BEARING SPECIALISTS ASSOCIATION

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- Bearing Installation & Fitting
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- Vibration Analysis
- Wear Sleeves and Other Shaft Repair Options
- Planetary Roller Screws
- Bearings for the Food & Beverage Industry
- Split Roller Bearing Technology
- Bearing Mounting Tools

BEARING INDUSTRY INFORMATION

- Bearing Standards Organizations
- Brief History of Bearings
- The Domestic Bearing Industry: Investing in the Future
- History of Adhesives
- Load Ratings & Bearing Life
- Status of Bearing Load Ratings

BEARING BRIEFS

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Vibration Analysis

Finding Problems with Bearings and Rotating Equipment Using Vibration Analysis

Bearings with rolling elements generate several frequencies which can be calculated and detected if you know the physical dimensions of the bearings and the R. P. M. at which they are running. These frequencies can be recorded with an accelerometer and a spectrum analyzer.

Many companies sell equipment and software for trending of these data. When there is a difference from bearing fault frequencies, a person experienced in reading these printed charts and trends can predict when a bearing may fail.

Four Stages in Bearing Failure Are Detected with Vibration Analysis

1. The first stage (normal operation) appears at ultrasonic frequencies from about 1,200K to 3,600K CPM (cycles per minute). At this point the frequencies are evaluated by Spike Energy and Shock pulse instruments which listen to these frequencies. Trending this information can tell a person if there is a change or not.

2. The second stage of bearing failure defects begin to ring bearing components natural frequencies, which are picked up with a spectrum analyzer in the middle of the spectrum, 3OK-12OK CPM.

3. In the third stage of failure, bearing defect frequencies and harmonics appear on the spectrum as bearing defect frequencies. At this time if you remove the bearing, you can see the defects in the rolling elements.

4. Stage four appears toward the end of bearing life. It shows up as random high frequency vibration spikes on the spectrum, all running together. With vibration analysis, many other problems with rotating equipment can be diagnosed without taking equipment out of service. This can save hours of downtime and thousands of dollars.

BSA, 800 Roosevelt Rd, Bldg C-312, Glen Ellyn, IL 60137 **www.bsahome.org**

MRC Ball Bearing Vibration Data

Frequency – as related to vibration – is the number of times an impact occurs during a specific period. Frequency is measured in Hertz (cycles per second) and CPM (Cycles Per Minute).

1 Hz = 60 CPM
Predominant Frequencies generated by bearings are:

BPFO	Bearing Outer Race Frequency
BPFI	Bearing Inner Race Frequency
BSF	Ball Spin Frequency Rolling Elements
FTF	Fundamental Train Frequency

These frequencies and multiples of these frequencies show up as spikes on a vibration analysis spectrum when bearings begin to fail.

Using the MRC Ball Bearing Vibration Data

All data are based on 1 RPM (Revolutions Per Minute). If a machine is running 1800 RPM, you would multiply 1800 by the frequency in the chart to get BPFO, BPFI and BSF in Hertz. To convert these into CPM you must multiply your answer by 60.

For Example:
Bearing Size 100KR running at 1800 RPM

BPFO = .0497
.0497 X 1800 RPM = 89.46 Hz
89.46 Hz x 60 = 5367.6 CPM

BPFI = .0836
.0836 X 1800 RPM = 150.48 Hz
150.48 Hz x 60 = 9028.8 CPM

BSF = .0295
.0295 X 1800 RPM = 53.1 Hz
53.1 Hz x 60 = 3186 CPM

When looking for defects in a 100 KR bearing running at 1800 RPM, we would look for spikes in the spectrum at 5367.6 CPM, 9028.8 CPM, and 3186 CPM. We would also look at multiples of these frequencies up to the number of balls in the bearings.

The Educational Services Committee acknowledges with appreciation the contributions of Thomas A. Brown, Applied Industrial Technologies — ABC, in compiling this report.