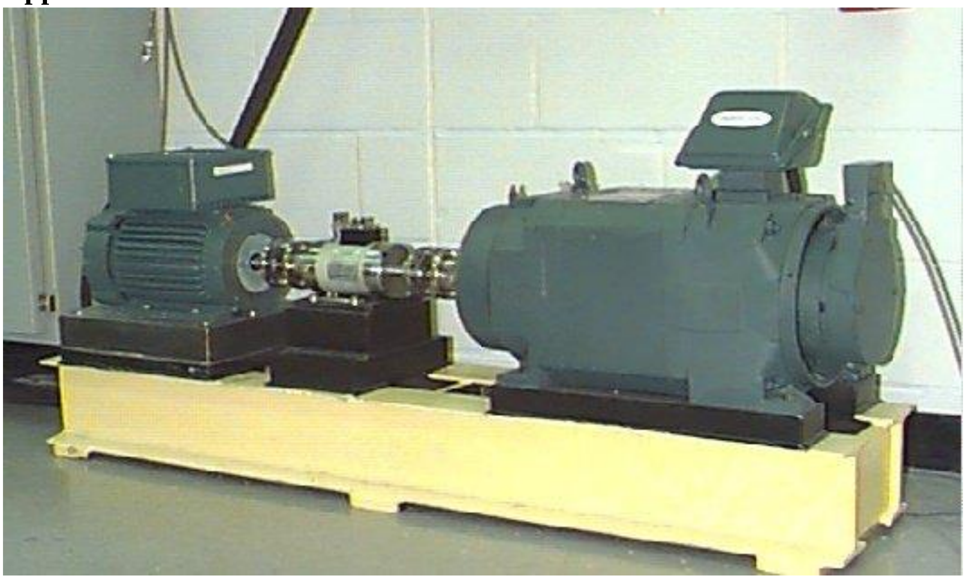
Welcome to the Case Western Reserve University Bearing Data Center Website

This website provides access to ball bearing test data for normal and faulty bearings. Experiments were conducted using a 2 hp Reliance Electric motor, and acceleration data was measured at locations near to and remote from the motor bearings. These web pages are unique in that the actual test conditions of the motor as well as the bearing fault status have been carefully documented for each experiment.

Motor bearings were seeded with faults using electro-discharge machining (EDM). Faults ranging from 0.007 inches in diameter to 0.040 inches in diameter were introduced separately at the inner raceway, rolling element (i.e. ball) and outer raceway. Faulted bearings were reinstalled into the test motor and vibration data was recorded for motor loads of 0 to 3 horsepower (motor speeds of 1797 to 1720 RPM).

Apparatus & Procedures



As shown in **Figure 1** above, the test stand consists of a 2 hp motor (left), a torque transducer/encoder (center), a dynamometer (right), and control electronics (not shown). The test bearings support the motor shaft. Single point faults were introduced to the test bearings using electro-discharge machining with fault diameters of 7 mils, 14 mils, 21 mils, 28 mils, and 40 mils (1 mil=0.001 inches). See **FAULT SPECIFICATIONS** for fault depths. SKF bearings were used for the 7, 14 and 21 mils diameter faults, and NTN equivalent bearings were used for the 28 mil and 40 mil faults. Drive end and fan end bearing specifications, including bearing geometry and defect frequencies are listed in the **BEARING SPECIFICATIONS**.

Vibration data was collected using accelerometers, which were attached to the housing with magnetic bases. Accelerometers were placed at the 12 o'clock position at both the drive end and fan end of the motor housing. During some experiments, an accelerometer was attached to the motor supporting base plate as well. Vibration signals were collected using a 16 channel DAT recorder, and were post processed in a Matlab environment. All data files are in Matlab (*.mat) format. Digital data was collected at 12,000 samples per second, and data was also collected at 48,000 samples per second for drive end bearing faults. Speed and horsepower data were collected using the torque transducer/encoder and were recorded by hand.

Outer raceway faults are stationary faults, therefore placement of the fault relative to the load zone of the bearing has a direct impact on the vibration response of the motor/bearing system. In order to quantify this effect, experiments were conducted for both fan and drive end bearings with outer raceway faults located at 3 o'clock (directly in the load zone), at 6 o'clock (orthogonal to the load zone), and at 12 o'clock

Fault Specifications

Bearing	**Fault Location**	**Diameter**	**Depth**	**Bearing Manufacturer**
Drive End	Inner Raceway	.007	.011	SKF
Drive End	Inner Raceway	.014	.011	SKF
Drive End	Inner Raceway	.021	.011	SKF
Drive End	Inner Raceway	.028	.050	NTN
Drive End	Outer Raceway	.007	.011	SKF
Drive End	Outer Raceway	.014	.011	SKF
Drive End	Outer Raceway	.021	.011	SKF
Drive End	Outer Raceway	.040	.050	NTN
Drive End	Ball	.007	.011	SKF
Drive End	Ball	.014	.011	SKF
Drive End	Ball	.021	.011	SKF
Drive End	Ball	.028	.150	NTN
Fan End	Inner Raceway	.007	.011	SKF
Fan End	Inner Raceway	.014	.011	SKF
Fan End	Inner Raceway	.021	.011	SKF
Fan End	Outer Raceway	.007	.011	SKF
Fan End	Outer Raceway	.014	.011	SKF
Fan End	Outer Raceway	.021	.011	SKF
Fan End	Ball	.007	.011	SKF
Fan End	Ball	.014	.011	SKF
Fan End	Ball	.021	.011	SKF

(All dimensions in inches)

Bearing Information

Drive end bearing: 6205-2RS JEM SKF, deep groove ball bearing

Size: (inches)

Inside Diameter	**Outside Diameter**	**Thickness**	**Ball Diameter**	**Pitch Diameter**
0.9843	2.0472	0.5906	0.3126	1.537

Defect frequencies: (multiple of running speed **in Hz**)

Inner Ring	Outer Ring	Cage Train	Rolling Element
5.4152	3.5848	0.39828	4.7135

Fan end bearing: 6203-2RS JEM SKF, deep groove ball bearing

Size: (inches)

Inside Diameter	Outside Diameter	Thickness	Ball Diameter	Pitch Diameter
0.6693	1.5748	0.4724	0.2656	1.122

Defect frequencies: (multiple of running speed **in Hz**)

Inner Ring	Outer Ring	Cage Train	Rolling Element
4.9469	3.0530	0.3817	3.9874

Download a Data File

Data was collected for normal bearings, single-point drive end and fan end defects. Data was collected at 12,000 samples/second and at 48,000 samples/second for drive end bearing experiments. All fan end bearing data was collected at 12,000 samples/second.

Data files are in **Matlab** format. Each file contains fan and drive end vibration data as well as motor rotational speed. For all files, the following item in the variable name indicates:

DE - drive end accelerometer data
FE - fan end accelerometer data
BA - base accelerometer data
time - time series data
RPM - rpm during testing

Click on a link below to continue:

Normal Baseline Data

12k Drive End Bearing Fault Data

48k Drive End Bearing Fault Data

Fan-End Bearing Fault Data

Normal Baseline Data

Motor Load (HP)	Approx. Motor Speed (rpm)	Normal Baseline Data
0	1797	Normal_0
1	1772	Normal_1
2	1750	Normal_2
3	1730	Normal_3

12k Drive End Bearing Fault Data
* = Data not available

Fault Diameter	Motor Load (HP)	Approx. Motor Speed (rpm)	Inner Race	Ball	Outer Race Position Relative to Load Zone (Load Zone Centered at 6:00)		
					Centered @6:00	Orthogonal @3:00	Opposite @12:00
0.007"	0	1797	IR007_0	B007_0	OR007@6_0	OR007@3_0	OR007@12_0
	1	1772	IR007_1	B007_1	OR007@6_1	OR007@3_1	OR007@12_1
	2	1750	IR007_2	B007_2	OR007@6_2	OR007@3_2	OR007@12_2
	3	1730	IR007_3	B007_3	OR007@6_3	OR007@3_3	OR007@12_3
0.014"	0	1797	IR014_0	B014_0	OR014@6_0	*	*
	1	1772	IR014_1	B014_1	OR014@6_1	*	*
	2	1750	IR014_2	B014_2	OR014@6_2	*	*
	3	1730	IR014_3	B014_3	OR014@6_3	*	*
0.021"	0	1797	IR021_0	B021_0	OR021@6_0	OR021@3_0	OR021@12_0
	1	1772	IR021_1	B021_1	OR021@6_1	OR021@3_1	OR021@12_1
	2	1750	IR021_2	B021_2	OR021@6_2	OR021@3_2	OR021@12_2
	3	1730	IR021_3	B021_3	OR021@6_3	OR021@3_3	OR021@12_3
0.028"	0	1797	IR028_0	B028_0	*	*	*
	1	1772	IR028_1	B028_1	*	*	*
	2	1750	IR028_2	B028_2	*	*	*
	3	1730	IR028_3	B028_3	*	*	*

48k Drive End Bearing Fault Data

Fault Diameter	Motor Load (HP)	Approx. Motor Speed (rpm)	Inner Race	Ball	Outer Race Position Relative to Load Zone (Load Zone Centered at 6:00)		
					Centered @6:00	Orthogonal @3:00	Opposite @12:00
0.007"	0	1797	IR007_0	B007_0	OR007@6_0	OR007@3_0	OR007@12_0
	1	1772	IR007_1	B007_1	OR007@6_1	OR007@3_1	OR007@12_1
	2	1750	IR007_2	B007_2	OR007@6_2	OR007@3_2	OR007@12_2
	3	1730	IR007_3	B007_3	OR007@6_3	OR007@3_3	OR007@12_3
0.014"	0	1797	IR014_0	B014_0	OR014@6_0	*	*
	1	1772	IR014_1	B014_1	OR014@6_1	*	*
	2	1750	IR014_2	B014_2	OR014@6_2	*	*
	3	1730	IR014_3	B014_3	OR014@6_3	*	*
0.021"	0	1797	IR021_0	B021_0	OR021@6_0	OR021@3_0	OR021@12_0
	1	1772	IR021_1	B021_1	OR021@6_1	OR021@3_1	OR021@12_1
	2	1750	IR021_2	B021_2	OR021@6_2	OR021@3_2	OR021@12_2
	3	1730	IR021_3	B021_3	OR021@6_3	OR021@3_3	OR021@12_3

12k Fan End Bearing Fault Data

* = Data not available

Fault Diameter	Motor Load (HP)	Approx. Motor Speed (rpm)	Inner Race	Ball	Outer Race Position Relative to Load Zone (Load Zone Centered at 6:00)		
					Centered @6:00	Orthogonal @3:00	Opposite @12:00
0.007"	0	1797	IR007_0	B007_0	OR007@6_0	OR007@3_0	OR007@12_0
	1	1772	IR007_1	B007_1	OR007@6_1	OR007@3_1	OR007@12_1
	2	1750	IR007_2	B007_2	OR007@6_2	OR007@3_2	OR007@12_2
	3	1730	IR007_3	B007_3	OR007@6_3	OR007@3_3	OR007@12_3
0.014"	0	1797	IR014_0	B014_0	OR014@6_0	OR014@3_0	*
	1	1772	IR014_1	B014_1	*	OR014@3_1	*
	2	1750	IR014_2	B014_2	*	OR014@3_2	*
	3	1730	IR014_3	B014_3	*	OR014@3_3	*
0.021"	0	1797	IR021_0	B021_0	OR021@6_0	*	*
	1	1772	IR021_1	B021_1	*	OR021@3_1	*
	2	1750	IR021_2	B021_2	*	OR021@3_2	*
	3	1730	IR021_3	B021_3	*	OR021@3_3	*