COURSE OVERVIEW IE0805
CAT 3500 Electronic Engine Diagnostic

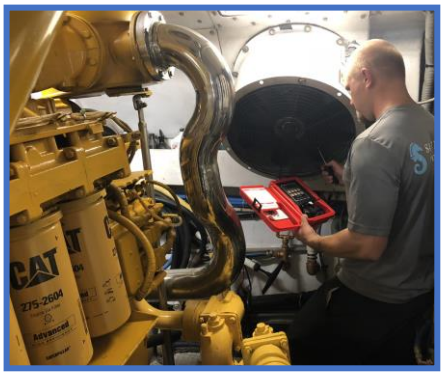
Course Title
CAT 3500 Electronic Engine Diagnostic

Course Date/Venue
July 13-17, 2026/Pierre Loti Meeting Room, Mövenpick Istanbul Hotel Golden Horn, Istanbul, Turkey

Course Reference
IE0805

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Practical sessions will be performed using our equipment in order to apply the theory learnt in the class.

This intensive course is designed for technicians at Midwestern to master the electrical diagnostic procedures for CAT 3500 series engines. Focusing on a blend of theoretical understanding and practical application, participants will learn to effectively use CAT diagnostic tools, interpret electrical schematics, and systematically troubleshoot complex electrical issues, ensuring optimal engine performance and minimal downtime. Emphasis will be placed on Midwestern's specific operational contexts and efficiency standards.

Further, the course will also discuss the CAT 3500 electrical systems and safety, engine actuator, electrical safety and diagnostic tools; the CAT 3500 engine series, basics of electronic engine management and electronic control module (ECM) architecture; the basics of diagnostic tools, schematics, wiring and CAT ET advanced diagnostics, advanced CAT ET and diagnostic software; the CAT ET installation and configuration, event and fault code management, engine configuration and parameters; and troubleshooting workflow and the sensor and actuator diagnostics, actuator testing and circuit integrity.

During this interactive course, participants will learn the ECM and power distribution troubleshooting, batteries, starting, and charging systems; the electronic fuel injection system, injector diagnostics, engine timing and speed control; the air and exhaust system interaction including engine protection and derate strategies; the systematic troubleshooting and best practices review; and the communication network diagnostics and cold start and shutdown issues.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain a fundamental knowledge on electrical principles and components of CAT 3500 engines
- Proficiently use CAT Electronic Technician (ET) and other diagnostic software.
- Accurately read and interpret CAT 3500 electrical schematics and wiring diagrams
- Perform systematic electrical troubleshooting to identify root causes of faults
- Diagnose and rectify issues related to sensors, actuators, ECMs, and power distribution
- Discuss CAT 3500 electrical systems and safety, engine actuator, electrical safety and diagnostic tools
- Identify CAT 3500 engine series, basics of electronic engine management and electronic control module (ECM) architecture
- Recognize the basics of diagnostic tools, schematics, wiring and CAT ET advanced diagnostics and advanced CAT ET and diagnostic software
- Apply CAT ET installation and configuration, event and fault code management as well as engine configuration and parameters
- Illustrate troubleshooting workflow, sensor and actuator diagnostics, actuator testing and circuit integrity
- Apply ECM and power distribution troubleshooting and recognize batteries, starting, and charging systems
- Discuss electronic fuel injection system, injector diagnostics, engine timing and speed control
- Carryout air and exhaust system interaction including engine protection and derate strategies
- Apply systematic troubleshooting and best practices review and discuss communication network diagnostics and cold start and shutdown issues
- Apply Midwestern's best practices for efficient and reliable electrical diagnostics and repairs
- Observe safe working practices, carryout root cause analysis independently and make the right decision in every situation

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 CAT 3500 electronic engine diagnostic for diesel engine technicians and mechanics, maintenance and reliability engineers, workshop supervisors and service managers and operations staff overseeing engine performance.

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.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Accommodation

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

Course Fee

US$ 8,800 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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:

- 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.

- 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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electromechanical Engineer** with over **30 years** of extensive experience in the **Power**, **Petroleum**, **Petrochemical** and **Utilities**. He specializes in **CAT 3500 Engine Series**, **Electronic Control Module (ECM) Architecture**, **CAT ET Installation & Configuration**, **SIMATIC S7-300 & S7-1500**: Basic PLC Programming & Operation, Maintenance & Troubleshooting for **SIMATIC S7-300/S7-1500** Systems, Process Automation with **SIMATIC S7-1500** & PID Control, **SIMATIC S7-300**: Hardware Configuration & Commissioning, **SIMATIC S7-300** Safety Systems: Fail-Safe Programming, **SIMATIC S7-300** Communication, **SIMATIC S7-1500**: Hardware Configuration, Commissioning & Diagnostics, **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. Further, he is also well versed in **Pumps**, **Valves**, **Boilers**, **Pressure Vessels**, **Heat Recovery Steam Generators** (**HRSG**), **Bearings**, **Compressors**, **Motors**, **Turbines**, **Actuators**, **Carbon Footprint**, **Energy Efficiency**, **Power Plant Performance & Efficiency**, **P&ID**, **Engineering Drawing**, **Codes & Standards** and **Hydraulic Systems** 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, , 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's** & **Bachelor's** degree 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.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: ***Monday, 13th of July 2026***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0800 - 0830	***Foundations of CAT 3500 Electrical Systems & Safety*** *Overview of CAT 3500 Engine Electrical Architecture • Key Electrical Components: ECMs, Sensors (Pressure, Temperature, Speed), Actuators (Injectors, Solenoids), Wiring Harnesses, Batteries, Charging Systems • Basic Electrical Principles: Voltage, Current, Resistance, Ohm's Law Application to Engine Circuits • Digital versus Analog Signals in Engine Control • Midwestern's Specific Engine Configurations and Typical Electrical Setups*
0830 – 0930	***Engine Actuator Overview*** *Fuel Injectors and Solenoids • Governor and Throttle Actuators • Relays and Control Valves • ECM Command Signals to Actuators*
0930 – 0945	*Break*
0945 – 1030	***Electrical Safety & Introduction to Diagnostic Tools*** *Safety First: LOTO (Lockout/Tagout), PPE, Handling High-Voltage Components, Battery Safety • Multimeter Mastery: Advanced Functions, Testing for Continuity, Voltage Drop, Resistance, and Current • Basic Oscilloscope Use: Understanding Waveforms, Signal Integrity • Introduction to CAT Electronic Technician (ET): Navigating the Interface, Basic Connection, Obtaining Engine Information. • Midwestern's safety Protocols and Tool Calibration Procedures • Hands-on: Multimeter Exercises on Simulated Circuits, CAT ET Basic Navigation*
1030 – 1130	***Overview of CAT 3500 Engine Series*** *CAT 3500 Engine Applications (Power Generation, Marine, Industrial) • Engine Configurations • Mechanical versus Electronic Control Evolution*
1130 – 1215	***Basics of Electronic Engine Management*** *Purpose of Electronic Engine Control • Closed-Loop versus Open-Loop Control • Role of Sensors and Actuators • Engine Performance Optimization Principles*
1215 – 1230	*Break*
1230 – 1330	***Electronic Control Module (ECM) Architecture*** *ECM Internal Components • Input/Output Signal Processing • Memory Types and Data Storage • Communication with Engine Systems*
1330 – 1420	***Basics of Diagnostic Tools*** *CAT Electronic Technician (ET) Software Overview • Required Cables and Adapters • Laptop and Communication Setup*
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:	Tuesday, 14th of July 2026
0730 – 0830	***Schematics, Wiring & CAT ET Advanced Diagnostics*** *Morning: Reading CAT 3500 Electrical Schematics • Symbols and Conventions Specific to CAT Schematics • Tracing Power Distribution, Sensor Circuits, and Control Circuits • Understanding Data Link Communication • Interpreting Connectors, Wire Codes, and Harness Layouts • Focus on Common Midwestern 3500 Engine Schematics*
0830 - 0930	***Advanced CAT ET & Diagnostic Software*** *Performing Active Diagnostics and bi-Directional Controls with CAT ET • Retrieving and Interpreting Diagnostic Trouble Codes (DTCs) and Event Codes • Using Live Data Parameters (PIDs) to Monitor Engine Performance in Real-Time • Flashing ECMs and Programming Parameters • Hands-on: Tracing Circuits on Actual Schematics, Connecting to Engines with CAT ET, Running Basic Diagnostic Tests and Reviewing Data Logs*
0930 – 0945	*Break*
0945 – 1100	***CAT ET Installation & Configuration*** *Software Installation Requirements • Communication Setup and Troubleshooting • Engine Connection Procedures • User Interface Navigation*
1100 – 1215	***Event & Fault Code Management*** *Diagnostic Codes versus Event Codes • Active, Logged, and Historical Faults • Code Severity Levels • Clearing and Confirming Faults*
1215 – 1230	*Break*
1230 – 1330	***Engine Configuration & Parameters*** *Adjustable Engine Parameters • Password Levels and Security • Factory Settings versus Field Adjustments • Risks of Improper Configuration*
1330 – 1420	***Troubleshooting Workflow*** *Structured Diagnostic Approach • Avoiding Common Diagnostic Mistakes*
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:	Wednesday, 15th of July 2026
0730 – 0930	***Sensor & Actuator Diagnostics*** *Comprehensive Sensor Testing • Understanding the Function and Testing of Critical Engine Sensors • Engine Speed/Timing (ESS) • Engine Oil Pressure (EOP) • Engine Coolant Temperature (ECT) • Intake Manifold Air Temperature (IMAT)*
0930 – 0945	*Break*
0945 – 1100	***Sensor & Actuator Diagnostics (cont'd)*** *Boost Pressure (BP) • Fuel Pressure, Rail Pressure • Testing Methodologies: Voltage, Resistance, Frequency, Signal Integrity with Oscilloscope • Common Sensor Failure Modes and their Impact on Engine Operation • Midwestern's Preferred Sensor Testing Tools and Procedures*
1100 – 1215	***Actuator Testing & Circuit Integrity*** *Diagnosing Electronic Unit Injectors (EUI) and Common Rail Injectors • Testing Solenoids (e.g., Wastegate, Exhaust Brake) and their Circuits • Checking Power Supply and Ground Circuits for all Components*
1215 – 1230	*Break*

1230 – 1420	***Actuator Testing & Circuit Integrity (cont'd)*** *Identifying Open Circuits, Shorts, and High Resistance Issues in Wiring Harnesses • Hands-on: Bench Testing Various Sensors and Actuators, Performing Voltage Drop Tests on Live Engine Circuits, Fault Isolation Exercises*
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: Thursday, 16th of July 2026

0730 – 0830	***ECM & Power Distribution Troubleshooting*** *ECM and Data Link Diagnostics • Understanding of the Engine Control Module (ECM) Function and Communication • Troubleshooting Data Link Communication Issues Using Diagnostic Tools • Pinpoint Testing ECM Connectors for Power, Ground, and Signal Integrity • Strategies for Diagnosing Intermittent ECM-Related Faults*
0830 – 0930	***Batteries, Starting, & Charging Systems*** *Advanced Battery Testing: Load Testing, Specific Gravity, Internal Resistance • Diagnosing Starter Motor Circuits: Solenoid, Motor, Wiring • Troubleshooting Alternator and Charging System Faults • Addressing Parasitic Draws and Electrical Leakage • Midwestern's Specific Battery and Charging System Maintenance Checks • Hands-on: Full Electrical System Checks on an Engine, Diagnosing Battery/Charging System Faults, Simulating and Troubleshooting ECM Communication Errors*
0930 – 0945	*Break*
0945 – 1100	***Electronic Fuel Injection System Overview*** *Unit Injector Operation • Fuel Delivery Control Logic • Timing and Duration Control • ECM Fuel Strategies*
1100 – 1130	***Injector Diagnostics*** *Injector Performance Indicators • Cut-Out and Cylinder Balance Tests • Electrical versus Mechanical Injector Faults • Injector Replacement and Calibration*
1130 - 1215	***Engine Timing & Speed Control*** *Speed/Timing Sensor Diagnostics • Synchronization Issues • Timing-Related Fault Codes • Effects on Performance and Emissions*
1215 – 1230	*Break*
1230 – 1330	***Air & Exhaust System Interaction*** *Turbocharger and Boost Pressure Diagnostics • Intake Air Temperature Effects • Exhaust Temperature Monitoring • Air-Fuel Ratio Considerations*
1330 – 1420	***Engine Protection & Derate Strategies*** *Engine Protection Logic • Alarm versus Shutdown Conditions • Power Derate Causes*
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: **Friday, 17th of July 2026**

0730 – 0930	***Systematic Troubleshooting & Best Practices Review*** *Advanced Troubleshooting Methodologies • Applying a Logical, Systematic Approach to Diagnose Complex, Multi-Symptom Electrical Issues • Case Studies: Reviewing Real-World CAT 3500 Electrical Failures and their Resolutions • Developing Effective Diagnostic Flowcharts • Leveraging Midwestern's Internal Knowledge Base and Experience for Diagnostics • Understanding "no-Code" Diagnostics*
0930 – 0945	*Break*
0945 – 1100	***Communication Network Diagnostics*** *Data Link Architecture • CAN/J1939 Communication Basics • Data Link Fault Codes • Troubleshooting Communication Failures*
1100 – 1215	***Cold Start & Shutdown Issues*** *Cold Start Strategy Diagnostics • Glow Plug and Start Aid Systems • Shutdown Logic and Fault Causes • Post-Shutdown Data Analysis*
1215 – 1230	*Break*
1230 – 1345	***Midwestern's Best Practices, Documentation, & Q&A*** *Review of Midwestern's Specific Diagnostic Checklists, Documentation Standards, and Reporting • Efficient Use of Technical Resources and Manufacturer Information • Preventive Measures to Avoid Common Electrical Issues*
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*

Simulators (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 the "CAT Communication Adapter Diagnostic Tool".

CAT Communication Adapter Diagnostic Tool

Course Coordinator

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