**

0730 – 0930	<b>Fault Analysis Techniques</b> Visual Inspection & Condition Assessment • Electrical Testing Methods (IR Testing, Power Factor Measurement, Etc.)
0930 – 0945	Break
0945 – 1100	<b>Fault Analysis Techniques (cont'd)</b> Thermographic Imaging & Vibration Analysis • Introduction to Online Monitoring Systems
1100 – 1200	<b>Fault Detection &amp; Monitoring</b> Importance of Early Fault Detection • Monitoring Systems for Switchgear • Protective Relay Systems & their Functions
1200 – 1215	Break
1300 – 1420	<b>Fault Detection &amp; Monitoring (cont'd)</b> Circuit Breakers & Fault Detection Mechanisms • Alarm Systems & Remote Monitoring Options
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two

**Day 3: Tuesday, 30<sup>th</sup> of June 2026**

0730 – 0930	<b>Safe Operation &amp; Maintenance Practices</b> Safety Protocols for Working with Electrical Switchgear • Lockout/Tagout Procedures & Personnel Safety • Importance of Regular Maintenance & Inspections
0930 – 0945	Break
0945 – 1100	<b>Safe Operation &amp; Maintenance Practices (cont'd)</b> Lubrication, Cleaning & Tightening of Switchgear Components • Record-Keeping & Documentation





1100 – 1200	<b>Remedies for Electrical Faults</b> Fault Isolation & Identification Techniques • Repair & Replacement of Faulty Components • Techniques for Restoring Electrical Insulation
1200 – 1215	Break
1215 – 1300	<b>Remedies for Electrical Faults (cont'd)</b> ARC Flash Mitigation Strategies • Techniques for Effective Grounding & Earthing
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three

**Day 4: Wednesday, 01<sup>st</sup> of July 2026**

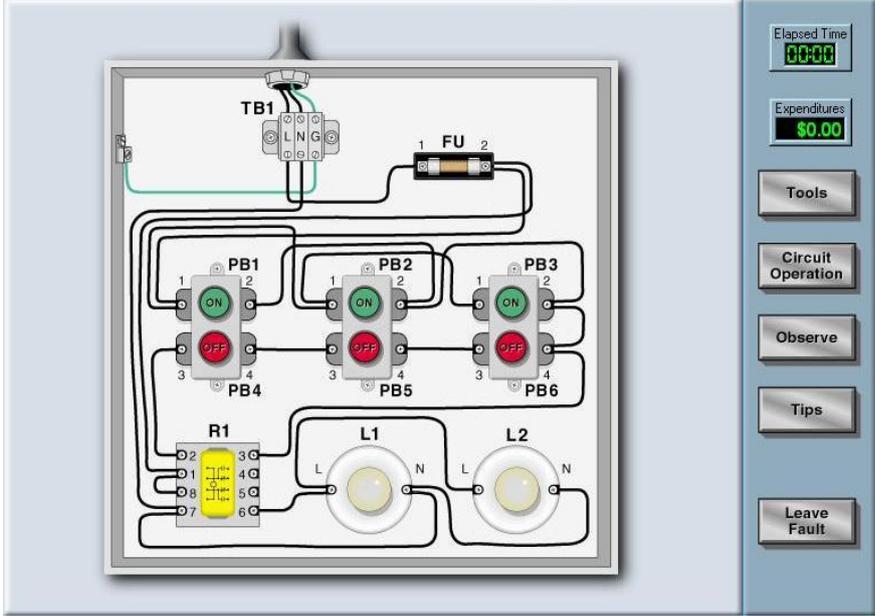
0730 – 0930	<b>Switchgear Testing &amp; Commissioning</b> Pre-Commissioning Checks & Inspections • Functional Testing of Switchgear Components • Testing & Calibration of Protective Relays
0930 – 1045	<b>Switchgear Testing &amp; Commissioning (cont'd)</b> Verification of Control & Interlocking Systems • Commissioning Documentation & Procedures
1045 – 1100	Break
1100 – 1215	<b>Emergency Response &amp; Fault Handling</b> Emergency Response Procedures for Electrical Faults • Identifying Critical Faults Requiring Immediate Action • Troubleshooting Techniques for Fault Localization
1215 – 1230	Break
1230 – 1420	<b>Emergency Response &amp; Fault Handling (cont'd)</b> Rapid Repair & Recovery Strategies • Post-Fault Analysis & Investigation
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Four

**Day 5: Thursday, 02<sup>nd</sup> of July 2026**

0730 – 0900	<b>Case Studies &amp; Practical Exercises</b> Analyzing Real-World Electrical Fault Scenarios • Exercises for Fault Detection & Diagnosis
0900 – 0915	Break
0915 – 1100	<b>Case Studies &amp; Practical Exercises (cont'd)</b> Simulated Fault Handling Exercises
1100 – 1200	<b>Review &amp; Assessment</b> Recap of Key Concepts and Techniques covered in the Course • Review of Case Studies & Practical Exercises • Assessment to Evaluate Participants' Knowledge & Understanding
1200 – 1215	Break
1215 – 1345	<b>Review &amp; Assessment (cont'd)</b> Q & A to Address Any Remaining Queries
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

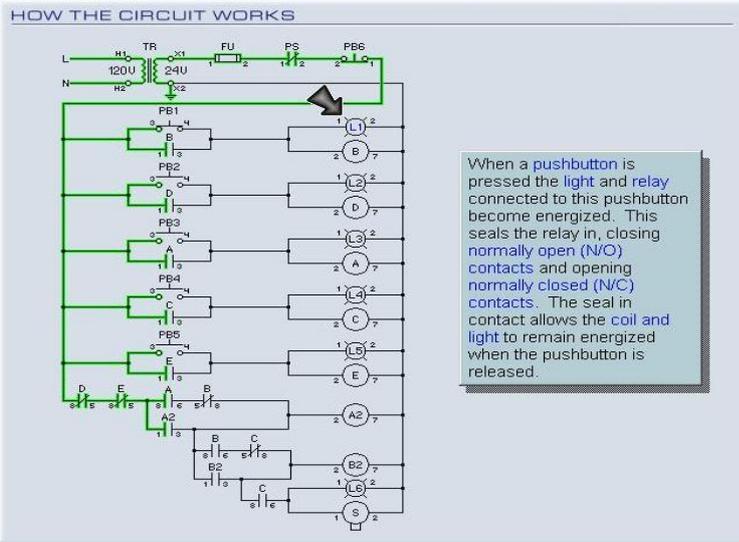
**Simulator (Hands-on Practical Sessions)**

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators “Troubleshooting Electrical Circuits V4.1”, Power World” and “ETAP software”.



**Basic Techniques**

HOW THE CIRCUIT WORKS



When a pushbutton is pressed the light and relay connected to this pushbutton become energized. This seals the relay in, closing normally open (N/O) contacts and opening normally closed (N/C) contacts. The seal in contact allows the coil and light to remain energized when the pushbutton is released.

Main Menu

Narrations:

On Off

3 of 10

Exit

**Basic Control Circuits**



**Guided Troubleshooting**

Does the door operate properly?

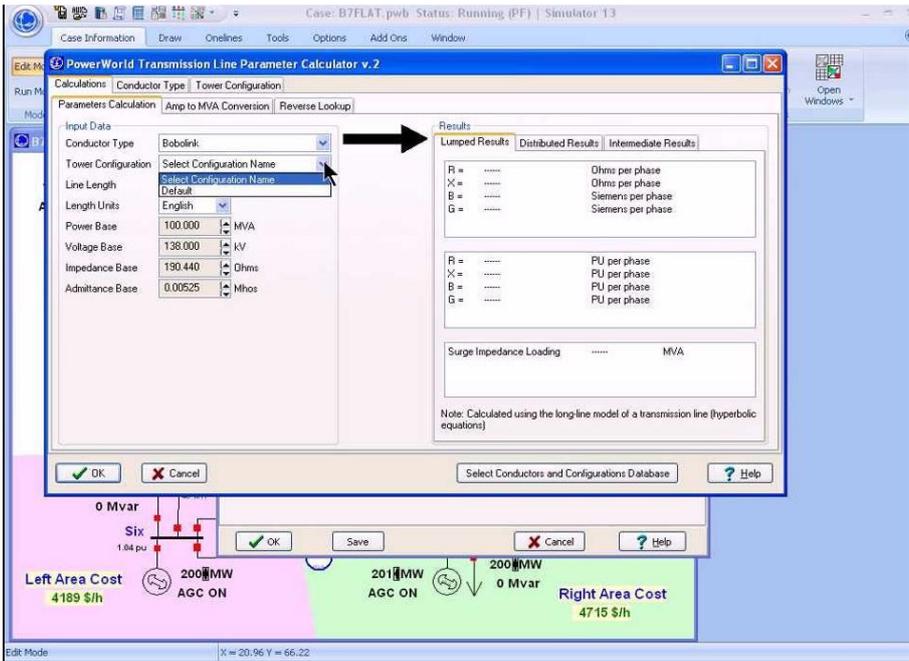
Yes No

Observations

Minimize

Tools Observe Tips Elapsed Time 00:00 Expenditures \$0.00 Leave Fault

**Motor Control Techniques**



Case: B7FLAT.pwb Status: Running (PF) | Simulator 13

PowerWorld Transmission Line Parameter Calculator v.2

Input Data

Conductor Type: Bobolink

Tower Configuration: Select Configuration Name

Line Length: Default

Length Units: English

Power Base: 100,000 MVA

Voltage Base: 138,000 kV

Impedance Base: 130,440 Ohms

Admittance Base: 0.00525 Mhos

Results

Lumped Results

R = ..... Ohms per phase

X = ..... Ohms per phase

B = ..... Siemens per phase

G = ..... Siemens per phase

R = ..... PU per phase

X = ..... PU per phase

B = ..... PU per phase

G = ..... PU per phase

Surge Impedance Loading ..... MVA

Note: Calculated using the long-line model of a transmission line (hyperbolic equations)

0 Mvar

Six 1.04 pu

Left Area Cost 4189 \$/h

200 MW AGC ON

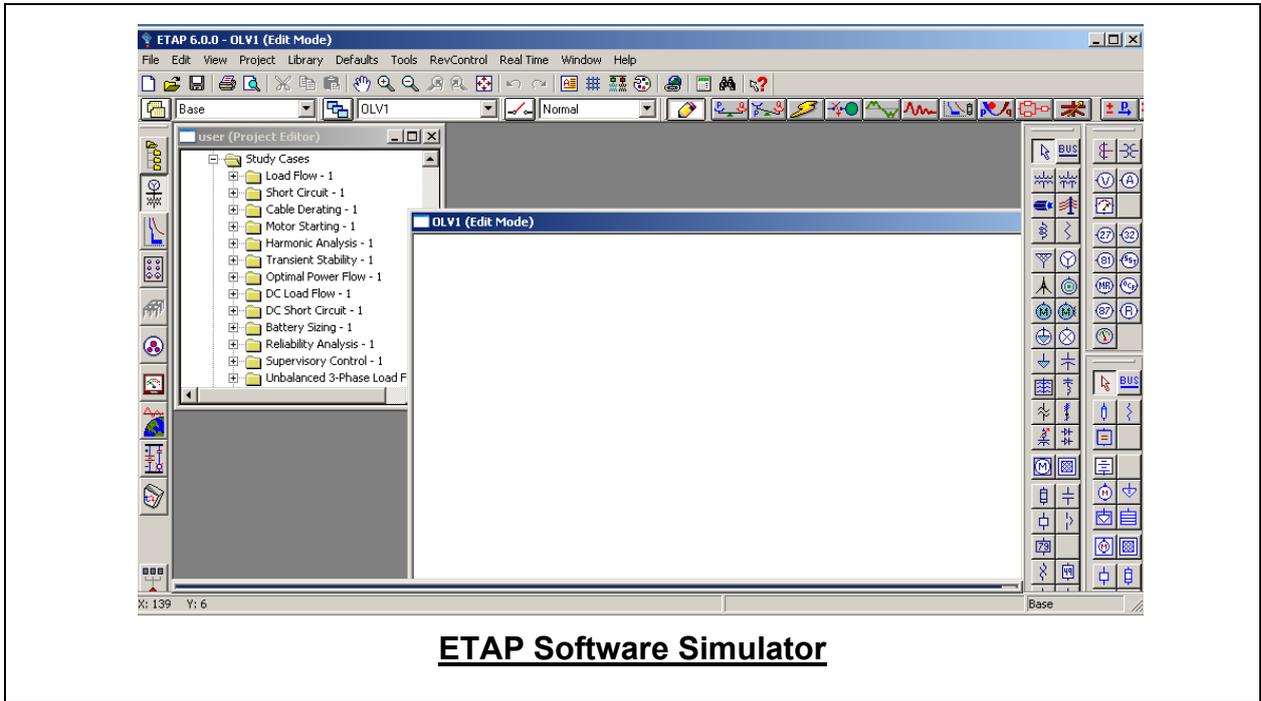
201 MW AGC ON

200 MW

0 Mvar

Right Area Cost 4715 \$/h

**Power World Simulator**



**Course Coordinator**

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