SKF Reliability Systems

SKF Reliability Maintenance Institute Courses




Driving the power of knowledge engineering through education

Introduction

Covering every aspect of machine reliability...

Manufacturers today are under tremendous pressure to provide the highest possible quality at the lowest possible cost. Therefore, achieving maximum machine reliability is critical.

The Reliability Maintenance Institute (RMI) is a comprehensive offering of training courses designed to help plants eliminate machinery problems and achieve maximum reliability and productivity by utilizing the very latest in precision maintenance techniques.

Each course is designed to address a specific machine installation or maintenance problem and help you correct it. Some courses involve the use of highly sophisticated diagnostic equipment, while others are more basic in nature and cover such topics as bearing fundamentals and proper lubrication.

Training for all plant levels that impact machine reliability...

Unlike other maintenance training programs, the Reliability Maintenance Institute offers training to all plant levels that impact machine reliability.

Achieving maximum machine reliability requires more than a highly trained and knowledgeable maintenance staff. Plant managers must also be up to date on the latest maintenance practices and machinery improvement programs.

To that end, SKF offers special programs for senior plant management. These courses cover such topics as how to evaluate current plant maintenance and reliability practices, measuring key benchmarks, and how to determine the best course of action for realizing the greatest financial return on your maintenance investment.

Courses for managers offer the right combination of implementation skills, maintenance procedures and management insights necessary to put together an effective program for eliminating machinery and process problems, thereby increasing profitability.

Everything you need from one reliable source...

Many companies offer training in one or more of these areas. But only SKF offers a comprehensive program that covers every aspect of machine reliability and addresses the technical and managerial needs of everyone in an industrial company – from the shop floor to the president's office. SKF is one of the foremost authorities on rotating machine maintenance and offers a wealth of product knowledge and application experience.

The Reliability Maintenance Institute offers a mix of course types and venues to meet your training needs. RMI courses are held at various SKF sites. On-site training is available at your plant or facility and some classes are held at regional locations, bringing the subject matter closer to your part of the country.

No matter what industry you're in or what type of machinery you use, the Reliability Maintenance Institute can help you maintain and manage your assets more productively.

Course Listing

Bearing Maintenance and Technology (WE201)

Course Objective

The course objective is to provide information to improve the service life of rolling bearings, which improves the reliability of rotating equipment.

Target Audience

- Mechanical Maintenance Engineer, Supervisors, Technicians, Mechanics
- Planning Manager, Quality Engineers
- Reliability Engineers, Managers, Supervisors, Store Supervisors
- Electrical Engineers, Supervisors and Technicians

Training Content

Basics of Bearings and Their Applications

- Rolling bearing theory
- Anti-friction bearing types and applications
- Plain bearing types and applications
- Meaning of “L 10 Life” and “Service Life”
- Application of fits and tolerances

Fundamentals of Lubrication

- How bearing lubrication works
- The importance of selecting the proper lubricant for an application
- Maximise bearing life through understanding of proper lubricating principles and functions
- How much and how often to lubricate rolling bearings

Seal Types and Application

- Contact seals, Non-contact seals
- Housing seal types

Principles of Mounting and Dismounting Bearings

- Cylindrical seating
- Tapered seating
- Adapter and withdrawal sleeves
- Cold and hot mounting and dismounting
- Mounting and dismounting using oil injection
- Principles of mounting plain bearings

Introduction to Bearing Failures and Their Causes

- Identify and interpret actual bearing failures

Practical Mounting and Dismounting of Bearings

- Preparation for mounting and dismounting
- Checking the components
- Mounting and dismounting tools
- “Hands on” exercises

Prerequisite

Participants should have an understanding of industrial safety. A fundamental knowledge of and ability to use basic hand tools is required.

Course Duration

4.5 days

Bearing in Rotating Machinery Application (WE202)

Course Objective

Student will learn rolling element bearing selection processes for typical industrial applications, with the ultimate objective of improving the operational reliability of rotating equipment. At course completion, students will understand the basics of how to:

- Specify and size the best bearing arrangements
- Verify the capability of current bearing designs
- Optimize performance of existing applications
- Ensure operational reliability with proper design of:
  - Assembly and repair practices
  - Lubrication and maintenance practices
  - Condition monitoring capabilities

Target Audience

Reliability engineers, managers and technicians at industrial plants and OEM facilities responsible for rolling bearing performance and reliability. Rotating equipment engineers, reliability engineers and maintenance supervisors. Design engineers directly responsible for machine design incorporating rolling element bearings. Those interested in optimizing rolling element bearing performance in rotating equipment.

Training Content

Industrial motors

- Learn advanced concepts related to rolling bearings
- Factors affecting the performance of rolling bearings
- Troubleshooting and preventing common motor problems
- Motor condition monitoring: methods and practice

Industrial fans

- Bearing mounting and dismounting procedures on tapered adapters and tapered shafts
- Locating and non-locating bearings: controlling heat expansion
- Lubrication of open bearings in pillow blocks and split housings
- Detecting and correcting unbalance
- Rebuilding fan applications for peak performance

Industrial pumps

- Controlling thrust loads in applications
- ANSI vs. API pumps: design overview
- Fluid machinery: common problems and corrections

Industrial gearboxes

- Coupling machinery: alignment overview
- Selecting the proper lubricant: oil lubricated machinery
- Gearbox monitoring and inspection

Prerequisite

Participants should be knowledgeable in bearing maintenance and technology.

Course Duration

2 days

Root Cause Bearing Failure Analysis (WE204)

Course Objective

On completion of this course, students will be able to provide background and methodology for analysing failed and damaged bearings and their components. Students will be able to uncover the true root causes of bearing damage and failures, and reduced service life.

Target Audience

- Service, maintenance, machine repair, or plant/facility engineering staff
- All personnel at industrial plants responsible for rolling bearing performance and reliability
- Rotating equipment engineers, reliability engineers, millwrights, mechanics, and maintenance supervisors
- Those interested in rolling bearing and rotating equipment performance

Training Content

Bearing knowledge

- Understand common bearing terminology
- Learn basic knowledge required for bearing damage analysis

Load path patterns in bearings

- Understand bearing operation and normal load patterns
- Discuss abnormal load patterns and their causes

Methodology

- Understand why bearings fail in service
- Understand the concept of Root Cause Failure Analysis (RCFA)
- Perform bearing damage analysis including reporting

ISO 15243 – Bearing failure modes and classification

- Understand the main points that the ISO classification is based upon
- Understand the terminology and visual appearance of failure modes

Hands-on - Analysis of sample bearing failures

- Inspect a series of sample bearing failures and report the findings
- Group discussion on the cases and use SKF Bearing Inspector
- We encourage participants to bring a failed bearing (and machine history) from their plant, to analyse during the workshop sessions

Monitoring Bearings

Condition monitoring of rolling element bearings using vibration analysis. List of Topics:

- Understanding Bearing Vibration
- Special vibration analysis technologies
- Spectral analysis of bearing damages and failure

Prerequisite

Participants should be knowledgeable in bearing maintenance and technology.
A pre-study of *Bearing Failures and Their Causes* (a technical paper distributed free of charge to the attendees).

Course Duration

2 days

Lubrication in Rolling Element Bearings (WE203)

Course objective

This course is designed to help students understand the fundamentals of lubrication, types of lubricants, importance of correct lubricant selection, awareness & consequences of incorrect selection and application, storage & handling, cleanliness. The course is delivered with an emphasis on practical training with hands-on samples of greases, bearings, and displays of various lubricating systems available for all to handle and view as the training progresses.

Target Audience

Maintenance personnel and engineers responsible for bearing lubrication, lubricant specification and lubrication system planning and design.

Training Content

Lubrication fundamental

- Function of lubrication
- Lubricant additives and their effects
- Avoiding surface damage in bearings

Grease lubrications

- Grease functions and properties
- Grease delivery and metering systems
- Selection of grease type: choosing the right grade, base, stiffness and oil for your application
- Compute grease intervals and relubrication amounts for a variety of application conditions, such as contamination, high or low temperatures and vibration

Oil lubrication

- Choosing the right lubricant: oil and grease quality standards and testing
- Effects of cleanliness and contamination
- Using the new life theory to predict the effects of contamination on bearings
- Effects of water ingress
- Effective use of filtration and choosing the right filter
- Change-out intervals
- Bearing housing design concepts
- Comparison of oil delivery methods: static, wick-feed, lifting rings, circulating oil, mist, air-oil, oil spot
- Determining oil flow rates

Applying lubricants

- Determining lubrication quantities and intervals
- Hands-on lubrication and relubrication procedures for pillow blocks, ball bearings, roller bearings, sealed and shielded bearings
- Electric motor relubrication

Common errors/troubleshooting

- Over-greasing, under-greasing and mixing of greases
- Corrective actions

Course Duration

3 days

Rolling Bearings Technology for Design Engineers (OEM301)

Course Objective

Students will gain an understanding of rolling element bearing, seals and lubrication technologies and theories used in selection processes for typical industrial applications, with the ultimate objective of improving the life, functionality and operational reliability of rotating equipment.

Target Audience

- Design engineers directly responsible for machine design incorporating rolling element bearings
- Users interested in optimizing performance in existing machinery
- Those interested in optimizing rolling element bearing performance in rotating equipment.

Training Content

Bearing Theory
- Purpose of bearings. Rolling element bearing history
- Rolling element contact behaviour

Bearing components and functions
- Rolling elements, rings and cages. Component materials

Selection of bearing type
- Advantages and disadvantages of various bearing types
- Bearing features and functionality

Selection of bearing size
- Determining loads and duty cycles. Bearing life determination
- Computer-based tools (skf.com, IEC and Bearing Select)

Bearing data and dimensional tolerances
- Bearing designations
- Dimensional tolerance classes
- Internal clearances and preload classes

Friction and speeds
- Frictional model within rolling element bearings
- Speed rating methodologies

Bearing system design
- Associated component design
- Locating and non-locating. Shaft and housing fits
- Selection of internal clearance or preload. Bearing material selection
- Mounting and dismounting considerations. Sealing requirements. Mechatronics

Bearing arrangements
- Bearing types and integration

Lubrication
- Selection of appropriate lubricant
- Lubricant life estimation. Lubrication methods

Machine system health
- Vibration analysis. Temperature monitoring. Lubrication analysis

Bearing Failures and Their Causes
- Analysis of common failures modes
- Mounting and operating conditions

Introduction to SKF interactive engineering tools

Storage, shipping and handling

Course Duration

4.5 days

Linear Motion Technology and Maintenance (WE280)

Course Objective

- Overview of different types of linear motion products and their applications
- Become familiar with different shaft guiding products, their advantages and limitations
- Understand the advantages of using profile rail guides and precision rail guides for high accuracy and load applications
- Determine when to use plain bearing instead of rolling bearings for linear motion applications
- Understand different precision classes of ball screw and the way they are manufactured
- Understand the principle of roller screws
- Overview of the SKF actuators product range

Target Audience

- Design engineers directly responsible for machine design incorporating rolling element bearings
- Users interested in optimizing performance in existing machinery
- Those interested in optimizing rolling element bearing performance in rotating equipment.

Training Content

Linear Guides

Shaft guiding
Precision shafts
Linear ball bearing table without drive
LLT Profile rail guides
Miniature profile rail guides
Precision rail guides
Applications

Ball and roller screws

Ball screws and roller screws
How to choose
Precision rolled ball screws
Ground ball screws
Roller screws
Roller screws service range
Applications

Principles of actuator selection and application

Linear actuator definition & type
Performance considerations
Selection criteria
Calculations
Application checklist
Typical applications
Selection guide

Linear actuators

AC versions
DC versions
No motor

Course Duration

2 days

Precision Shaft Alignment (WE240)

Course Objective

The course objective is to teach students how to align two coupled rotating machinery shafts to specified tolerances using a laser alignment system, including proper planning, rough and precision alignment processes per approved procedures.

Target Audience

- Maintenance, engineering, technical support and management personnel whose job functions involve alignment of rotating machinery
- Appropriate for those who align machines and those who detect, investigate and resolve premature machinery failure due to misalignment
- Those who direct activities relative to alignment and machine reliability

Training Content

Introduction and overview

- Review of shaft alignment fundamentals
- Advantages, disadvantages, and sources of error associated with various alignment methods
- Describing and documenting shaft offset and angular misalignment conditions
- Pre-alignment procedures
- Review the three major phases of alignment
- Review of dial indicator alignment methods
- Laser alignment systems overview

Fundamental horizontal machine alignment processes

- Setting up the laser system
- Measuring and entering the dimensions
- Obtaining measurements
- Interpreting results
- Making moves/adjustments
- Alignment completion

Dealing with alignment challenges

- Base-bound and bolt-bound conditions
- Dynamic movement
- Identify general types of soft foot and how to detect and correct soft foot conditions
- Effects of thermal growth on the alignment process and machine operation

Course Duration

3 days

Dynamic Balancing (WE250)

Course Objective

- Understanding principles of balancing
- Selecting the most appropriate procedure to be applied to selected balancing situations
- Understanding procedures for setting up the component to be balanced
- Understanding procedures for operating the balancing equipment
- Learn methods of rigid and flexible rotor balancing
- Learn the appropriate balancing technique for single and multiple planes balancing

Target Audience

- Reliability, Mechanical Maintenance and Electrical Maintenance /Manager/Supervisor/Engineer/Technician
- Operations Manager / Supervisor, Planning Manager, Quality Engineer

Training Content

Vibration analysis - the first step in field balancing

- Fourteen “votes” that confirm unbalance
- Resonance, misalignment and other problems that might “look like”

Unbalance - what balancing technique will be successful?

- Single plane, two-plane, or static and couple approach
- Use amplitude and phase measurements to determine approach
- L/D ratio & rotor response to trial weight can confirm
- Amount and location of trial weight and balancing in one run
- Rotor response, calibration factor and lag angle

Single plane (static) balancing

- Vector diagram solution to help understand single plane technique
- Balancing without phase - 3 and 4 circle methods
- Instrument and calculator (computer) solutions
- Combining or splitting correction weights.

Two-plane (dynamic) balancing

- Cross effect and the concept of “false” couple
- Two plane solutions, instrument and/or calculator

Static and couple balancing

- When to use this approach
- How to compute - calculator and vector diagram
- What type of rotors respond to this approach

Balancing machines

Hard bearing versus soft bearing
Overcoming problems - thrusting, windage and gross initial unbalance
Balancing tolerances
Why specify mass unbalance measures versus vector measures in defining tolerance
Prove rotor balance using the traverse test

Course Duration

2 days

Vibration Analysis – Introductory Level (WI201)

Course Objective

The course objective is to provide a practical approach to detecting and analyzing common machinery problems using vibration monitoring and analysis.

Target Audience

Engineers and technicians whose responsibilities require them to be proficient in the setup and use of the a condition monitoring system; maintenance supervisors, predictive maintenance coordinators, reliability engineers, inspectors, shop supervisors, advanced mechanics, and millwrights who wish to become familiar with vibration monitoring and analysis.

Training Content

Basics of vibration

- Time waveform analysis
- Amplitude vs. frequency
- Vibration – measurements, units and scale factors
- Vibration sensors
- Resonance
- Detection vs. analysis

Set up the vibration measurement

- Physical and database considerations
- Selecting the machinery
- Sensor location and mounting methods
- Setting Fmax

Alarm methods and setting alarms limits

- ISO guidelines
- Assessing overall vibration severity
- Alarms setting

Spectral analysis and phase analysis

- Spectral analysis techniques and pattern recognition
- Sidebands, harmonics
- Waterfall plot
- Understanding phase

Vibration signal processing methods

- Enveloping
- SEE™ Technology, HFD (high frequency detection)

Analyzing typical machinery problems

- Imbalance, misalignment and looseness
- Bent shaft, cocked bearing

Monitoring rolling bearings

- Bearing failure stages
- Bearing defect frequencies

Vibration diagnostic tables

- ISO 2372 Vibration diagnostic table

Course Duration

2 days

ISO 18436 Vibration Analysis Level 1 (WI202)

Course Objective

- Operate portable instrumentation on pre-assigned or pre-programmed routes
- Acquire readings from permanently installed instrumentation
- Input results into a database and download sampling routes from a computer
- Conduct testing under steady-state operating conditions following predefined procedures
- Compare overall or single value vibration measurements against pre-established alert settings
- Verify integrity of collected data; prevent or control poor data
- Evaluate and report test results in accordance with instructions; highlight areas for further investigation

Target Audience

Plant personnel requiring an introduction to vibration analysis techniques and technologies used in a condition predictive maintenance program, including maintenance supervisors, rotating machinery engineers, predictive maintenance technicians and coordinators, reliability engineers and multi-skilled mechanics.

Training Content

Introduction to Predictive Maintenance and Machine Vibration

- Definitions of PdM and condition monitoring
- Goals of a PdM Program

Machine vibration – basic theory and analysis:

- Characteristics of vibration (frequency and period)
- Amplitude – magnitude of vibratory motion. RMS peak and peak-to-peak conversations
- Frequency – how often the vibration occurs
- Phase – how one machine component or support frame vibrates relative to another
- Basics of a time waveform versus a spectrum

Preparation for data collection:

- Types of vibration transducers. Choosing the optimum transducer location
- Effects of transducer mounting on its performance, accuracy and repeatability
- Choosing the optimum FFT data collector

Introduction to data collection systems:

- Setting up a PdM database (plants, trains, machines and points)
- Choosing the proper parameter (vibration, acceleration, velocity and/or displacement)
- Setting up the optimum PdM routes and schedules

Introduction to problem recognition:

- How to recognise abnormal conditions. How to identify hardware versus software faults
- How to identify good versus bad data. How to detect common machine problems

Prerequisite

The candidate shall have a minimum 6 months experience in the field of machinery condition monitoring, vibration analysis and diagnostics.

Course Duration

4 days

ISO 18436 Vibration Analysis Level 2 (WI203)

Course Objective

- Select the appropriate machinery vibration measurement technique
- Perform basic vibration analysis of machinery and components such as shafts, bearings, gears, fans, pumps, and motors using spectrum analysis
- Maintain a database of results and trends
- Perform basic (single channel) impact tests to determine natural frequencies
- Classify, interpret and evaluate the test results in accordance with applicable specifications and standards
- Recommend corrective actions
- Recommend the use of alternative condition monitoring (CM) technologies with an understanding of the principles of all four CM technologies

Target Audience

Plant personnel requiring a basic understanding of analytical methodologies used to determine machinery conditions for improvement of predictive maintenance program results; including maintenance supervisors, rotating machinery engineers, predictive maintenance coordinators, reliability engineers and advanced mechanics and technicians.

Training Content

Common machinery malfunctions are discussed, including basic guidelines for the best detection tools for each machinery problem and key signs to be aware of. Malfunctions and common pitfalls are demonstrated and real-world vibration analysis case histories are shared.

1. What is vibration and how can it be used to evaluate machinery condition:
   - Frequency, a time waveform, phase, an FFT spectrum (signature)
   - Displacement, velocity, and acceleration
   - RMS, peak, and peak-to-peak amplitude
   - How to know when vibration is too high
2. Vibration sensors and their application
3. Vibration and detection by various instruments. Analog vs. digital methods
4. High frequency detection (HFD) and alarm levels at various speeds
5. Vibration analysis and how it is used to evaluate machine operating condition
   - Mass unbalance, eccentric rotors, bent shafts, misalignment, mechanical looseness, improper component fit, soft foot and belt drive problems
   - Rolling bearing, gear wear and electrical problems detection using vibration spectrum analysis
6. Vibration alarms, spectral band alarms and optimum frequency ranges
7. Common pitfalls in making everyday vibration measurements and the effect on detection and diagnosis of machinery problems
8. Time waveform and converting to an FFT spectrum
9. Predictive maintenance programs
10. Real-world case histories for problems found within the Illustrated Vibration Diagnostic Chart

Prerequisite

The candidate shall have a minimum 18 months experience in the field of machinery condition monitoring, vibration analysis and diagnostics.

Course Duration

5 days

Introduction to Static and Dynamic Electric Motor Monitoring (WI261)

Course Objective

- Develop a general understanding of what static testing and dynamic motor monitoring involves
- Knowledge of what standards are used in testing electric motors
- Develop a general understanding of electrical motor theory
- Knowledge of general workings of instrumentation for both static motor testing and dynamic motor monitoring

Target Audience

Condition Monitoring Engineer/Technician, Electrical Manager/Supervisor, Engineering Manager/Supervisor, Mechanical Maintenance Engineer/Manager/Supervisor, Operations Manager/Supervisor, Quality Engineer, Reliability Engineer/Supervisor/Manager.

Training Content

Basic AC motor theory

- Basic electromagnetic theory
- Basic AC motor construction
- Various types of motors

Introduction to static motor theory

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

Introduction to dynamic motor monitoring

- Machine system overview
- Properly connecting the Explorer
- Obtaining quality data
- Power, motor, load assessments

Course Duration

2 days

Static Electric Motor Testing (WI262)

Course Objective

- Develop an in-depth understanding of the Static tester and any software interfaces
- General understanding of motor testing applications
- Develop an in-depth understanding of electrical motor theory and how it pertains to high voltage motor testing
- Hands on training for true familiarity with instrumentation connection and operation

Target Audience

Condition Monitoring Engineer/Technician, Electrical Manager/Supervisor, Engineering Manager/Supervisor, Mechanical Maintenance Engineer/Manager/Supervisor, Operations Manager/Supervisor, Quality Engineer, Reliability Engineer/Supervisor/Manager.

Training Content

Static high voltage motor testing theory

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

Software training

- Creating databases, motors, and test ID's
- Data collection parameters
- Establishing and understanding pass/fail criteria
- Data interpretation

Non-three phase motor testing

- DC motors
- Synchronous motors
- Wound rotor motors
- Non-rotating equipment

Course Duration

2 days

Dynamic Electric Motor Monitoring (WI263)

Course Objective

- Develop a general understanding of AC motor theory as it relates to online operation.
- Develop an in-depth understanding of the capabilities and limitations associated with dynamic motor monitoring.
- Gain a general understanding of all the parameters monitored by the Explorer and the relevance of these parameters to specific faults.
- Develop an in-depth working knowledge of the Explorer as it relates to hands-on operation and software functionality.

Target Audience

Condition Monitoring Engineer/Technician, Electrical Manager/Supervisor, Engineering Manager/Supervisor, Mechanical Maintenance Engineer/Manager/Supervisor, Operations Manager/Supervisor, Quality Engineer, Reliability Engineer/Supervisor/Manager.

Training Content

Dynamic motor monitoring theory

- Power condition parameters
- Motor performance/condition
- Energy efficiency development
- Torque waveform development

Software training

- Creation and management of databases
- Creation and editing electrical test models
- Test acquisition setup
- Data collection
- Basic data interpretation and analysis

Intro to DC online analysis

- Basic DC motor theory and concepts
- Ensuring proper connections
- Software functionality
- Basic DC analysis

Course Duration

2 days

Streamlined Reliability Centered Maintenance - SRCM (MS331)

Course Objective

Upon completion of this course students will have the knowledge to:

- Know how to describe the SRCM process flow
- Recognise the importance of data structure and content before you do any kind of strategy work
- Understand the importance of identifying and categorising assets
- Understand criticality and the Failure Modes and Effects Analysis (FMEA) approach in SRCM
- Understand how to develop a SRCM analysis, as well as the implications of making the strategy work
- Understand why to conduct a task comparison
- Understand methods needed for SRCM implementation and recognise what a living program is

Target Audience

Maintenance, Plant/Facility Engineering staff, rotating equipment Engineers, Maintenance Supervisors, Managers at industrial plants, Reliability Engineers and those interested in rotating equipment performance.

Training Content

Module I: Setting the scene for SRCM (Introduction)

- Asset Management Support Tool (AMST) module structure

Module II: Conceptual models and business context

- Understand where SRCM came from
- Discuss the difference between SRCM and RCM
- Discuss SRCM compliance with the RCM standard

Module III: SRCM methodology

- Effectively discuss the SRCM process model
- Determine what data is required prior to SRCM

Module IV: Identify what is important

- How to select which system to analyse and determine system boundaries
- Understand the importance of the functional failure analysis (FFA)

Module V: Define what should be done

- Know what dominant failure causes are
- How to prescribe maintenance to critical assets and to decide run-to-failure (RTF) maintenance
- Know when design changes are required

Module VI: Change the existing program

- Understand the importance of task comparison
- How to implement well and what feedback is

Module VII: Project steps

- Understand typical SRCM project steps
- Understand what takes place during a SRCM
- review meeting

Course Duration

3 days

Reliability Centered Maintenance - RCM (MS332)

Course Objective

Upon completion of this course, students will have the knowledge to:

- Know how to describe RCM process flow and understand the differences in RCM approach
- Recognise the importance of data structure and content before performing any kind of strategy work
- Understand the importance of identifying and categorising assets
- Understand criticality and the FMECA approach in RCM
- Understand how to develop an RCM analysis and the implications of making the strategy work
- Understand why to conduct a task comparison and what work packaging is
- Understand methods needed for RCM implementation. Know the content of a RCM project plan
- Understand what risk based inspection (RBI) in the asset management support tool AMST is

Target Audience

Maintenance, Plant/Facility Engineering staff, Rotating Equipment Engineers, Maintenance Supervisors, Managers at industrial plants, Reliability Engineers and those interested in rotating equipment performance.

Training Content

RCM Overview and Business Context

What RCM Is and Is No. Where Does RCM Fit? Why Do RCM?

Cost Benefits of RCM. RCM Standards

RCM phase "what is important?"

- Know what a criticality matrix is and how to select which system to analyse
- Determine system boundaries
- Understand what failure modes, failure causes and failure effects are

RCM phase "what should be done?"

- Know what important failure characteristics are
- Know when to decide RTF maintenance. How to prescribe maintenance to critical assets

RCM customisation and requirements

- Understand RCM customisation and the use of RCM template data
- Determine what data is required for RCM
- Become aware of the asset management support tool (AMST)

Change the Existing Program

SKF RCM Process Model. Task Specification and Task Comparison

Work Packaging and Implementation

Daily Work Coordination Process. The Living Program

Documentation and Information Management

RCM project

- Know the steps in a RCM project

Risk Based Inspection Integration with RCM

- Understand the evolution of RBI
- Understand variations and the requirements of RBI

Course Duration

3 days

Spare Parts Management and Inventory Control (WC230)

Course Objective

The course objectives are to provide participants with a sound knowledge and understanding of:
- Spare parts and inventory management processes and principles
- Basic spare parts and inventory management terminology
- The importance and relations of spare parts and inventory management with respect to business goals
- Identifying, structure, and classifying spare parts on their criticality, (re)order parameters and other spare parts characteristics
- Applying basic analysis techniques to optimise the availability of spares and cost-effectively handle obsolete spares
- Key institutes and reference material on spare parts and inventory management

Target Audience

Engineers, Supervisors and Managers from the following functions:
Inventory control, purchasing, reliability and maintenance engineering, logistic support, quality, production and warehouse management

Training Content

Spare parts management

- Business Context and Related Disciplines
- Spare Part Management: Goals and Definitions
- Risks in Spare Part Management

Maintenance and spare parts strategy

- Asset Management – In Context. Asset Breakdown Structure
- Maintenance Strategy. Spare Part Strategy
- Risk Based Spare Part Review

MRO inventory management – Basics

- MRO Inventory – Introduction
- Replenishment by Reordering. Basic Inventory Control Models
- Warehouse Management. Partnering and Pooling

MRO inventory management – work processes and CMMS

- Inventory Control Functionalities in CMMS
- Setting the Reorder Point & Quantity
- Inbound Processes: Article Purchasing and Provisioning
- Outbound Processes: Article Reservations and Issuing. Catalog Management

Inventory Management – Evaluation & Optimization

- Drivers and Opportunities for Optimization
- Optimization Strategy. Key Performance Indicators
- Review Methods

Obsolete management

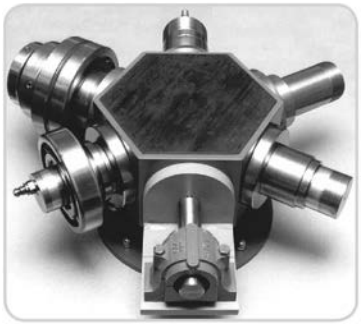
Definition of Obsolescence
Management of Change (MoC)

Course Duration

2 days

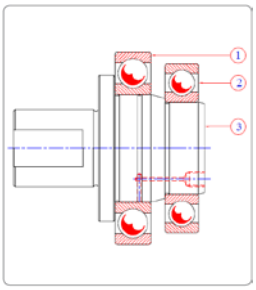
SKF TRAINING TOOLS

SKF Bearing Mounting and Dismounting Demonstration Kit



The SKF Bearing Mounting and Dismounting Demonstration Kit have been designed for use as a comprehensive teaching aid for industries.
SKF Bearing Mounting and Dismounting Demonstration Kit include a manual with step by step instructions and exercises which allow for individual tuition for each student.

It facilitates instruction in all aspects of bearing mounting and dismounting procedures including induction heating, mechanical tools, oil injection and lubrication. All the equipment required to perform these tasks is included in the SKF Bearing Mounting and Dismounting Demonstration Kit.



Through the construction of the various shaft, housing and sealing arrangements, students can build a working model.
They can then test the different techniques they have learned.

SKF Shaft Alignment Tools

Machines need to be aligned in both the horizontal and vertical plane. Misalignment can be caused by either parallel or angular misalignment.
The use of an advanced laser shaft alignment tool will increase your alignment knowledge.

Description

For effective machine alignment, the measurement is only 5% of the process. Users often find themselves encountering difficulties by skipping some important alignment steps. The SKF TKSA 80 system has a complete built-in alignment process to increase users' knowledge of alignment. The program takes users from preparation and evaluation all the way through to correction and finally a report of the result. With a 7 inch screen, the TKSA 80 can accommodate large machine train alignment jobs. It offers a unique database to store the machine set-up data for future use, visual inspections on oil leakage, oil level, foundation bolt status and wear indications.

SKF TRAINING TOOLS

SKF Rotor Kit

Measurements may be obtained to study

- Frequency Based Signals
- Time Based Signals
- Orbital Analysis
- Shaft Blow
- Identity Rotor Critical Speeds
- Phase Analysis
- Balancing
- Shaft Relative & Case Absolute

The Rotor Kits simulate the dynamic motion of a rotating machine in a compact, easy to use package. Ideal for class room or laboratory use, the rotor kit may be used to demonstrate vibration phenomena found in large rotating equipment.
The Rotor Kit allows you to alter parameters such as rotor speed and weight, and to induce malfunctions such as unbalance, shaft bow or rub and misalignment. Results can be viewed on a variety of portable instrumentation or continuous monitoring systems.

SKF Grease Test Kit

Portable grease analysis kit for use in the field

Lubricant analysis is a vital part of a predictive maintenance strategy. However, until now, this has been almost completely related with oils, despite the fact that around 80% of bearings are lubricated with grease.
Tribology knowledge and years of research have allowed SKF to develop a complete methodology to assess greases condition directly in the field.

Features and benefits

Main benefits of grease analysis are:

- Grease relubrication intervals can be adjusted according to real conditions
- Grease quality can be evaluated to detect possible unacceptable deviations from batch to batch
- Greases performance can be assessed, allowing verification of the suitability of a certain grease for a specific application.

Main benefits of TKGT 1 are:

- Portable kit, designed to be used directly in the field No special training required to perform the tests
- No harmful chemicals required
- The methodology included with the kit brings SKF lubrication knowledge to the customer in order to properly understand the results of every test.
- Small sample size required. Just 0.5 grams of grease are needed to perform all the tests.
- Quick assessment tool allowing taking decisions directly in the field.

SKF training courses at a glance

Basic

E-learning web based training	Course Code
Asset Efficiency Optimisation Basics	MS100
Assessment basics	MS101
Operator driven reliability	MS120
Maintenance Strategy Review	MS130
Shaft Alignment Basics	WE140
Balancing Basics	WE150
Basics of Industrial Seals for Rotating Motion	WE170
Vibration Basics	WI100
Thermography basics	WI130
Lubrication Analysis Basics	WI140
Bearing Basics	GRB001
Spherical roller bearings	GRB002
Angular Contact Ball Bearings	GRB003
CARB toroidal roller bearings	GRB004
Taper roller bearings	GRB005
Deep groove ball bearings	GRB006
Lubrication	GRL001
Power Transmission	GRPT01
SKF Machine Condition Advisor	PT01-MCA

Self learning PC based training	
Vibration Analysis I	SLT1
Vibration Analysis II	SLT2
Vibration Analysis of Industrial Fans	SLT3
Diagnostics of Cement Plant Machinery	SLT4
Dynamic Balancing I	SLT5
Basics of Rolling Element Bearings	SLT6
Mounting of Rolling Element Bearings	SLT7
Dismounting of Rolling Element Bearings and Failure Analysis	SLT8
Vibration Analysis of Rolling Element Bearings	SLT9
Vibration Analysis of Plain Bearings	SLT10
Vibration Analysis of Electrical Machines	SLT11
Operation and Maintenance of Pumps	SLT12
Operation and Trouble shooting of Material Handling Systems	SLT13
Analysis of Resonance Related Problems	SLT14
Dynamic Analysis for Equipment and Structural Analysis	SLT15
Alignment - Theory & Practice	SLT16
Diagnostics of Sugar Plant Machinery	SLT17
Diagnostics of Thermal Power Plant Machinery	SLT18
Diagnostics of Paper Plant Machinery	SLT19

On site Short Courses	
Bearing Basics	N/A
Bearing Handling and Storage	N/A
Bearings for Electric Motors	N/A
Introduction to Thermography Analys	N/A
Introduction to Bearing Housings and Seals	N/A
Introduction to Oil Seals	N/A
Introduction to Condition Based Maintenance	N/A
Fitting Spherical Roller, Self-Aligning Ball and CARB Bearing	N/A
Bearing Lubricatio	N/A
V Belts and Pulley	N/A
Bearing Failure Analysis	N/A

Application specific Courses

Improving Bearing Reliability in Pumps	WE211
Improving Bearing Reliability in Aggregate and Cement	WE212
Improving Bearing Reliability in Fans	WE213
Improving Bearing Reliability in Paper Machines	WE214

Level 1	Course Code
Introduction to Asset Management	MS200
Maintenance Strategy Review (MSR) awareness	MS230
Fundamentals of machine condition	WI201
Vibration Analysis	WI202
Infrared Thermography	WI230
Maintenance Planning & Scheduling	WC200
Spare parts management & inventory control	WC230
Bearing Technology & Maintenance	WE201
Precision Shaft Alignment	WE240
Lubrication in rolling element bearings	WE203
Proactive Maintenance Skills	WE241
Condition Based Maintenance	N/A
Dynamic balancing	WE250
Predictive Maintenance for Electric Motors	WI260
Machinery Lubrication Technician	WE265
Introduction to Static Testing & Dynamic Motor Monitoring	WI261
Dynamic Motor Monitoring/Introduction to DC Motor Monitoring	WI263

Level 2	
Streamlined Reliability Centered Maintenance (SRCM)	MS331
Optimising Asset Management through Maintenance Strategy	MS300
Vibration Analysis	WI203
Reliability Centered Maintenance (RCM)	MS332
Root Cause Bearing Failure Analysis	WE204
Root Cause Analysis (RCA)	LP200
Machine Lubrication Technician	WE266
Dynamic Motor Monitoring	WI264

Level 3	
Vibration Analysis	WI204

SmartStart™ Training	
Marlin and SKF @ptitude Analyst Inspector	WICM232
AX/GX Series Microlog and SKF @ptitude Analyst	WICM264
Balancing with an SKF Microlog	WE255

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