Application Note: MINIMIZING MOTOR SHAFT BEARING CURRENT

Please refer also to the Inverter Instruction Manual

AN082604-1

Hitachi Industrial Equipment & Solutions America, LLC

MINIMIZING MOTOR SHAFT BEARING CURRENT

Overview

One cause of premature bearing failure is so-called “electrical discharge machining.” This problem has been around for many years. Current takes the path with the least resistance which is sometimes through the motor bearings. The current concentrates near the contact points and can cause pitting, fluting and other damage. The bearing’s lubrication also plays an important role in determining the path of current flow and the extent of bearing damage that may occur.

All electrically driven rotating machines generate some level of AC and/or DC shaft voltages, but they are generally insignificant. AC induction motors are no exception, and when driven by PWM type AC inverters, the problem becomes more severe. But at what voltage and current level does this phenomenon become a problem? There are many different views on what levels are acceptable. Different methods of grounding, the type of equipment, bearing lubrication, bearing clearances, bearing types, etc. can all affect the severity of the problem.

Minimizing Bearing And Shaft Current Leakage

In our experience, this phenomenon has not posed a significant problem for most motors. Many motor manufacturers have developed improved winding techniques that minimize the generation of bearing currents in the first place. However, there are some basic rules that will minimize the likelihood of problems in typical applications:

- Keep the motor circuit lead length as short as possible.
- Use shielded cable or cable installed in steel conduit for motor leads.
- Operate the inverter at lowest carrier frequency that is practical (below 5 kHz).
- Ensure proper grounding techniques are used, including proper cable selection and optimizing ground location; eliminate floating ground, ground loops, etc.

Should a bearing current problem be encountered, Hitachi offers inverter output filters and reactors that will reduce high-frequency components of the inverter output waveform. Other options that can be considered are installation of a shaft grounding brush, or use of motors with insulated bearings, but these are rarely necessary.