

2018 Training Handbook

Electric Motor Condition Monitoring





Electric Motor Testing, Monitoring and Analysis

Motor test instrument and technology training

SKF motor test and monitoring courses are specifically designed to help maintenance professionals optimize effective electric motor predictive maintenance planning and testing techniques.

Optimal plant operation and consistently high rebuild quality are common objectives of maintenance and motor shop personnel. SKF's fundamental electric motor theory and technology training courses offer more than traditional equipment training programs. These courses enable maintenance and motor shop professionals to produce immediate results from their electrical motor maintenance programs. Such training imparts practical knowledge of motor theory along with basic to advanced training on equipment operation.

Flexible programs

These courses are offered throughout the year at SKF's professional training facility in Fort Collins, Colorado. Courses can also be customized to fit the unique needs of organizations and individuals, whether at a company facility or an SKF training center. However training is performed, it can be done to suit schedules and skill levels. Two- to three-day training programs are available. For customer site and private location training, please contact the SKF EMCM training support staff to obtain a quotation. A course workbook and other support materials are provided.

Motor reliability training agenda

8:00 am: Registration (first day), or class begins (days 2–3)

11:30 am: Lunch

4:30 pm: Class ends daily

6:00 pm: Evening events*

*Some days include group dinners.

*Most meals are included in the course fee for these classes only.

How to register for electric motor test training

By phone: 970-282-1200, or 800-752-8272

On-line: <http://www.skfusa.com/emcm>

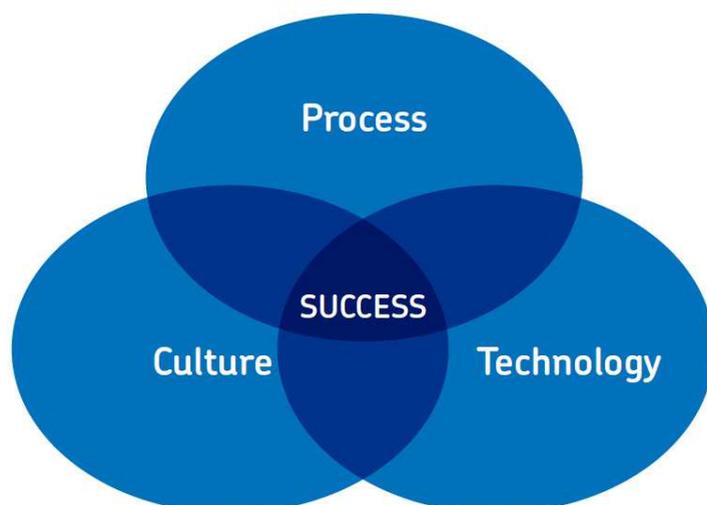
Calendar 2018 course schedule dates are available.

Customer site (1–3 days), upon schedule. Call for quote.

Private-Fort Collins, CO training center (1–3 days), upon schedule. Call for quote.

WebEx (1–3 hours), upon schedule. Call for quote.

Keys to success...



- A corporate culture willing to embrace the need for change
- A commitment to implementation of technologies with requisite financial, training and personnel resources
- A willingness to support processes to implement cultural and technological changes

Introduction to Electric Motor Testing and Monitoring Technologies

Course description

This introductory course provides a wealth of information about technologies that can help motor maintenance professionals maximize reliability of their electric motor plant machinery. The course enables attendees to plan and execute maintenance strategies that minimize costly unplanned downtime.

Key learning outcomes

- Acquire a general understanding of AC motor theory, construction, and the respective requirements and benefits of motor testing and monitoring
- Learn the importance of the industry standards that apply to electric motor testing
- Develop knowledge of instrumentation used in both static-state (off-line) testing and dynamic-state (in-service) motor monitoring

Course content

Basic motor theory

- Motor construction
- Basic electromagnetic theory
- Common AC motor failure modes
- Various motor types

Introduction to static-state motor testing

- Insulation systems
- Failure modes
- Testing methods and pass/fail criteria
- Recommended test voltages
- Test sequence overview

Introduction to dynamic-state motor monitoring

- Machine system overview
- Connection for motor current signature analysis
- Obtaining quality data
- Power, motor, load assessments
- Test result reporting

WI261 Course Information

Dates	March 6-7, 2018 (Atlanta, GA) May 15-16, 2018 (Chicago, IL) June 12-13, 2018 (Fort Collins, CO) July 23-24, 2018 (San Francisco, CA)
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Course fee US \$ 1,595



Electric Motor Predictive Maintenance

Course description

Electric motors account for some of the highest numbers of reliability incident reports involving rotating equipment and machinery. How a given electric motor is chosen, installed, lubricated, handled, stored, aligned, and maintained are all critical to the motor's performance and longevity. This course provides a clear understanding of common motor failure modes, the types of predictive testing that are most effective, and the frequency that each method should be applied to maximize motor uptime, and optimal performance.

Key learning outcomes

- Learn effective electrical motor predictive maintenance planning and execution
- Learn best practices to detect motor problems prior to failure
- Understand the various types of motor testing, which ones are most effective, and the frequency needed to achieve high reliability and minimal unplanned downtime
- Develop competence to accurately diagnose root-cause failure modes

Course content

Electric motor basics

- Motor types
- Motor construction and components
- Repair and service fundamentals
- Common failure modes (electrical and mechanical)

Electrical and mechanical testing

- Predictive maintenance motor diagnostic techniques
- Static-state electrical motor test methods
- Dynamic-state motor monitoring methods
- Insulation condition determination
- Mechanical test methods (vibration, thermography, etc.)

Typical electric motor bearing arrangements

- Basics of electric motor bearings
- Bearing arrangements and clearances

Motor teardown and bearing replacement

- Bearing replacement methods
- Bearing failure modes
- Electrical discharge and circulating currents

WI216 Course Information

Dates	March 27-28, 2018 (Charlotte, N.C.) April 24-25, 2018 (San Francisco, CA) August 27-28, 2018 (Fort Collins, CO) September 18-19, 2018 (Columbus, OH) October 2-3, 2018 (Orlando, FL) November 13-14, 2018 (Houston, TX)
Course fee	US \$ 1,595

Lubrication

- Bearing life, typical lubrication mistakes, contamination

Final tests and delivery procedures

- Post motor service: quality assurance testing
- Mechanical integrity
- Preparing motors for transportation and storage

Route-course failure analysis

- Electrical and mechanical

Hands-on practical test exercise

- Fault-finding: diagnose motors with common faults



Static Motor Testing Level I

Course description

This course provides an in-depth look at the technical theory and concepts of electrical insulation testing in motors. Each test method will be discussed in the context of motors tested while in a static-state (powered down/off). Students are taught to analyze results corresponding to specific insulation fault modes. The operation of various SKF Static Motor Analyzers (Baker DX and Baker AWA-IV) and respective software programs are covered in detail. Discussions include methods to reduce costly downtime, troubleshooting, and motor quality control through use of static motor testing. Hands-on testing is included to provide students practical experience. By the end of this course, students should have working knowledge of static motor testing methods, and be able to collect quality data to analyze for common motor failure modes. A final written and practical exam is required to complete this course.

Key learning outcomes

- Develop a thorough understanding of electrical insulation theory as it pertains to electric motor testing
- Understand motor insulation testing applications
- Gain a working knowledge of the test instruments and respective software
- Acquire hands-on experience with operation of the instrumentation and its associated hardware and software

Course content

Static-state motor testing theory

- Insulation systems
- Failure modes and mechanisms
- Test methods
- ANSI/IEEE/EASA/NEMA testing standards
- Recommended test voltages/sequences
- Analysis of test results

Software training

- Create databases, motors, and test IDs
- Data collection parameters
- Establish and understand pass/fail criteria
- Data interpretation

Non-three-phase motor testing

- DC motors
- Generators
- Synchronous motors
- Wound rotor motors
- Non-rotating electrical equipment (e.g., transformers)



WI262 Course Information

Dates	March 13-15, 2018 September 11-13, 2018
Time	8:00 AM - 4:30 PM MT
Course fee	US \$ 2,195
Location	SKF Training Center in Fort Collins, Colorado, U.S.A.

Static Motor Testing Diagnostics Level II

Course description

(Note: successful completion of WI262: Static Motor Testing Level I is a prerequisite for this course)

This advanced course is designed to build on the knowledge obtained from previous static course work and significant field experience with static motor test equipment. This course provides instruction on detailed diagnosis of motor condition using actual motor test data and SKF motor test software applications. It will also rely upon user case studies, and advanced theoretical instruction. Course completion is contingent upon passage of a final written and practical exam.

Key learning outcomes

- Develop an in-depth understanding of test equipment and analysis tools
- Acquire a thorough understanding of static motor test parameters and thresholds
- Develop practical knowledge of electrical insulation and circuit theory
- Demonstrate how specific electric motor failure modes are revealed by motor test data

Course content

Static-state motor testing analysis

- RLC (resistance-inductance-capacitance) circuit analysis
- Rotor influence check
- Insulation resistance
- Leakage current
- High potential (HiPot) testing
- Surge wave analysis
- PP/LL EAR
- Data interpretation of partial discharge (PD) on surge test

SKF motor test PC desktop software

- Data trending
- Advanced data analysis tools
- External software tools

Advanced static-state motor testing methods

- DC motors
- Field coils
- Low impedance coils
- Comparative analysis
- Non-rotating equipment



WI362 Course Information

Dates	May 8-10, 2018 November 6-8, 2018
Time	8:00 AM - 4:30 PM MT
Course fee	US \$ 2,195
Location	SKF Training Center in Fort Collins, Colorado, U.S.A.

Dynamic Motor Monitoring Level I

Course description

This introductory course provides a fundamental look at technical theory and concepts associated with diagnosing problems with motors that are in a dynamic, or powered-on (operational) state. Upon completion of this course, students should gain a working knowledge of dynamic motor monitoring methods, be able to collect quality data and interpret threshold alarms and their associated failure modes. This course includes hands-on operation of motor analyzers in a laboratory environment. Successful completion of this course is contingent upon passage of a final written and practical exam.

Key learning outcomes

- Develop a general understanding of AC motor theory as it relates to the collection of dynamic-state monitoring data
- Develop a general understanding of the capabilities and limitations associated with dynamic motor monitoring
- Gain a general understanding of all the parameters acquired by SKF Dynamic Motor Analyzers and the relevance of these parameters to specific faults
- Develop a working knowledge of the SKF Dynamic Motor Analyzer - EXP4000

Course content

Dynamic-state motor monitoring theory

- Power quality parameters
- Motor performance monitoring
- Energy efficiency estimation
- Torque waveform development



WI263 Course Information

Dates	February 20-22, 2018 July 10-12, 2018
Time	8:00 AM - 4:30 PM MT
Course fee	US \$ 2,195
Location	SKF Training Center in Fort Collins, Colorado, U.S.A.

Software training

- Creation and management of databases
- Creation and editing of parameter thresholds
- Test acquisition setup
- Data collection methods
- Data interpretation and analysis

Introduction to DC on-line analysis

- DC motor theory and concepts
- Ensuring proper connections
- Software functionality and reporting

Dynamic Motor Monitoring Level II

Course description

(Note: WI263: Dynamic Motor Monitoring - Level I is a prerequisite for this course)

This course builds upon knowledge obtained from successful completion of previous SKF course work and significant field experience with dynamic motor monitoring equipment. The course provides instruction on detailed diagnosis of motor and motorized system problems. Coursework includes review of case studies, analysis of previously-acquired data, hands-on live motor acquisition/monitoring, and resultant data analysis in a laboratory environment. Successful completion of this course is contingent upon passage of a final written and practical exam.

WI363 Course Information

Dates	April 10-12, 2018 October 16-18, 2018
Time	8:00 AM - 4:30 PM MT
Course fee	US \$ 2,195
Location	SKF Training Center in Fort Collins, Colorado, U.S.A.

Key learning outcomes

- Develop an in-depth understanding of dynamic-state motor monitoring equipment and associated software
- Gain extensive understanding of motor and machine system monitoring applications
- Develop a good working knowledge of electric motor theory and how it pertains to motor monitoring
- Hands-on training for familiarity with instrumentation connection and operation
- Effectively learn how to diagnose potential problems within electric motors and the systems they operate within

Course content

Dynamic-state motor monitoring theory

- Level I course review
- Fundamentals of waveform and spectral analysis
- Power condition
- Motor performance/condition
- Energy efficiency assessment
- Motor load assessment
- Torque analysis
- Fundamental fault frequency characteristics

Software training

- Level 1 software review
- Advanced data collection techniques
- Intermediate waveform interpretation and analysis

Case studies

- AC case studies review and hands-on analysis
- DC case studies review





Welcome to the World of SKF Knowledge

Equipment failures often begin with the neglect of basic maintenance practices, such as proper lubrication, correct mounting methods, and attention to detail in visual inspections. Any introduction of new proactive and precision maintenance skills requires training in maintenance best practices supported by industry-approved engineering and maintenance standards.

New skills developed through SKF training include how to do the big things correctly – such as testing in accordance with global standards and compliance with recognized quality practices. We also train how to do the little things correctly, such as how to store a motor with no detriment of condition, or how to inspect and troubleshoot existing equipment in operation. Such actionable knowledge helps trained professionals ensure motors are returned to operation with high confidence in service longevity and reliability.

Such competency improvements help deliver outstanding equipment reliability because maintenance professionals are able to make sure equipment and machinery parts do not suffer undue stresses that lead to premature failure. These skills also enable maintenance to take up in-house repair and rebuilds, reduce dependency on subcontractors and maximise quality production – therefore maximise plant availability and productivity!

Why SKF for reliability and maintenance training?

SKF courses are backed by more than 100 years of experience and knowledge of rotating machine reliability. Close working partnerships with our industrial end-users and equipment manufacturers provide us an intimate understanding of the processes and challenges specific to every major industry.

The purpose of this handbook is to provide a convenient guide to the courses and qualifications SKF delivers to motor maintenance professionals. These courses can be tailored to site-based applications with an emphasis on “hands-on” activities to impart basic troubleshooting skills and fundamental knowledge about how machines and their components operate internally.

We invite personnel from maintenance trades and engineering to gain new knowledge and skills from SKF that enable achievement of maintenance objectives while making positive impacts on daily work and plant performance.

The key to successful development of professional skills is to choose a competent training provider – one that understands your development needs and delivers training that addresses them!

We wish you an enjoyable learning experience in 2018!

Sincere regards,

Paul Knock
Global Sales Manager
SKF Electric Motor Condition Monitoring
Fort Collins, Colorado USA

Registration

To register for one or more of these seminars, please use a copy of the following form for each course you wish to attend. You can fill out and fax your completed form to +1 970-282-1010, or you may send by email after scanning each form as a .pdf to salesEMCM@skf.com. You may also email to request access to online registration forms available for each course.

Name _____

Organization _____

Email _____

Title _____

Business telephone _____

Additional attendees:

Name _____

Organization _____

Email _____

Title _____

Name _____

Organization _____

Email _____

Title _____

Select course:

Please write in the SKF course title(s) or code(s). Refer to left top of page of each course to find the code starting with "WI."

Payment options:

Make checks payable to SKF USA - Fort Collins
SKF USA - Electric Motor Condition Monitoring, 4812
McMurry Ave., Suite 100, Fort Collins, CO 80525 USA

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Expiration date: _____ CCV no: _____

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Authorization:

Signatory must be authorized to sign on behalf of contracting organization.

Name of authorizing manager:

Title _____

Signature _____

Date _____

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