Electric Motor Testing—
Energized & De-Energized Testing Techniques

The primary objective of this Electric Motor Testing class is to equip trainees with the knowledge and procedures needed to determine the condition of electric motors using a combination of de-energized (static, off-line) motor testing methods and energized (on-line, dynamic) testing methods.

The class provides a combination of theoretical knowledge and procedural awareness passed on to the student through lecture, and individual instruction and then reinforced through hands-on lab exercises, simulations, and demonstrations—all designed to actively engage the student in the learning process. Electric Motor Testing training helps students localize electrical and mechanical anomalies that impact motor performance and reliability regardless of the makes and models electric motor tester equipment they use.

Students will learn the techniques associated with use of digital and analog multimeters, LCR Bridge/Kelvin Bridge, and Megohmmeters to evaluate, troubleshoot, and maintain motors and motor circuits. Students will gain a solid understanding of static and dynamic measurements of impedance, resistance, capacitance used to identify and localize electrical and mechanical anomalies.

This 32 hour course covers the theory and applications of energized and de-energized motor testing as applied in predictive and preventative maintenance programs, quality assurance, and condition monitoring as well as troubleshooting of motors in the field. This class focuses on testing tools and techniques including how to safely collect and analyze measurement data. Upon completion, students will be able to understand data collected from tests and describe how measurement data relates to failure modes. The student should also be able to determine the difference between acceptable and erroneous data. Students leave training ready to put motor testing tools and techniques to work.

The course is open to everyone regardless of whether or not they own motor testing instrumentation. Attendees that do have equipment are encouraged to bring their motor testers and laptop PCs as there are a number of hands-on learning opportunities available during the week.

Part Number/Description	
FRS-EMT-COMBO Electrical Motor Testing (EMT) - Energized & De-Energized training *See course outline and general schedule on next page.*	

For current course schedule, ordering assistance, or cancellation/refund policy, please contact:

Fox River Systems, Inc.
902 S. Randall Road, Suite C, #328
St. Charles, IL 60174
USA

Tel: (630) 365-4030
Fax: (630) 365-4031
www.FoxRiverSystems.com

Pub: LEVEL1-EMT-ENERGIZED 2018-12

Electric Motor Testing—Energized & De-Energized

Course Introduction & Overview

- Introductions and course overview
- Brief History of Electricity and Electric Motor Testing
- History of Electricity and Motor Testing
- Introduction to electric motor failure modes

- Topic 1—Direct Current (DC) Theory Review
  - Ohm's Law
  - Power
  - Series & parallel resistive circuit—DC

- Topic 2—Alternating Current (AC) Theory Review
  - AC circuits—series/parallel circuits
  - Resistance, inductance & capacitance
  - Reactance and impedance
  - Data Collection Labs

- Topic 3—Theory Review of Transformers and Distribution
  - Transformer Construction: Core & Windings
  - Turns and Voltage Ratios
  - Single Phase vs. Polyphase
  - Transformation Configurations: Delta/Wye, Delta/Delta, Wye/Delta, and Wye/Wye
  - Line voltages and phase vectors
  - Electrical distribution and grounding systems

- Topic 4—Motor Nameplate
  - Model, Serial, Type, NEMA Design Classification
  - Horse Power, Volts and Amps, KVA
  - RPM and Frequency
  - Service Factor, Temperature and altitude affects
  - Insulation Class & Types
  - Torque curves vs. application
  - Efficiency
  - Important information omitted from nameplate

- Topic 5—Motor Construction
  - Stator construction, Stator core and frame
  - Stator windings, Stator core testing and damage
  - Laminations design and grades
  - Core losses—hysteresis, Eddy currents
  - Bar types and configurations
  - Rotor construction, Rotor core and frame
  - Rotor testing & anomalies that affect rotor performance
  - Motor rewind procedures

- Topic 6—Motor Operation Theory
  - AC generators design & construction
  - Induced voltage and frequency
  - 3 phase motor components & Rotating magnetic field
  - Synchronous speed
  - Three phase motor operation
    - Slip, anomalies, & factors that affect motor RPM
    - Starting & torque curves
    - Affect of pole numbers
    - Power Factor (PF)

- Topic 7—Theory to Support De-Energized Electric Motor Test
  - Insulation resistance testing
  - Polarization index (PI)
  - Dielectric Absorption Ratio (DAR) test
  - Data Collection Labs

- Topic 8—Motor Current Signature and Electrical Signature Analysis
  - Safety and technical documentation to support Electric Motor Testing
  - FFT generation, current/voltage spectral analysis, demod.
  - Electrical anomalies
  - Mechanical anomalies
  - Data Collection Labs
  - Practical Examinations

Review & Examinations

- Comprehensive Course Review
- General Course Examination
- Data Analysis Examination

NOTE: This course employs a combination of lecture and demonstration, simulations, relevant group discussion, and hands-on lab exercises to reinforce learning.

	MON	TUE	WED	THU	FRI
8am | 12pm		Electric Motor Testing	Electric Motor Testing	Electric Motor Testing	Electric Motor Testing (Course Review & Exams)
1pm | 5pm	Electric Motor Testing (Course Overview)				Training concludes at 12pm after exams

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Electric Motor Testing (EMT) training and examinations are provided by Fox River Systems.