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This catalogue presents a wide range of reliability and maintenance training courses to support you in developing a successful training programme for your employees.

SKF training courses are based on over 100 years of experience and knowledge of rotating equipment performance that is unmatched in the world. We have established close working partnerships with our clients. As a result, we have gained a unique insight into the processes and challenges that every major industry faces today.

In the current business environment, companies who really stand out are the ones that invest time and money in upgrading the skills of their employees and helping them maximise their potential. The same companies, who continually create opportunities for their employees to learn, will in time reap the rewards of their investment and stay ahead of their competition.

From an industry perspective, SKF training courses focus on enhancing the efficiency of plant machinery and equipment assets, which are integral to the production process in your business. Your employees will have the opportunity to learn from our experienced instructors, as they impart their knowledge on ‘best-in-class’ reliability maintenance practices.

Our partnerships with global certification councils along with educational institutions will provide your staff with key knowledge of emerging technologies in the field of engineering, specifically rotating equipment. With comprehensive training sessions that involve ‘hands-on’ learning experience, your employees will be equipped with SKF knowledge that enables them to become highly skilled technicians who will add value to your business.

We would like to extend our congratulations to you in making an important business decision – that is, to invest in training for your employees. We wish you an enjoyable learning experience!

Benefits of training

• Eliminates re-work and machinery problems to increase reliability and productivity
• Stops problems before they happen by addressing the root causes
• Enhances plant safety
• Increases employee productivity by teaching them advanced techniques to complete everyday tasks more efficiently
• Reduces the need for employee supervision
Training course dates 2017

**Maintenance and reliability**
**MS200 Introduction to modern maintenance philosophies, 1 day**
- 21 February Aberdeen
- 13 June Aberdeen
- 12 September Aberdeen
- 17 October Luton

**Condition-based maintenance**
**WI200 Introduction to condition monitoring, 3 days**
- 16-18 May Leeds
- 11-13 July Aberdeen
- 12-14 September Leeds
- 05-07 December Leeds

**WI201 Fundamentals of machine condition, 2 days**
- 21-22 February Luton
- 14-15 June Leeds
- 07-08 August Luton

**WI202 Vibration analysis - Category 1, 4 days**
- 23-26 January Aberdeen
- 06-09 February Leeds
- 06-09 March Luton
- 19-22 June Aberdeen
- 03-06 July Leeds
- 14-17 August Luton
- 09-12 October Leeds
- 20-23 November Luton

**WI203 Vibration analysis - Category 2, 5 days**
- 13-17 March Aberdeen
- 03-07 April Leeds
- 08-12 May Luton
- 18-22 September Aberdeen
- 06-10 November Leeds
- 11-15 December Luton

**WI230 Introduction to infrared thermography, 1 day**
- 10 January Leeds
- 05 September Aberdeen
- 30 November Leeds

**WI231 Infrared thermography - Category 1, 4 days**
- 20-23 March Leeds
- 25-28 September Leeds

**WI250 Lubricant sampling and storage, 2 days**
- 11-12 January Leeds
- 27-28 November Aberdeen

**WE203 Lubrication in rotating bearings, 1 day**
- 23 February Leeds
- 05 April Luton
- 06 July Leeds
- 25 July Leeds
- 05 September Leeds
- 26 October Luton

**WE204 Bearing damage analysis, 1 day**
- 06 April Luton
- 26 July Aberdeen
- 06 September Leeds

**WE208 Renewables technician, automatic lubrication systems, 1 day**
- 16 May Luton
- 20 November Aberdeen

**WE209 Automatic lubrication systems, (level 1 and level 2), 1 day each**
- 17-19 May Leeds
- 21-23 November Aberdeen

**WE240 Precision shaft alignment, 1 day**
- 14 February Aberdeen
- 09 March Leeds
- 26 September Luton
- 26 October Leeds
- 14 November Aberdeen

**Work control processes**
**WC230 Spares optimisation and inventory control, 3 days**
- 11-13 April Aberdeen
- 10-12 October Aberdeen
- 07-09 November Luton

**WE250 Balancing theory and practice, 2 days**
- 16-17 February Aberdeen
- 15-16 November Aberdeen

**WE201 Bearing maintenance and technology, 2 days**
- 14-15 March Luton
- 25-26 April Leeds
- 03-04 May Aberdeen
- 18-19 July Leeds
- 12-13 September Luton

**WE202 Bearings in rotating machinery applications, 2 days**
- 21-22 February Leeds
- 04-05 July Luton
- 24-25 October Luton

**WE208 Renewables technician, automatic lubrication systems, 1 day**
- 16 May Luton
- 20 November Aberdeen

**WE209 Automatic lubrication systems, (level 1 and level 2), 1 day each**
- 17-19 May Leeds
- 21-23 November Aberdeen

**WE240 Precision shaft alignment, 1 day**
- 14 February Aberdeen
- 09 March Leeds
- 26 September Luton
- 26 October Leeds
- 14 November Aberdeen

**WE250 Balancing theory and practice, 2 days**
- 16-17 February Aberdeen
- 15-16 November Aberdeen

**Engineering**
**LP200 Root cause analysis, 2 days**
- 07-08 March Leeds
- 19-20 September Luton
## SKF training courses at a glance

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<td>PT04-GPS Revised standards for rolling bearing tolerances (ISO 199/ISO 492)</td>
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# SKF training courses at a glance

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<td><strong>Condition-based maintenance</strong></td>
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<td>WE209 Automatic lubrication systems</td>
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<td><strong>Engineering</strong></td>
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## Industry and applications courses

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How can I increase profitability through developing the skills of personnel?

SKF recommends 5 key steps to successful training results

**Step 1**
Select the right work category
(Highest return on investment to an organisation)

**Step 2**
Training needs analysis
(Highest skills improvement opportunity for staff)

**Step 3**
Customised learning planning
(Quickest learning paths to required competency levels)

**Step 4**
Monitor performance improvement
(Through structured documented savings process)

**Step 5**
Work category re-assessment
(Continuous improvement and re-activation of skills cycle)
Step 1: Select the right work category

Best return on investment for an organisation

Drawing on years of SKF productivity experience, we can help you identify improvement opportunities that will yield positive bottom-line results, then suggest a strategy for implementing a programme to achieve them.

Our goal at SKF is to help you achieve maximum return on your reliability investment. The SKF Client Needs Analysis (CNA) is a performance benchmarking process with proven success in many industries.

The SKF Client Needs Analysis enables this understanding, combining our experience in reliability-focused maintenance with your knowledge of plant conditions. The goal is to provide useful, actionable information to help you focus on credible performance improvement opportunities.

Ideally the CNA will give you the opportunity to gain a clearer perspective on your reliability programme that is generally not possible while immersed in daily activities. Once the analysis is complete, you will receive a comprehensive report that includes:

- A summary of initial set-up details
- A spider chart illustrating a micro-level assessment for each question versus the maturity phases
- A maturity summary matrix showing a macro-level assessment for all four main facets of the asset efficiency optimisation process versus the maturity phases
- A ranked deviation chart illustrating your performance question-by-question versus your industry averages
- A detailed roadmap of recommendations for improving plant reliability

Moving toward a world-class facility starts with understanding where you stand today, and defining your objectives for the future.

Figure 1: The four phases of maintenance maturity.
Step 2: Training needs analysis

Clearly identified skills improvement opportunity for staff

Training needs analysis (CNA-training): The shift to a fully integrated, reliability and risk-based asset management strategy starts with a good initial understanding of where your staff are today and where your staff need to be to attain optimum plant performance. The CNA-training enables this crucial understanding, combining our experience in training and knowledge of maintenance and reliability. The goal is to provide useful and meaningful information to help you focus on improvements for plant performance.

CNA-training is conducted with individuals or a group of your staff from the following work areas:

**Managers**
- Maintenance
- Reliability
- Engineering

**Superintendents/Supervisors**
- Mechanical maintenance
- Electrical maintenance
- Planning and stores

**Engineers**
- Mechanical
- Electrical
- Reliability
- Condition monitoring
- Application

**Technicians**
- Mechanical
- Electrical
- Reliability
- Condition monitoring
- Lubrication
Targeting eight areas of competency for improvement

Opportunities for improvement are determined based on findings from the CNA-training. Typical improvements fall in the following areas:

1. Bearing and seal technology
2. Power transmission
3. Lubrication
4. Oil analysis
5. Vibration analysis
6. RCA/RCFA
7. Maintenance strategy
8. Thermography

A progressive and structured approach to training assessment

Skill gap analysis in all key areas of competency. The CNA-training needs analysis will give you a clearer perspective of your staff’s competency and skill levels. The results are analysed and you will be provided with a report which includes:

1. A summary of individuals or group of individuals work profile
2. A ‘spider chart’ showing a micro-level assessment of each question, with skill levels for each area of competency, opportunities for improvement as well as areas of exceptional performance (refer to spider chart below)
3. A skills summary matrix showing macro level assessment for each of the areas of competency
4. A detailed proposal of recommendations for improvement for the individual or group of individuals supported by the finding of the training needs analysis
Maintenance and reliability engineering training

Course levels
The SKF training courses focus on disseminating maintenance related knowledge worldwide. It offers various programmes that are developed for easy application.

SKF offer training courses by skill levels. Following this development path is not mandatory, yet highly recommended, as participants will realise the most benefits by taking the courses sequentially.

E-learning
E-learning modules delivered online, 24/7, at SKF Knowledge Centre. Introductory courses familiarise students with basic terms and offer basic training on various subjects.

Intermediate classroom courses
Classroom courses taught by SKF specialists at customer locations or SKF facilities. A combination of theory and hands on instruction. Intermediate courses typically last 2~3 days.

Step 3: Customised learning planning
Course categories
While specific course topics vary widely, SKF training courses are organised around the following five facets of the SKF Asset Efficiency Optimisation (AEO) model:

**Maintenance and reliability (MS)**
Relates to methods and technologies used to develop a maintenance strategy. Courses emphasise a technically and financially sound maintenance strategy developed to match business goals.

**Condition-based maintenance (CBM) (WI)**
Relates to methods and technologies used to identify maintenance work. Course topics include condition monitoring, data collection, information integration and analysis.

**Work control processes (WC)**
Relates to methods and technologies used to control maintenance work. Course topics include maintenance planning and scheduling, standard job plans, spare parts alignment and inventory control.

**Proactive maintenance or mechanical maintenance (WE)**
Relates to methods and technologies used to complete maintenance tasks. Course topics mainly include bearing maintenance, best practices in lubrication, precision alignment, dynamic balancing, and electric motor maintenance.

**Engineering (LP)**
Relates to methods and technologies used to evaluate maintenance work and strategy, thereby ‘closing the loop’ and making maintenance a continual improvement process. Course topics include root cause analysis, reliability analysis, maintenance work feedback and performance management system, machine redesign, and technology upgrades.

The SKF development path
*The blended learning approach to enhance training effectiveness*

- **Introductory**
  - **Maintenance and reliability**
  - **Condition-based maintenance**
  - **Work control**
  - **Proactive maintenance or mechanical maintenance**
  - **Living program (continuous improvement)**

- **Intermediate**
  - **Instructor-led classroom knowledge transfer**

- **Follow-up enhancing**
  - **Post-course refresher/enhancer**
Step 4: Monitor performance improvement

Using a powerful new software programme, an SKF representative can show you how to track thousands or even hundreds of thousands of pounds of savings when knowledge gained from SKF training is implemented.

Solutions range from unique SKF training and products that reduce maintenance costs, to reliability services that solve recurring machine problems and virtually eliminate unplanned downtime.

How can you have confidence in the forecasted savings? All this is achieved using your own resources – for materials, labour, downtime, energy costs, inventory, lubrication, replacement costs and more.

Step 5: Work category re-assessment

Continuous improvement and re-assessment of skills cycle

SKF recommends customers to re-assess the improvements made in different work categories after a period of 12–24 months. It also allows customers to identify new improvement opportunities, thereby closing the re-assessment loop and making this part of a continuous improvement process.

Key to success:
- A corporate culture willing to embrace the need for change
- Commitment to implementing new technologies with requisite financial, training and personnel resources
- Willingness to support processes for implementing cultural and technology changes

With SKF documented solution programme, a structured documented savings process, you spend minutes and can save thousands.
Can’t spare time for training? Get expert training at your premises

Advantages

Diverse range of courses
- Access to a full range of public programmes as well as programmes specifically tailored to meet your unique training needs

Convenience
- We arrange timing and delivery of courses to suit your schedule
- No travel time for delegates, thus providing time and cost savings – we come to you!

Experienced instructors
- Industry experts who are able to provide course participants with the full spectrum of maintenance and reliability based training

Cost effective
- Cost effective method for training groups of employees from your organisation

Team environment
- Training all employees at the same time promotes a team environment and provides immediate learning impact

On-site training would be an ideal option for you, if:
- You have 8 or more potential participants from your organisation
- You want to choose a date and location that suits you
- You want a trainer that understands your industry as well as a program customised to meet your unique training needs
- You want to save time and money while getting the best training

Example of a SKF reliability training centre setup at the customer site

This technical training centre consists of the latest equipment and technology in bearing maintenance and condition monitoring fields. This provides a unique opportunity for employees to attend hands on training programmes and gain practical knowledge. The centre was set up in close collaboration between SKF and the client.
**SKF instructors**

**Graeme Poole**
Graeme is SKF UK’s Training Manager providing condition monitoring training all over the UK. He has been in the condition monitoring industry for over 25 years following an early career as a rotating equipment engineer. Graeme is an approved ISO Vibration Analysis trainer.

**Alan Shire**
Alan is a Contract Manager and condition monitoring specialist for SKF. He has been with SKF for 26 years and has worked exclusively in the area of condition monitoring, covering sales, installations, training, technical support. Alan is also an approved ISO vibration analysis trainer.

**Chris Munday**
Chris is a Senior Applications Engineer with over 25 years’ experience of bearing, sealing and lubrication issues. Since joining SKF from a process pump background, he has worked with OEM and aftermarket customers to develop business, particularly in the petrochemical, food and beverage and marine industries. His particular expertise is in bearing root cause failure analysis.

**Mark Townsend**
Mark has been with SKF for 28 years as a Service Engineer and Service Manager mounting bearings and associated products across all industry sectors. He has been an SKF trainer for over twenty years, covering bearing maintenance and technology, bearing failure analysis and alignment.

**Dino Kouadria**
Dino is a lead consultant providing technical support and services on motor reliability and maintenance related issues at our Aberdeen site. He has over 20-years experience in the development and use of diagnostic testing tools of electrical equipment and extensive background in condition monitoring systems assessment, development and use.

**Tom Gribbin**
Tom has been with SKF as a practising service engineer for 27 years, supporting customers with bearing and maintenance products requirements. He served his time with British Aerospace as a maintenance engineer for 19 years and then joined the engineering team of a large paper mill for three years. Over his engineering life he has encountered almost every type of machine with a rotating shaft or housing with rolling bearings, and is well qualified to carry out practical training giving customers the knowledge to achieve superior bearing performance.

**Gary Setford**
Gary is a Contract Manager for SKF, focusing on condition monitoring, particularly vibration-based systems and services providing technical support, training and the specification, delivery, contract management and implementation of portable and on-line solutions. He has been in the condition monitoring industry for over 20 years following an early career in rotating equipment, with the last 17 years being at SKF. He has delivered many training courses over this period covering both vibration theory and practical applications and also product-specific training (hardware and software). He is a BINDT approved trainer for the vibration analysis course.

**Paul Hilford**
During his career, Paul has benefitted from a broad experience in asset management, ranging from practical hands on reliability and maintenance engineering, right through to corporate change management leadership. He holds relevant engineering qualifications and is a certified Change Management Practitioner (PROSCI). Since 2003 he has led change in asset management and equipment maintenance and reliability practices for various organisations around the world, both internally as an employee, and externally in a consultative role.
BINDT approved training from SKF

SKF is a global Approved Training Organisation (ATO), registered with the British Institute of Non-Destructive Testing (BINDT) as per ISO 18436 requirements, which covers training related to condition monitoring and diagnostics of machines.

BINDT is an approved certifying body in accordance with ISO/IEC 17024 offering personnel certification against criteria set out in international and European standards through the Personal Certification in Non Destructive Testing (PCN) certification scheme. BINDT has developed a programme for the certification of competence of personnel engaged in various condition monitoring disciplines in accordance with ISO 18436.

Senior members of SKF’s training team sit on the BINDT working groups for vibration analysis and lubricant analysis. The course material and examinations have been developed in conjunction with PCN and the Condition Monitoring and Diagnostic Technologies (COMADIT) committee to establish the first globally recognised qualifications in condition monitoring. The following training courses are approved to BINDT through the PCN certification scheme:

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<td>Infrared thermography - Category 1</td>
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To be eligible to apply for PCN certification the candidate has to provide documentary evidence of successful completion of a BINDT approved or formally recognised training course, and complete an end of course assessment (or continuous assessment throughout the course) with a pass of at least 75% or higher.

Generally, candidates will require at least six months experience (gained before or after the certification exam is undertaken) to be awarded Category 1 status and usually at least 12 months experience to be awarded Category 2 status. However, detailed requirements, all relevant documentation and application forms can be provided, along with guidance on the application process either before or during the training course.
## Level 1: e-learning courses

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Reliability knowledge delivered at your convenience

Our expanding range of e-learning courses covers a wide range of topics that you can learn from at your own pace and convenience.

A personal approach in an online environment

- The online e-learning courses from SKF are designed to introduce you to the subject and are considered the pre-requisites for the intermediate level classroom courses.
- Course participants will benefit from the opportunity to interact with a course tutor, via the 'ask the expert' functionality that is accessed from within each training module.
- Each course is also accompanied by a dedicated support forum, allowing participants to interact with other learners and subject experts to further enhance their learning experience.
Maintenance and reliability

**MS100**
**Asset efficiency optimisation (AEO) basics**

*Course overview*
This is an introductory course on maintenance optimisation. It considers the shortcomings of traditional maintenance and the benefits to be gained by replacing a cost focus with one of value and risk. Tools to assist with the optimisation exercise are briefly discussed and a work process is outlined to ensure that the optimised maintenance plan achieves the desired results.

**MS101**
**Assessment basics**

*Course overview*
Excellence in asset management is no more or less complex than being able to ask and answer structured questions routinely and accurately. This course provides a general introduction to the subject of assessing maintenance performance. Tuition includes guidance on the selection and implementation of the correct assessment approach. The nature of organisational change is also discussed and suggestions made regarding management of the change process.

**MS100**
**Maintenance and reliability**

**MS120**
**Operator driven reliability**

*Course overview*
This course provides an introduction to the concept of Operator Driven Reliability (ODR). Its origins and terminology are explained, and the relationships between ODR and other maintenance methodologies is discussed. Factors that are key to successful implementation are also described.

**MS130**
**Maintenance strategy review**

*Course overview*
The course starts with an explanation of what a good maintenance strategy is meant to achieve. It then goes on to introduce Reliability Centred Maintenance (RCM) as a means of devising an effective strategy. Some variations on the classic RCM methodology are described, including SRCM and Risk Based maintenance. A cost-based approach to RCM is also outlined.

The course goes on to suggest how a maintenance strategy review project might be organised, and concludes by discussing the challenges that must be faced when implementing the results of such a project.

**MS113**
**Proactive reliability maintenance**

*Course overview*
This course provides an introduction to proactive maintenance. It starts by exploring what is meant by the term “proactive maintenance” and goes on to discuss five of the primary tools that are typically used in its implementation. An introduction to the use of key performance indicators to monitor programme effectiveness is included, along with suggestions for a disciplined approach to operational review.
Condition-based maintenance

Vibration basics

Course overview
All machines obey Newton’s universal laws of motion - from a small electric toothbrush through to a steam turbine in a power station. This introduction to vibration is therefore pertinent to any application or any segment. The session discusses the main cause of vibration (rotational forces) and the basic units of measurement.

Lubrication management

Course overview
This course looks at the importance of good lubrication practices, and discusses 10 key facets that should be included in an effective lubrication management program.

Work control processes

Spares inventory management and optimisation

Course overview
This course introduces you to the terminology, processes and activities associated with spare part and inventory management. The objective of this course is to increase your knowledge of basic spare parts and inventory management terminology, processes and principles with respect to your business goals. This course will help you to identify, structure and classify spare parts based on their criticality and re-order parameters, and help you to optimise your spare parts inventory.

SKF Machine Condition Advisor

Course overview
This course introduces the SKF Machine Condition Advisor, and its application in assessing the condition of rotating machinery. This involves three key tasks: Preparing and planning for measurements, collecting and recording readings, and evaluating the collected data to detect changes in machinery condition.

The basics
This lesson introduces the SKF Machine Condition Advisor as a predictive maintenance tool, and describes the three determinants of machine condition that it measures.

Instrument setup
In this lesson you will learn how to prepare the instrument for use, and how to configure the instrument to suit your own preferences.

Using the instrument
A virtual instrument is used to collect data from a typical fan. A simple data recording system is discussed, and instruction offered regarding the evaluation of the collected data.

Practical conditions
This lesson considers some of the practical difficulties that might be encountered in using the Advisor on real process machinery. Once again, a virtual instrument is used to collect data from a typical machine.
Proactive maintenance

WE104

Bearing damage classification

Course overview

This course provides a basic introduction to the classification of damage in rolling bearings, according to standard ISO15243: 2004.

Understanding the root causes of bearing damage not only helps to ensure reliable bearing operation, but can also avoid costly downtime. While most bearings perform extremely well in their particular application, a bearing failure can have expensive consequences. Bearing failure modes are defined according to an ISO classification.

Classifying the damage in the right way helps to understand what has happened, to find the root cause and identify solutions to prevent recurrence of the problem. Armed with this information, it is possible to make sure that a bearing can perform flawlessly in its particular role. The ISO classification helps to improve communication, and avoid misunderstandings.

WE150

Balancing basics

Course overview

This course consists of two previously recorded webinars providing a basic introduction to balancing theory and practice:
- Part one provides the theory behind rotor balancing.
- Part two provides a practical demonstration of the procedure used to achieve a two plane balance of a rotor, from start to finish.

Engineering products

GRB001

Bearing basics

Course overview

On completion of this course the learner will be able to describe the three primary functions of a bearing, and to correctly identify the component parts of a standard bearing. The learner will also be able to list the most common bearing types and describe the main characteristics of each. He will also be able to explain eight factors that will affect the choice of bearing for a particular application. The learner will also be able to identify (with the aid of notes) the bearing type described by use of a basic designation, and to identify variants of a standard bearing design from information given in prefixes and suffixes applied to standard designations. (Estimated study time: 50 minutes).

GRB003

Angular contact ball bearings

Course overview

Before taking the Angular contact ball bearings course, it is recommended that you have passed the Bearings basic course (GRB001), or have some prior knowledge about bearings.

Lessons focus on features and benefits of single row and double row angular contact ball bearings. Arrangement of universally matchable angular contact ball bearings is also discussed. Four-point contact ball bearings are also considered.

SKF angular contact ball bearings are used in many pump and compressor applications. Three examples of demanding applications are presented. (Estimated study time: 60-90 minutes).

GRB005

Tapered roller bearings

Course overview

This course describes the construction and features of the SKF range of tapered roller bearings. Typical applications for these bearings are discussed, and the user will be able to identify an SKF tapered roller bearing by its designation.
Deep groove ball bearings

Course overview
Before taking the Deep groove ball bearings course, it is recommended that you have passed the bearings basic course (GRB001), or have some prior knowledge about bearings.

In this course you will learn the basics about SKF deep groove ball bearings. The course consists of the following parts:

- An introduction to the course contents and an explanation of how the course works
- In this section you will learn about the features and benefits that set SKF deep groove ball bearings apart from the competition
- Product range and designations: Working with bearings on a daily basis, it is useful to recognise the most common bearing designations. In this lesson, you will learn about the SKF deep groove ball bearing range and the most relevant designations
- Applications: SKF deep groove ball bearings are successfully used in a wide range of applications. This lesson illustrates four different applications

Revised standards for rolling bearing tolerances (ISO 199/ISO492)

Course overview
ISO 199 and ISO 492 are the basic standards for rolling bearing tolerances. They were revised to incorporate ISO GPS (Geometrical Product Specifications), enabling rolling bearing tolerances and the ISO GPS systems to be based on the same platform. The benefits are better descriptions of SKF products in terms of functions.

The revised standards give users more information about the interface between SKF products and the rest of their machinery in order to better integrate our products. Today you need to be an expert in bearings, to understand that for instance, the bearing diameter tolerances are given as a mid-range size, but with revised standards these tolerances are clearly described by using the common industrial language of ISO GPS. It functionally takes the interface between the bearing and another mechanical part into account. In detail the rolling bearing standards:

- ISO 199:2014 Rolling bearings – Thrust bearings – Geometrical product specifications (GPS) and tolerance values
- ISO 492:2014 Rolling bearings – Radial bearings – Geometrical product specifications (GPS) and tolerance values

are now aligned with general ISO GPS standards like ISO 1101 and ISO 5459. This e-learning includes information about the content of ISO 199:2014 and ISO 492:2014 and describes the changes to the former version.

Power transmission

Course overview
This course presents the basics of the SKF power transmission product range, covering timing belts, wedge belts, chains and couplings. The course includes discussion of various aspects of installation and maintenance of these products.
## Level 2: classroom courses

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Level 2: Classroom courses
Intermediate, typically 2–3 days

Taught by SKF Instructor’s these courses are a great way to learn or refresh your knowledge and skills. The courses are taught using a blended learning approach with a combination of classroom training and practical workshops to improve the overall learning effectiveness. Course topics relate to methods, technologies and best practices to develop, implement sustain precision and proactive maintenance practices in order help improve reliability and profitability.

The courses can also be customised to your own needs and delivered on-site at your facility.
Introduction to modern maintenance philosophies

Course objective
This course will give participants an introduction into modern maintenance techniques from asset management principles to understanding ‘How and Why’ different maintenance tasks are selected. It will outline the different condition-based maintenance techniques that are typically used within industry to help determine faults and residual life within an asset.

Duration
1 day

Course content

Fundamentals
- Introduction to asset management principles
- Overview of the six failure curves
- Maintenance task selection techniques reliability centered maintenance (RCM) and failure modes and effect analysis (FMEA)
- Understanding failure modes
- Condition-based maintenance (CBM) as a strategy

Visual inspection techniques
- Autonomous maintenance and visual indicators
- Use of strobe lights
- Recording and trending data

Vibration analysis
- Why vibration monitoring?
- The different techniques available
- Typical faults detected

Thermal imaging
- Why thermal imaging?
- Monitoring electrical systems
- Monitoring mechanical assets
- Typical faults detected

Oil debris analysis
- Why oil debris analysis?
- Sampling techniques
- Analysis of results
- Typical faults detected

Who should attend
Craftspeople, technicians, operators and supervisors.
Condition-based maintenance

Introduction to condition monitoring

Course objective
This is a basic level introduction course and is aimed at explaining the basics of other condition monitoring techniques to those who work in lubricant analysis laboratories. Included in this course will be an overview of vibration analysis, infrared thermography and airborne ultrasound. Practical sessions will be used during each technique to re-inforce the learning. The course will end with a session that explains to laboratory staff how common problems are identified through the use of lubricant analysis reports.

Duration
3 days

Course content

Maintenance strategy overview

Vibration analysis
- Time waveform and the FFT
- Amplitude and frequency
- Measurements and units
- Transducers – accelerometers and proximity probe
- Basic fault analysis

Lubricant analysis
- Lubricant functions, conditions and types
- Compositions (base oils and additives)
- Properties of oils and greases
- Relubrication guidelines
- Storage and management of lubricants
- Contamination control
- Sampling techniques
- Testing of oil samples

Infrared thermography
- Theory of infrared thermography
- How infrared thermography works
- Different types of measurement
- To include colour pallettes, distance and emissivity
- Overview of IR camera
- Collecting IR images and storing in software
- Image review in software
- Analysis examples

Airborne ultrasound
- Theory of ultrasound
- How ultrasound works
- Influence from other sources
- Contact and non-contact measurement considerations
- Distance from source of ultrasound
- Sensitivity of instrument
- Using ultrasound equipment
- Analysis examples

Review session
- Review questions covering all topics
Fundamentals of machine condition

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

Who should attend
Engineers and technicians whose responsibilities require them to be proficient in the setup and use of the SKF 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.

Duration
2 days

Course content

Basic of vibration
- Time waveform analysis
- Amplitude vs. frequency
- Vibration — measurable characteristics
- Scale factors
- Measurements and units
- Displacement probe/eddy probe
- Multi-parameter monitoring
- 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
- Spectral enveloping and bands
- Phase alarms
- Exception criteria

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 and misalignment
- Bent shaft
- Mechanical looseness
- Cocked bearing

Monitoring rolling bearings
- Why do bearings fail?
- Bearing failure stages
- Bearing defect frequencies
- Displaying fault frequencies

Vibration diagnostic tables
- ISO 10816 Vibration diagnostic table
Vibration analysis – Category 1

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.

Who should attend
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.

Duration
4 days

Course content

Introduction to predictive maintenance and machine vibration
- Definitions of PdM and condition monitoring
- How PdM compares with other maintenance systems
- Goals of a PdM programme
- Critical role of vibration analysis in Pdm

Machine vibration – basic theory and analysis:
- Characteristics of vibration (frequency and period)
- Amplitude – magnitude of vibratory motion
- RMS peak and peak-to-peak conversions
- 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)
- Selecting the proper parameters
- Setting up the optimum PdM routes and schedules
- Printing out the proper reports after uploading
- 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
Vibration analysis – Category 2

Course objective
- Select the appropriate machinery vibration measurement technique
- Set up instruments for basic resolution of amplitude, frequency and time
- 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 (including acceptance tests) 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

Duration
5 days

Who should attend
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.

Course 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, and misalignment
   - Mechanical looseness, improper component fit, soft foot, and belt drive problems
   - Rolling bearing problem detection using vibration spectrum analysis
   - Gear wear problem detection
   - Electrical problems within induction motors
   - Balance resonances, detection, and effects on machinery

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
Introduction to infrared thermography

Course objective
This is a basic level introduction course and is aimed at explaining the basics of infrared thermography to new users including some background science on the technology, heat transfer methods, basics of radiation, thermography in maintenance and an overview of applications.

Duration
1 day

Course content

Background science
- Explain what infrared radiation is
- Explain the difference between temperature and heat
- Understanding Celsius and Fahrenheit temperature scales
- Comparing temperature differences measured using different scales

Heat transfer
- Methods of heat transfer
- Differences between qualitative and quantitative thermography

Radiation basics
- Relationship between absorption, reflectance and emission
- Blackbody concept
- Explanation of emissivity

Thermography in maintenance
- Benefits of thermography in maintenance
- Disadvantages of thermography in maintenance
- Focus, range, span and level in thermography
- Difference between real and apparent temperature differences

Applications
- Main areas of thermography application
- Explanation of infrared images from different applications
Infrared thermography - Category 1

Course objective
The training programme combines both theoretical and practical activities blended together to provide a positive learning experience. The theoretical information is essential for understanding the real world problems that face thermographers in the field today. This is combined with hands-on operator training that teaches you how to use infrared instruments. Our trainers are highly qualified and experienced and they can teach you not only basic system operation, but also the finer points of your specific piece of equipment and give you the knowledge to utilise the tools at your disposal. You will also learn the principles behind the main applications of infrared thermography and study how industries incorporate this technology into different businesses. (This course is designed to meet and exceed ISO 18436 and the SNT-TC-1A recommended practices). The course will be delivered by The Institute of Infrared Thermography.

Duration
4 days

Course content

Day 1
- Introduction
- Introduction to thermography
- Heat transfer theory
- Conduction
- Convection
- Radiation
- Change of state
- Electromagnetic spectrum
- Thermal radiation principles
- Basic concepts
- Blackbody
- Realbody
- Absorbance
- Emittance
- Reflectance
- Transmittance
- Radiosity concepts
- Hands-on workshop

Day 2
- Review
- Infrared equipment operations
- Hands-on workshop
- Qualitative operations
- Qualitative analysis
- Temperature measurement
- Requirements for accurate measurement
- Performing temperature measurements

Exercises
- Direct and relative measurements
- Field quantification
- Checking equipment calibration

Day 3
- Review
- Qualitative or quantitative
- Resolution
- Instrument resolution and accuracy
- Instrument drift/compensation
- Spatial resolution
- Distance/size relationship
- Errors and compensation
- Atmospheric effects
- Safety – review safe working practices
- Applications overview
- Maintenance strategies
- Electrical examples
- Mechanical examples
- Techniques reinforced
- ISO standards for condition monitoring

Report and report writing
- Characteristics that make a good report
- Real life pictures
- Support equipment
- Environmental data

Day 4
- Review
- Condition monitoring programmes
- Principles and complimentary technologies
- Design and acceptance testing
- Implementation
- Codes and standards
- Relevant application codes
- Certification exam
- End of course assessment
- End of course assessment to establish candidate’s readiness to apply for PCN certification examination
- Pass grade 75%
Lubricant sampling and storage

Course objective
This course is designed for providing those involved with the collection of lubricant samples all the basic knowledge they will need to understand the principles behind lubricant analysis. This will include an overview of lubrication fundamentals but will focus on the importance of correct storage and different transfer functions on the lubricant. The course will address the importance of correct sample location, proper use and storage of sample bottles as well as different sampling techniques. Sampling equipment including fittings, valves and vacuum pumps/tubes will all be covered during the course.

Duration
2 days

Course content

Maintenance strategies
- Maintenance strategies
- Role of oil analysis

Lubrication theory and fundamentals
- Lubricant fundamentals
- Lubrication conditions
- Base oil and additives
- Oil properties and classifications
- Synthetic oil
- Grease lubrication (base oil, additives and thickeners)

Lubricant selection
- Consideration for different systems

Lubricant application
- Re-lube and change frequencies
- Grease paths

Lubricant storage and management
- Cleaner oil
- Storage of oil
- PQ index
- Particle count
- Flash test
- Difference between real and apparent temperature differences
Field lubricant analysis - Category 1

Course objective
This course is designed to provide the new lubricant analyst/technician with all the basic knowledge they will need to understand the principles behind the technique including the importance of understanding different lubricant types, compositions and properties; the importance of correct storage and transfer functions; the importance of correct sampling methods and an understanding of the different failure mechanisms. This course will also benefit users of other condition monitoring techniques.

Duration
4 days

Course content

Maintenance strategies
• Maintenance strategies
• Condition-based monitoring

Lubrication theory and fundamentals
• Lubricant fundamentals
• Lubrication conditions
• Base oil and categories
• Additives and their functions
• Oil properties and classification
• Synthetic oil
• Grease lubrication
• Inadequate lubrication failures

Lubricant application
• Lubricant volume guidelines
• Re-lube and change frequencies
• Grease paths
• Lubricant and air systems

Lubricant storage and management

Lubricant condition control
• Solid contaminant control
• Filtration principles and technology
• Moisture contamination control
• Oil sampling
• Primary/secondary sample points
• Test port flushing

Lubricant health monitoring
• Lubricant failure mechanisms
• Anti-oxidants / oxidation inhibitors
• Thermal degradation
• Wrong or mixed lubricant
• Test methods and measurement units
• Viscosity
• TAN / TBN
• Water content
• Elemental analysis
• Fourier transform–infrared spectroscopy
• Particle quantifier index
• Particle count
• Gas chromatography
• Flash test
• Rotating pressure vessel oxidation test (RPVOT/RULER)

Wear debris monitoring and analysis

Report interpretation

Training assessment
Fundamentals of electric motor reliability

Course objective
The course objective is to provide an understanding of motor design, operation and failure and give a practical approach to selecting different variable/parameters that can be monitored and used to evaluate the motor condition and its performance to improve reliability. The focus will be mainly on using electrical parameters associated with induction motors as they are the most common drives in industrial applications.

Duration
2 days

Who should attend:
Service, maintenance, machine repair, or plant/facility engineering staff of an industrial plant, OEM facility, institution public utility or commercial building which uses electric motors.
- Managers and technicians at industrial plants and OEM facilities responsible for rotating machine performance and reliability.
- Rotating equipment engineers, reliability engineers, and maintenance supervisors.
- Those interested in electric motor performance.

Course description:
We use audio-visuals, lectures, hands-on training, and discussion opportunities during this course with real data and case studies used to support learning. Upon course completion, attendees will have gained the skills needed to choose, apply the appropriate electrical monitoring techniques to assess and improve electric motor reliability within the plant.

The course will be based on the following:
- Electric motor design and operation
- Motor role in an industrial plant
- Motor failure modes
- Motor condition and performance monitoring
- Condition assessment techniques summary
  1. Vibration analysis
  2. Infrared thermography
  3. Partial discharge analysis
  4. Motor current signature analysis
  5. Voltage/power quality analysis
  6. Torque monitoring
  7. Offline static electrical testing
- Case histories to demonstrate concepts and stimulate discussion
Work control processes

**WC230**

Spares optimisation and inventory control

**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

**Duration**

3 days

**Course content**

SKF spare part management and inventory optimisation training has been developed to support SKF customers (industrial end-users), improving their bottom line results. This course will consist of the following modules:

- Module 0: Introduction
- Module 1: Spare parts management (SPM)
- Module 2: Maintenance and spare parts strategy
- Module 3: MRO inventory management
- Module 3-A: MRO inventory management – Basics
- Module 3-B: MRO inventory management – work processes and CMMS
- Module 4: Obsolete management

**Case studies**

The purpose of the case studies is to provide participants with an opportunity to apply the gained knowledge and understanding in practice.

**Who should attend**

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

Proactive maintenance

**WE201**

Bearing maintenance and technology

**Course objective**

At the end of this course students will be able to perform routine bearing checks during operation and non-operation, identify bearing requirements for replacement or installation, and remove and install bearings.

**Duration**

2 days

**Course 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
WE202

Bearings in rotating machinery applications

Course objective
How to improve the service life of machinery with rotating equipment systems. It focuses on the most common rotating equipments such as motors, fans, pumps and gearboxes.

Duration
2 days

Course content
Part 1: Industrial motors
- Bearing arrangements
- Friction
- Sealed-for-life lubrication
- Shaft and housing fits
- Mounting and dismounting
- Troubleshooting

Part 2: Industrial pumps
- Bearing arrangements
- ANSI vs API design overview
- Pump bearings
- Cavitation
- Off-BEP operation
- Low bearing service life

Part 3: Industrial fans
- Bearing arrangements
- Controlling heat expansion
- Lubrication of fans
- Mounting and dismounting
- Grease selection: basics
- Case studies

Part 4: Industrial gearboxes
- Bearing arrangements

Who should attend
Application engineer, condition monitoring engineer / design engineer, maintenance engineer / manager / supervisor, quality engineer, reliability engineer / manager / supervisor.

WE203

Lubrication in rotating bearings

Course objective
At the end of this course, students will be able to:
- Understand the fundamentals of lubricant formulation and mechanisms
- Understand different types of lubricants
- Understand the need for the correct lubricant for the application – oil, grease or solid lubricant
- Understand how speed, temperature, load, influence the selection of the correct lubricant
- Understand why viscosity is important
- Awareness of the consequences of incorrect selection and application
- Understand how their actions can result in cost savings to their organisations due to enhanced lubrication practices

Duration
1 day

Course content
Principles of lubrication
- Lubrication regimes
- Importance of viscosity
- Additives – types and uses, including solid lubricants

Oil lubrication
- Base oil types
- Application methods – bath, circulation, ring-oil, splash, spray
- Oil change intervals

Grease lubrication
- Grease composition
- Thickener types and compatibility
- Consistency – NLGI
- Application methods – manual, automatic systems
- Relubrication intervals

Synthetic lubricants
- Effects of temperature, load, vibration and speed on lubricant selection
- Lubrication selection for bearings, gears, and industrial, vehicle and mining applications
- Bearing failure causes
- Lubrication software tools

Storage and handling of lubricants
- Oils and greases
- Contamination

Who should attend
Maintenance personnel and engineers responsible for bearing lubrication, lubricant specification and lubrication system planning and design.
Bearing damage analysis

Course objective
On completion 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.

Duration
1 day

Course content

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

Load path patterns in bearings
- Understand bearing operation
- Understand 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
- 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 can prevent a majority of problems and failures.

Who should attend
Service, maintenance, machine repair, or plant/facility engineering staff of an industrial plant, OEM facility, institution public utility or commercial building which uses rolling bearings and related equipment, Rotating equipment engineers, reliability engineers, millwrights, mechanics, and maintenance supervisors.

Renewables technician, automatic lubrication systems

Course objective
This course will explain the need for lubrication and how the lubricant is applied to wind turbine/renewable energy sources. The course is intended for apprentices, technicians, maintenance personnel and operations personnel who require some detail on how their system works. However, the course can be tailored to meet the needs of anyone involved with these machines.

Duration
1 day

Course content

Introduction to SKF Lubrication Business Unit
- What is available
- Products and systems

Why automatic lubrication is needed

Level 1: Course content Introduction

Hazards and safety precautions
- Automatic lubrication specific

Lubricant types and grades
- How this effects an automatic lubrication system
- Which ones are used

Applications on turbines/renewable
- Areas of the machines that lubrication can be found

Systems and components used
- Single line grease systems
- Progressive systems
- Multi line and circulating oil systems

System design and operation of individual components

System maintenance and fault finding
- what needs to be maintained and how to maintain it
- How to find and rectify system faults
Automatic lubrication systems

Level 1: Operators
Level 2: Technicians

Course objective
This course will explain the need for automatic lubrication systems and the various different types of system that are available. The course is intended for apprentices, technicians, maintenance personnel and operations personnel who require some detail on how their system works. However, the course can be tailored to meet the needs of anyone involved with the lubrication of machines.

The course will discuss the benefits of automatic lubrication, as well as system components, maintenance and troubleshooting the system. All optional components can be included in the 3 day course, 1 day per level, however, single components can be selected to tailor the course to your requirements and the duration will be amended accordingly.

Duration
3 days

Level 2: Course content Introduction

- What is available
- Products and systems

Why automatic lubrication is needed
- General overview of why lubrication is required
- How automatic lubrication helps this

Hazards and safety precautions
- Automatic lubrication specific

Lubricant types and grades
- How this effects an automatic lubrication system
- Which ones are used

Optional components
- Single line oil/grease systems
- Progressive oil/grease systems
- Dual line grease systems
- Multi-line grease systems
- Industry specific systems (such as food and beverage; chain and gear lubrication)
- Large and small circulating oil systems
- All of the above optional components will include operation, maintenance and fault finding
**WE240**

**Precision shaft alignment**

**Course objective**

**Reading material***
- Fixturlaser_01 Shaft Alignment: Introduction
- Fixturlaser_06 Shaft Alignment: Pre-Alignment

**Duration**

1 day

**Course content**

Up to 50% of this course consists of guided hands-on activities. It is suggested that participants bring their instruments to the course.

**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 condition
- 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**

- 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

**Who should attend**

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.

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**WE250**

**Balancing theory and practice**

**Course objective**

At the end of this course, students will be able to determine the most appropriate procedure to be applied to selected balancing situations, identify the main causes of unbalanced equipment, and understand the procedures for operating the balancing equipment.

- 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
- Understanding procedures for recording out of balance readings
- Learn methods of rigid and flexible rotation balancing
- Understanding techniques of single and multiple plane balancing
- Learn procedures for balancing imbalanced equipment

**Duration**

2 days

**Course content**

1 **Check balance**

- Principles of equipment balance testing are understood
- Most appropriate balancing check procedure is selected
- Component is set up correctly and to site/manufacturer’s procedure for balance check
- Balance/imbalanced is determined and compared to specification requirements
- Out of balance readings are recorded to prescribed procedures

2 **Balance equipment**

- Principles and methods of rigid and/or flexible rotation balancing are understood
- Techniques of single and/or multi-plane balancing are used appropriate to application
- Equipment is balanced utilising correct procedures
- Practical methods with basic instruments
- Examples of advanced techniques used by analysts
- Proactive and precision tolerances
- The effects of assembly on rotor balance

**Who should attend**

Application engineer, condition monitoring engineer, electrical engineer / fitter / manager / technician, engineering draftsman / manager / supervisor, mechanical maintenance engineer / lubrication fitter, operations manager / supervisor, planning manager, quality engineer, reliability engineer.
Engineering

LP200

Root cause analysis

Course objective

- Understand the importance of RCA in delivering internal services and its role in relation to other tools, notably vibration diagnostics, bearing failure diagnostics and maintenance strategy
- Become confident in building ‘why?’ trees and the 7 steps of a root cause study
- Be equipped with tools to assist in resolving complex problems and thinking laterally to fully explore possible causes of a problem

Duration

2 days

Course content

- Working from existing corporate information systems to capture events and incidents where RCA will be beneficial:
  - Machinery failures resulting in actual or potential loss of plant output
  - Machinery failure that represents large unbudgeted repair cost
  - Safety, health or environmental breaches
  - Repetitive failures that collectively represent an excessive maintenance cost
  - Non conformance in maintenance strategy
- Prioritise incidents and formally launch the RCA study by defining the problem
- Collect and preserve evidence to provide evidence on the incident
- Expose the causes of the incident by building a ‘why?’ tree. In general each incident will have three types of root cause:
  - Technical causes – the immediate technical cause of the failure
  - Human causes – actions or inactions that triggered the technical causes
  - Organisational causes – organisation factors that lie behind the human cause

The key elements of an RCA process discussed include

- Propose practical actions that will address the root cause of the incident and develop a business case for management approval of the resulting actions
- Following management approval, assign actions for implementation and track actions to completion
- Measure the performance of the RCA program through appropriate KPIs

Who should attend

Service, maintenance, machine repair, or plant/facility engineering staff of an industrial plant, or OEM facility

- Managers, technicians, rotating equipment engineers, reliability engineers, mechanics, and maintenance supervisors.
- Those interested in rolling bearing and rotating equipment performance.
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Trainers’ qualifications and competence
All training is tested where evidence of post-course knowledge can be used by the candidate as part of their portfolio of evidence of competence as required by the UK railway industry. Training is delivered by staff holding qualifications in education and competence assessment to national standards as mandated by the railway industry.

Training and assessment services
- Competence assessments in bearing related activities to industry standards
- Practical and theoretical training in bearing subjects to industry standards
- Bespoke training in bearing related examinations
- Training in bearing defects and examination techniques
- Quality audits of industry bearing facilities, products and services

Accreditations: ISO 9001-2000, ISO 14001, 18001 and IRIS.

Audited by major UK rail companies.

Railway bearing damage

Bearing defects and how to examine rolling bearings for defects
A one-day practical course where students are trained in the theory behind the causes of bearing defects and subsequent failure. Actual examples of bearings with defects are discussed, and the attendees are tested against the course booklet to confirm their knowledge and understanding of the subject. The test results can be used towards assessment of competence, as required by the railway industry for any staff engaged in safety critical work with as railway vehicle axle bearings. This course is of use to shop floor staff who actually overhaul bearing assemblies and have to understand the importance of lubrication, clearance and final checks when setting up a wheel set bearing assembly for railway service. Generally, this course is of use to wheelshop staff charged with the overhaul of wheelset components and the bearings associated with them. Each of the major wheelshops in the UK from Scotland down to Kent have requested SKF, an original equipment manufacturer, to run this training course for their staff. Feedback over the years has been excellent.

Bearing theory – Level 1
A mandatory one-day course as required by railway industry standard GM/RT 2030, covering similar subjects to the Level 2 course but in greater detail. This course is intended for use by shop floor staff who actually overhaul bearing assemblies and have to understand the importance of lubrication, clearance and final checks when setting up a wheel set bearing assembly for railway service. Generally, this course is of use to wheelshop staff charged with the overhaul of wheelset components and the bearings associated with them. Each of the major wheelshops in the UK from Scotland down to Kent have requested SKF, an original equipment manufacturer, to run this training course for their staff. Feedback over the years has been excellent.

Bearing theory – Level 2
A mandatory half-day course as required by railway industry standard GM/RT 2030. Aimed at maintenance staff who work around bearings and whose safety critical work requires them to have an appreciation of how their work can influence bearing operation under railway vehicles. Areas discussed include bearing nomenclature, storage and general handling guidelines, appreciation of bearing defects, the importance of correct lubrication and clearance supported by guidelines of what to look for in service to monitor the axle bearings on a vehicle. This course has been delivered to an estimated 1,000 students over the last ten years.
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SmartStart is an onsite startup service that focuses on a specific product and is designed to get that product up and running, your employees trained and your program implemented quickly and effectively. The training takes the form of coaching and mentoring rather than classroom instruction. The Instructor will offer guidance in applicable product and or database optimisation and functionality.
Condition-based maintenance

SKF Microlog Inspector

Course description
Course topics are organised according to the steps necessary to operate the product.

- Setup and utilise the MARLIN/Microlog Inspector Condition Detector (MCD) as a stand alone probe to monitor overall machinery and bearing vibration and temperature
- Installation and use of MARLIN/Microlog Inspector Quick Connect studs
- Set up and utilise the MARLIN/Microlog Inspector data manager to monitor and record machinery condition and plant process data
- Use the MARLIN/Microlog Inspector data manager to review data in the field
- Build a MARLIN/Microlog Inspector measurement database using SKF @ptitude

Duration
2 days

Analyst Inspector software
- Transfer data between SKF @ptitude Analyst Inspector and the MARLIN/Microlog Inspector data manager
- Display and generate trends and reports SKF continues to add new MARLIN/Microlog Inspector hardware and software platforms. The SmartStart program will be tailored to match customer specific systems and requirements.

WICM 264 AX / WICM 265 GX Series Microlog

Course description
Course topics are organised according to the steps necessary to set up a portable monitoring system and to operate the SKF Microlog AX/ GX SKF @ptitude Analyst software product.

Duration
2 days

Condition monitoring training topics
- Condition-based maintenance program overview
- guidelines for implementing a portable condition monitoring Program – practical guidelines for implementing a portable condition monitoring program
- Introduction to vibration analysis – discuss the advantages of various vibration signal processing techniques to isolate and detect specific machinery faults (e.g., acceleration enveloping signal processing for early detection of bearing faults)

SKF product training topics
- Set up default properties on the SKF @ptitude Analyst software
- Learn to navigate the software using its menus, dialogs, windows, hierarchy, terminology and workspaces,
- How to create a database of vibration measurements
- Download and upload measurements between SKF software and the AX/GX Microlog data collection device
- How to set up default properties in the AX/GX Microlog
- How to operate the AX/GX Microlog data collector/analysers to collect both route and off-route measurements
- Generate graphic plots and reports for analysing measured machinery condition (both software and AX/GX Microlog)
- Advanced AX/GX Microlog application modules, multiple channel measurements, FRF measurements and balancing.
SKF training courses are based on over 100 years of experience and knowledge of rotating equipment performance that is unmatched in the world.

We have established close working partnerships with our clients. As a result, we have gained a unique insight into the processes and challenges that every major industry faces today.

We would like to extend our congratulations to you in making an important business decision – that is, to invest in training for your employees. We wish you an enjoyable learning experience!