Chiller Motor with Audible Harmonic Drone has easily Diagnosed Root Cause

Suncoast Electric Motor Service in Tampa, Florida provides PMP service to numerous customers with a variety of needs. Pat Bannar, Suncoast's President, uses Baker Instrument Company, an SKF Group Company's test equipment exclusively and utilizes the Explorer as a major part of his PM programs. Mr. Bannar and his staff have established numerous PMP programs for utility companies, marine customers and various industrial clients. During the past five years, using the Baker Explorer, Suncoast has located countless situations where poorly performing motors were costing customers unnecessary expenses due to improper sizing, inefficiency, internal problems and poor performance. Following is a case study that is an example of the potential usefulness of dynamic testing. This case study has been documented and the results have been verified.

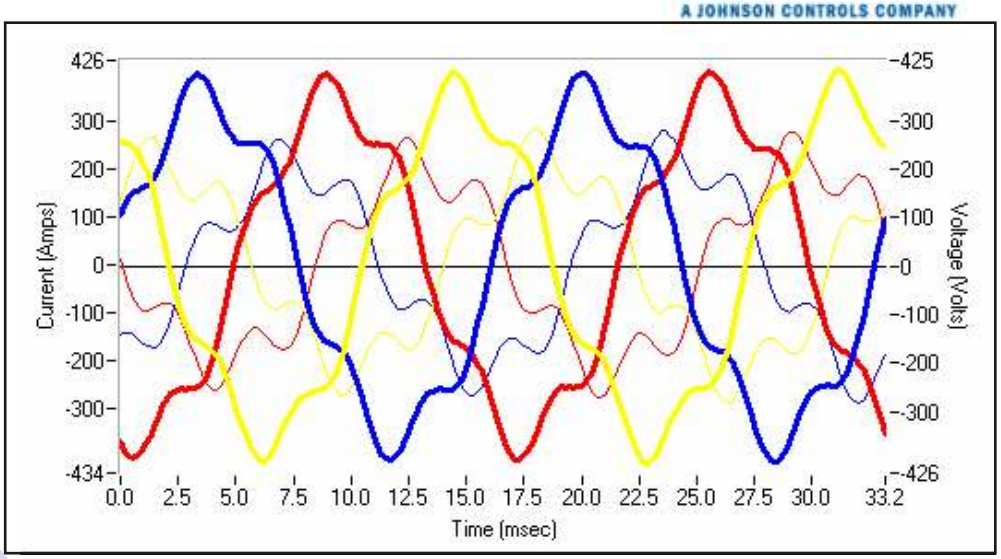

Figure 1

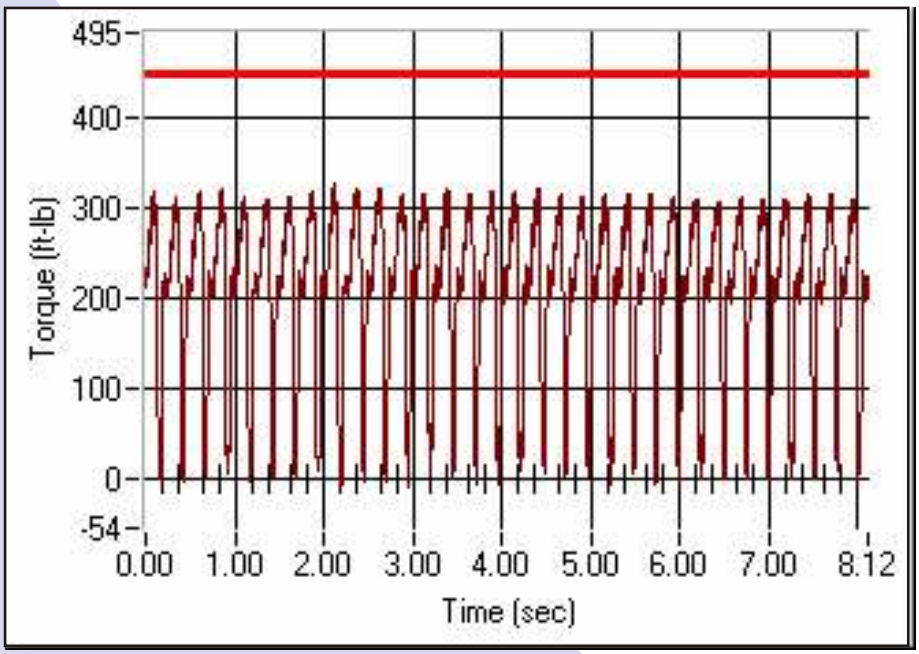

Figure 2

Case Study

A 400 horsepower, 460 volt York chiller motor, operating on a York soft-start had developed an audible harmonic drone and a physical pulsating vibration. York technician, Mr. Herb Brown, a 26 year veteran had diagnosed the problem as a bad bearing within the chiller, a problem he had encountered numerous times. He estimated the time to separate the unit, replace the bearing, recondition the motor, reassemble the unit and return it to operation would be two weeks at a cost of over $4,500.00. Suncoast was called in to verify the cause of the recent change in the motors performance and they performed a vibration analysis on the unit. The collected data did not appear to identify any problem area and the results were inconclusive at best. He then performed dynamic testing with the Explorer and the collected data showed the following graphs.

Figure 1 shows the voltage and current time-wave-forms for the three phases, (a-red, b-blue, c-yellow). The voltage traces are the thicker lines and the currents are the thinner lines. The figure's voltage waveforms show extremely large harmonics, which are the reason for the current's harmonics and the humming plus vibrations. Figure 2 shows the torque time-wave-form in the brown trace, and the nameplate calculated torque is the displayed red trace. This torque signature shows oscillations of relatively low frequencies, varying between zero and 75% torque four times every second.

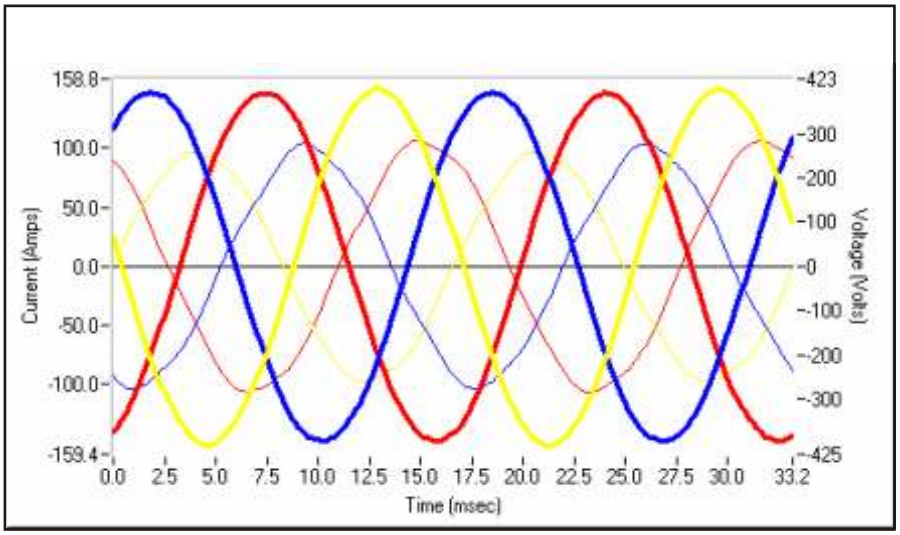

Figure 3

After seeing the erratic sine waves Mr. Ron Larson, York's drive specialist was brought in and he immediately identified the problem as a faulty comparator card in the soft start. Mr. Larson replaced the card and the motor was again returned to operation. The audible harmonic drone and the physical pulsations were gone. New data was collected and the following graphs were recorded which appear to show normal operation.

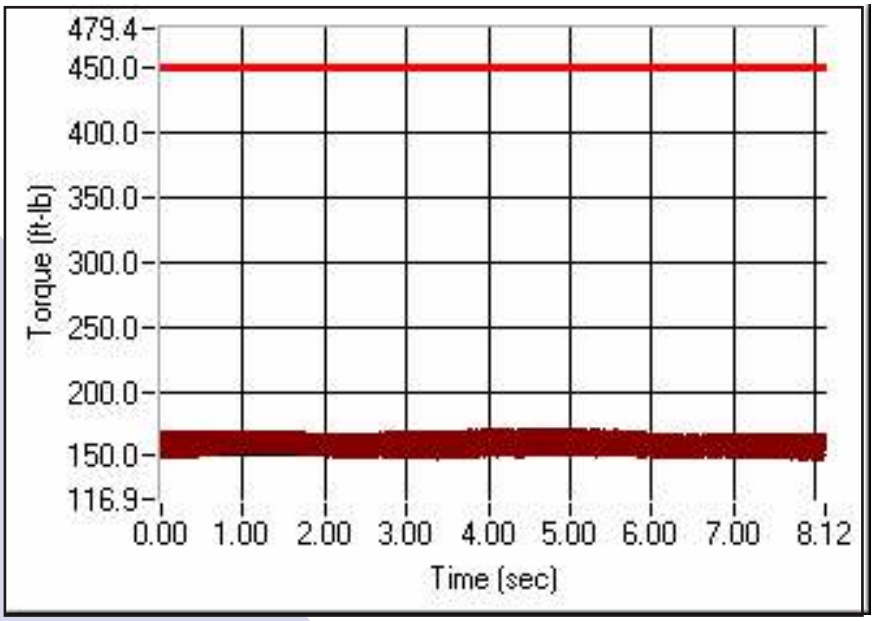

Figure 4

Figures 3 and 4 show the electrical and mechanical time wave forms respectively. The extreme voltage harmonics, which were causing the current harmonics, are gone. Note that the torque ripple of the healthy operation is extremely smooth. Now, the maximum torque pulled in steady-state is literally half of what used to be the peaking, cyclic loading to the motor. Neither the motor nor the chiller is prematurely aging any longer.

Conclusion

The faulty card cost the customer less than $200.00 and the motor was restored to a normal operating mode in minutes instead of weeks. The customer's savings were far greater than his test and repair costs and both York and this customer have realized the value of dynamic testing and the Explorer.