

Variable Speed Drives – Inverters, Guidelines for Turbine Motors

From growing industry experiences from around the world, motor manufacturers, OEM's, maintainers and end users are seeing electric motors experiencing currents flowing through the motor bearings, especially when used with a Variable Speed Drive (VSD/VFD) or Inverter of Drive.

A VSD consists of a rectifier and an inverter. The inverter runs on constant frequency. It uses PWM (Pulse Width Modulation) to generate a sine wave and regulate the output voltage. The VSD modulates both the frequency and voltage using PWM to keep the frequency ratio constant for the motor.

Sterling Pumps have become more aware of this issue on our Line Shaft Turbine pump motors, usually on higher kilowatt installation as more customers install their turbine with a VSD.

Causes of bearing currents

When stray currents are present on the motor shaft, it can overcome the insulating effects of the bearing lubrication. This can cause a current flow which can induce an 'electric discharge machining' effect on the bearing(s) causing potential bearing wear and possible premature bearing failure.

This voltage can be generated in 3 differing ways. 1) How the frame and shaft are grounded. 2) The electrical installation. 3) Electronic characteristics of the AC drive (VSD).

Solutions

Motor suppliers generally recommend that when an electric motor operated by a VSD for a motor frame size of 315 and 355 and larger, that an Insulated Bearing and Brush Kit be installed on the motor or alternatively two Bearing Brush Kits, one on the drive end (DE) and the non-drive end (NDE).

The electric motor should be grounded, and the motor connection cables with Protective Earth shielding across the entire system as this minimizes motor shaft and frame voltages.

Recommendation

Sterling Pumps and our motor vendor recommend for an electrically operated Line Shaft Turbine pump that a universal 'Carbon Fibre' Bush system be installed on each bearing, both the DE and NDE. These are extremely reliable, are cost effective and a proven method to discharge stray currents. This current elimination is required on 315 and 355 and larger frame size motors, whether 2p, 4p, 6p or 8p.

While an Insulated Bearing and Earth Brush are available to achieve the same outcome, the Insulated Bearing is not a common size and more difficult to source a replacement bearing. In remote regions, this could cause downtime issues.

While it is important to recognise bearing currents can be an issue, they contribute to a very small number of failures. Majority of bearing failures relate to simply mechanical problems such as too high an axial load or radial load, insufficient or wrong lubrication or foreign particles or moisture inside the bearing.