

Rotating Machinery Health and Reliability Excellence

This is a sample of slides and notes from day 2 of this course. For more samples and info please see ...

http://www.feedforward.com.au/Powerpoints/Reliability/machinery_reliability_Excellence.htm



FEEDFORWARD.COM.AU

Welcome to this course on setting-up rotating machines and equipment for a long, trouble-free operating life. The course is divided into an introduction stage and an advanced stage. During the course you will cover, and come to better appreciate, the important issues for achieving Rotating Equipment (RE) reliability. Much of our industrial machinery rotates, it uses bearings and lubrication, and is mounted onto a supporting structure. What you learn in the course to improve rotating equipment performance can be transferred and applied to all of them.




The course is brought to you by Mike Sondalini of Lifetime Reliability Solutions. Mike is an Australian equipment maintenance and reliability growth specialist who works around the world to help people and companies get outstanding reliability from their plant and equipment. His philosophy is to impart the knowledge and understanding needed to so look after all rotating equipment. Instead of focusing on specific equipment problems he provides an explanation and education that is the foundation for all rotating equipment health. To download complete 4 day course powerpoints, please see ...

http://www.feedforward.com.au/Powerpoints/Reliability/machinery_reliability_Excellence.htm

Today 2 Topics

- Rotor Balance, Balancing Standards
- Shaft Alignment, Shaft Alignment Accuracy
- RE Vibration, Vibration Standards
- Condition Monitoring of RE
- Maintenance Strategies for RE

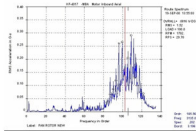
During the second day the issues listed in the slide will be covered in some detail. To complete the Introductory course, we need to touch on the full range of topics affecting RE reliability and maintenance. This allows those people only doing the Introduction days to get exposed to all the major factors they need to be aware of in order to improve their plant and equipment.

Those people going onto the Advanced Course will get greater detail in those topics again covered in the Advanced  days.

6 Mechanical Equipment Care Standards to Set, Use and Keep Using

These are the BIG 6 that maintenance can control.

Vibration:



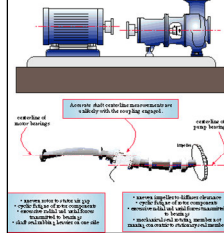
Fastener Torque:



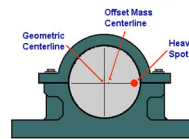
Lubricant Cleanliness:



Deformation:

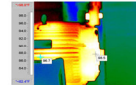


Balancing:

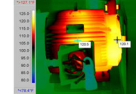


Alignment:

IR Image After Alignment



IR Image Before Alignment

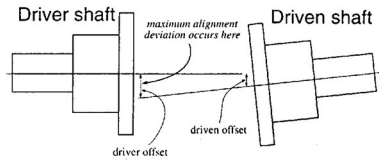


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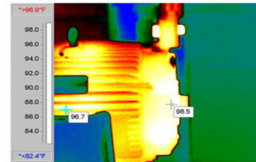
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When it comes to rotating mechanical equipment the 6 critical standards listed in the slide must be set and kept. It is necessary to spend the effort in researching and specifying them for your operation. Once they are determined, communicate them to the engineering and maintenance staff company-wide. Start using them in all situations, and for all subcontractors. Write them into your ACE 3T procedures. If necessary buy, or subcontract with providers, whatever equipment is required to meet them and train your people in how to achieve the standards in everything they do. If you want top class reliability from rotating mechanical equipment you have no choice but to get very, very good at continually meeting those standards.

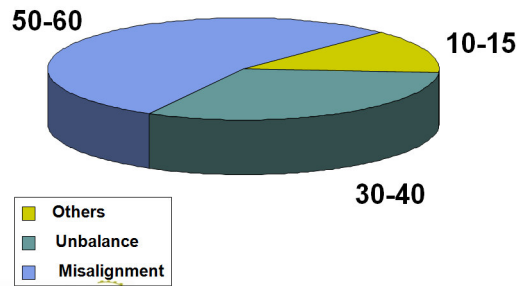
Effects of Shaft Misalignment



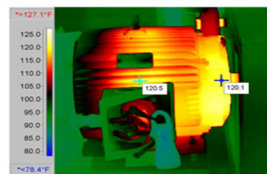
IR Image After Alignment



Major Sources of Vibration



IR Image Before Alignment



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Misalignment is single greatest source of machine vibration shown on the pie chart. Its impact is dramatically shown in the two thermographic images of the temperature of an electric motor housing before and after shaft alignment. The 30C degree temperature drop represents several years of additional trouble-free operating life for the motor.



Wear Particle Analysis

- Oil Wear Debris Analysis looks at the nature of foreign particles in the oil sample

- Particle Count: ISO 4406 Standard for oil cleanliness sets out the procedure
- Filtergram: passing the sample through a paper filter
- Ferrography: passing the sample over a magnetic field
- Wear Particle Analysis: a labour intensive process of microscopically identifying the nature of particles in filtergrams or ferrography



Caterpillar 785 Haul Truck Bearing Failure
Magnetic Plug from 785 Haul Truck
Left Rear Final Drive
4,412 operating hours on final drive
48,048 operating hours on truck
ISO 21/20/18



Magnetic drain plug used for warning of impending failure

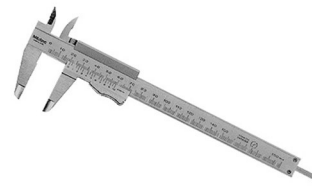
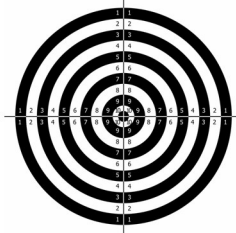
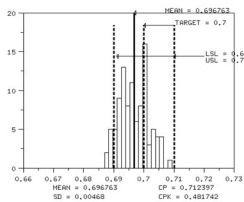
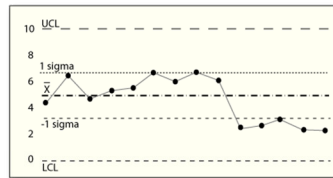
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The slide makes clear what wear particle analysis is all about. The particles are counted per ISO 4406 and microscopically examined for indications of their origin, and the method of destruction that removed them from the part where they originated.



Use Visual Management for Feed Forward Control of Performance

Imbed measurement actions in your maintenance SOPs. Use sensory information to identify the effects of an activity so you know exactly what is happening and can make suitable corrections.



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Confirming a result is suitable by use of sight is known as the 'visual control' method. Visual control measures give immediate feedback on whether we are getting the right result. At the traffic lights we know if we are going to make the lights in time or not. The pilot landing a plane can line-up with the centre line and lights to know the plane is in the middle of the runway. The kick for goal either went between the posts or it missed, there is no question about it. By converting into visual control measures it becomes possible for anyone and everyone to know if a thing is being done right. It means a manager or supervisor can immediately see for themselves how well the work is being done. It lets people check themselves with certainty that requirements are being met. Visual controls clearly indicate whether they made the target or not.