

Bearing Sensor News

Monthly Journal of Information Technology



This Issue

- Temperature & Lubricant P.1
- Monitoring Conditions P.2
- Studying Temperature P.3
 - 4 stages
 - Methodology

Bearing Sensor Temperature and Performance

Manufactures of Bearings have long been aware of the association of heat to bearing life and have designed formulas to precisely calculate temperature to safely operate. Operating with the least amount of stress, while not having to sacrifice performance is the goal. The illustration below shows ideal temperature for both lubricants and bearings to operate with optimal performance. Once they stray from the ideal range, the result will be acceleration in the wear down of the bearing. Below you will find some methods for determining bearing health and life expectancy, both in the plant and in the field based off temperature.

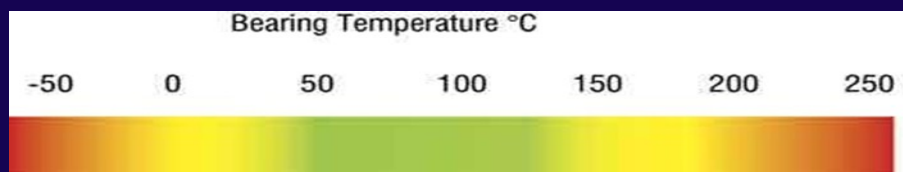


Figure 1. Heat Ranges of Bearings¹

Above shows the thermal range of a typical rolling element bearing. Keep in mind that bearing metal temperature is often 10 to 25 degrees Celsius higher than the temperature of the lubricating oil in the bearing within an oil circulation system. The green zone signifies the target point for bearing and lubrication temperature. Operating in the yellow zone reduces lubricant and bearing life; and if your bearings are in the red zone, expect both the bearing and the lubricant to be destroyed rapidly.

There are different temperature bands for different combinations of bearing and lubricant, but they will have the same general trend regarding the best operating temperature and its effect on accelerated wear and failure. In most standard lubricants, for every 15°C increase in temperature above 70°C, the lubricant life is more than halved and there is a negative effect on bearing life. Any mineral oil operating at a temperature above 80°C or 90°C will have a greatly diminished life. In no case should bearing temperature ever exceed the maximum rating of either the bearing or the lubricant.

SOLUTIONS

- Supplied in multiple case styles.
- Custom designs on request.
- RTD and Thermocouple types available.
- Thin film element.
- Fast response time.
- Pass throughs, elastomer fill and accessories.
- Miniature size from 0.083" in diameter and 0.30" in length.
- Temperature Range: -50 °C to +260 °C.
- Optional protective stainless steel overbraid.
- Available with spring loaded mounting and retaining washer.
- Vibration Resistant.
- Assembled with high temperature epoxy resin.
- Moisture resistant.

Bearing Sensor Temperature and Performance

Monitoring Bearing Conditions

Machine bearings are generally monitored through vibration and oil analysis, along with specific ultrasound techniques. Through the use of these steps it is now possible to link current data to historical data, and accurately assess the life span of the bearings. An increase in temperature is not always due to increased friction and typically it is not even considered a bearing failure in many bearing analysis texts² until Stage 3 bearing failure occurs.

Since temperature is such a dependable method of bearing life prediction, then why is it consistently ignored until the bearing has failed? The monitoring of temperatures with thermography has been considered unreliable due to many variables such as ambient temperature, speed, load and runtime. All of these factors have a noticeable influence on the bearings overall temperature. This compares two similar bearings on the same shaft which cancels the effects of these variables because they are common to both bearings. The remaining temperature difference between the two bearings on the same common shaft with the same load can only be the result of friction, an indicator that there is a problem with the bearing.

Subtle changes are unseen because there are many variables that can potentially contribute to the temperature of the bearing. In addition to friction, other factors that contribute to temperature variation are load, speed, ambient environment temperature, and runtime duration. If such conditions could be predicted and accounted for accurately, then increases in temperature would consistently indicate bearing problems.

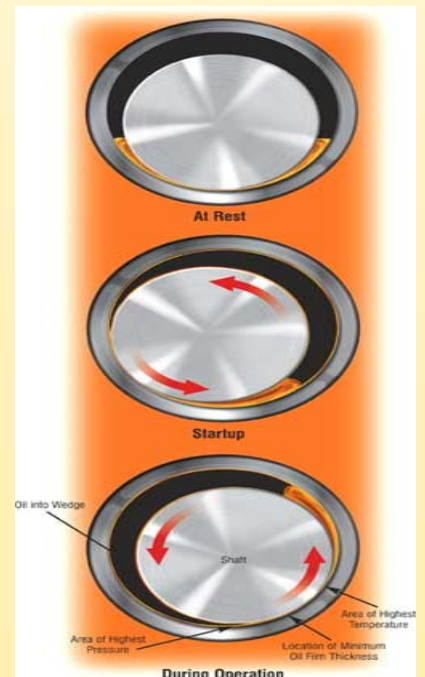
Vibration analysis and oil analysis are considered to be the two best ways to determine bearing health. Unfortunately, it is not always possible or affordable to use these methods in hostile production environments. Any uncommon environments where technicians cannot easily access the machine without taking it offline, or cannot access the machine due to hazardous conditions

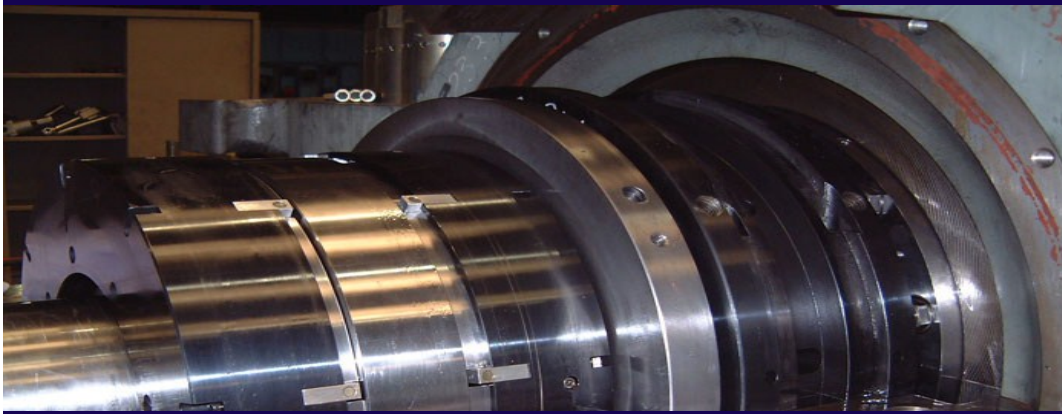


Management Success

Avoid costly plant shut downs with our express manufacturing service. We stock an inventory of components to manufacture babbit bearing sensors for high and moderate temperature service. Top hat, small profile bearing cap, and double oil seal configurations are routinely assembled with Nickel 120 ohm, Pt 100 ohm and thermocouples.

With our 35 years experience and manufacturing facility on the West Coast, the days of waiting a week or two for delivery of critically needed embedded sensors are Over!





Studying Temperatures

If bearing temperature changes due to maintenance-related problems it should be isolated from all the other factors that contribute to bearing heat. When monitoring the temperature of bearings there are 4 stages of bearing failure. Listed below are the 4 stages of bearing failure.

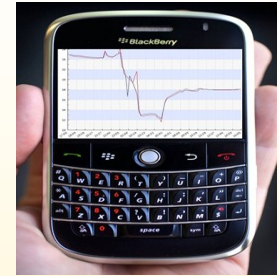
A properly designed monitoring device should detect bearing failure by Stage 2. Currently there is a new monitoring technique that is being evaluated that would significantly benefit industries that need to analyze bearing and lubrication life in difficult-to-reach areas. The heart of the patent is a technique that cancels all thermal variables except the increase in bearing temperature due to wear or lubrication failure.

The new procedure takes heat data from each bearing on a common shaft and compares the data. Because the load, speed, ambient temperature, and run duration are common to all the bearings common to the shaft, their effects on temperature cancel out. Any recorded temperature variation is the result of unwanted maintenance- or repair-related conditions such as over- or under lubrication, bearing damage, misalignment, or loose-foot condition. If one bearing is more than 15°C greater than another on the same shaft, the bearing health is in question and the cause of the increased bearing temperature must be determined. The bearing comparison is accomplished with electronic temperature sensors and comparators powered by a self-contained power supply that recharges its battery through the motion of the equipment.

EYE ON IT

Current Industry Trends

WIRELESS TEMPERATURE



Thermometrics now has the ability to offer customers wireless temperature monitoring and data logging systems.

Customers now have the ability to view temperature readouts on any windows mobile or xp wifi device and receive alerts when temperatures move beyond their constraints. This gives you the ability to monitor your temperature sensors from anywhere in world that you have internet access.



Four Stages Of Bearing Failure

Stage 1: Earliest detectable indication of bearing failure is done using vibration analysis. Signals appear in the ultrasonic frequency bands around 250 KHz to 350 KHz. At this point, there is approximately 10 to 20 percent remaining bearing life.

Stage 2: Bearing failure begins to "ring" at its natural frequency; (500 to 2,000 Hz) and the signal appears at the first harmonic bearing frequency. At this point, there is approximately 5 to 10 percent remaining bearing life.

Stage 3: Bearing failure harmonics of the fundamental frequency are now apparent. Defects in the inner and outer race are now apparent and visible on vibration analysis of the noise signal. Temperature increase is now apparent. At this point, there is approximately 1 to 5 percent of remaining bearing life.

Stage 4: Bearing failure is indicated by high vibration. The fundamental and harmonics begin to actually decrease, random ultrasonic noise greatly increases, and the temperature increases rapidly. At this point, there is approximately one hour to one percent remaining bearing life.



Thermometrics values the enhancement of product performance and its quality. For us, after sales services are just part of our mission, as our services begin immediately on the knowing of our customers requirements. We do our best to understand exact need, based on process parameters and what can suite the process best and the customers pocket as well. Thermometrics experienced sales and engineering staff are available to assist you in finding the best way to measure temperature in your equipment.

The Methodology Involves The Following..

- Temperature sensors are attached in close proximity to all the bearings on a common shaft or axle.
- The sensors apply input to a sensing unit that is self-contained and has wireless technology for communication with warning devices.
- The temperature data of each unit is analyzed and compared electronically.
- If any bearing temperature varies more than 15°C, an alarm is transmitted and an LED indicator will light.
- The system is self-powered by a small power supply which is actuated by the movement of the equipment.

**This technique will never be as accurate as oil or vibration analysis, but in remote or hazardous locations where these tools are not an option, it will provide an increased level of condition monitoring that was not available in the past.*



18714 Parthenia St.
Northridge, CA 91324

818.886.3755 ph
818.772.7690 fax

WWW.THERMOMETRICSCORP.COM
WWW.BEARINGSSENSORS.COM
WWW.TEMPERATUREDEVICES.COM