GE
Measurement & Control

Motor Health Indicators

Motor Stator Insulation Monitor

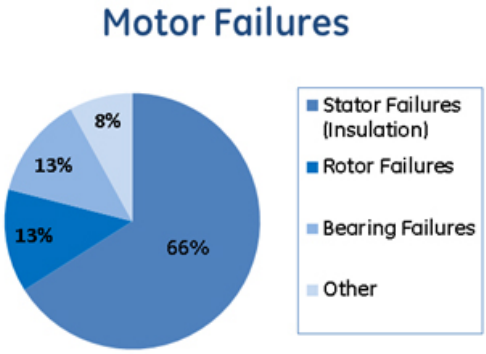
Product Information

Introduction

Industrial motors drive many of the world's most critical applications. Across multiple industries, motors are an ever-present fact in facilities and plants and drive some of the world's most critical assets. Whether the asset is a main air blower or wet gas compressor at an onshore refinery, a product export pump on an offshore platform or a boiler feedwater pump at a power generation station, these assets are critical to the viability of your operation, and they are very often motor driven.

"When motors fail, how do they fail?" Answer: stator insulation failure. Unlike most other types of rotating assets, motors are electrical devices and when they do eventually fail, the majority of the time the failure is due to insulation breakdown. While many motors have condition monitoring systems that will detect rotor failures (13%) and bearing failures (13%), no reliable online technology exists to address the main failure mode, stator (insulation) failure, which accounts for 66% of the failures!

Motor Failures 4kV and Greater



Understanding how motors fail helps point to a solution. If a technology exists that allows owners and operators to track the insulation degradation online reliably over time this would prove a useful tool. Outages could be scheduled and unplanned events could be avoided, Yielding increased reliability and safety.

Technologies do currently exist to characterize the condition of the motor stator insulation. For many years industrial motor owners and operators have been forced to rely on one of the two following technologies:

Offline Portable Motor Testing Instrumentation

Several companies offer offline testing equipment that can give a reasonable characterization of the stator insulation. Unfortunately, the motor and driven machines must be shut down, removed from service, and locked-out before testing can proceed. Many motor operators cannot afford this interruption.

Testing at this lengthy interval is of minimal value at best. The motor may be close to failure by the time the test occurs. Additionally, this testing happens at ambient temperatures and does not give a true characterization of the insulation condition while running at load, or at temperature. Worse yet, several of the most valuable offline tests use low-current, high-voltage methods that actually tax the insulation and contribute to early failure. So when the motor does eventually fail, the offline testing very likely contributed to the failure!

Online Partial Discharge (PD) Testing

Another method used is an online technology call Partial Discharge. As insulation degrades over the life of the motor, small discharges occur through the insulation. The PD system "listens" for these discharges and plots the approximate location and frequency of the discharges in an attempt to predict where and when the insulation will fail, and hence when the motor will fail. While partial discharge technology does perform an online measurement, the technology relies heavily on complex algorithms and modeling for its prediction. Partial Discharge has met with limited success due to the unreliability of the algorithms to predict where the failure in the insulation will occur. Often, equipment operators have had Partial Discharge equipment that predicts a particular motor failure, only to find that the motor continues to operate trouble-free for several years past the point it was predicted to fail! Clearly industry needs a better tool to ensure the reliability of their operations.

Motor Stator Insulation Monitor (MSIM)

The Motor Stator Insulation Monitor is an online monitoring system that is the industry's only continuous online, direct measurement of stator winding capacitive and resistive leakage currents, offering the only online indication of this measurement currently available outside of a laboratory.

This patented system was developed over several years in partnership with the GE Global Research Center and has been designed for compatibility with the Bently Nevada* 3500 Machinery Protection System and System 1 Optimization and Diagnostics software.

Product Information

Benefits

The MSIM's patented technology helps deliver highly specific and distinctive benefits:

- Works with many manufacturer's machines (any OEM)
- Continuous, online insulation integrity measurement
- No need to take the motor offline or shut down the process
- Directly measures resistive and capacitive leakage current
- Provides capacitance and Dissipation Factor (DF)
- Avoids or reduces the economic impact of motor replacement and repair by informing you of motor condition online
- Enables intensive monitoring while running until the process can be shut down in a controlled way
- Leverages existing 3500 series technology on both the driver and driven equipment together for a complete solution
- Fully configurable MODBUS communications parameters for integration with your DCS system
- Configurable alert and alarm setpoints for all variables
- Drives 3500 relay output for local annunciation
- Local Display available in the standard 3500 system
- Compatible with System 1 Optimization and Diagnostics Platform
- Reduces training investment; your staff is likely already trained on the very popular 3500 system
- Provides the insight necessary to avoid secondary damage to the process that occurs in an emergency trip

Technology Overview

MSIM consists of (3) voltage and (3) current sensors, a dedicated 3500 monitor and I/O module, and optional System 1* or DCS connectivity. In many ways, the installation is very similar to other 3500 system installations.

The key to how the MSIM works is the patented High Sensitivity Current Transformer (HSCT) technology (typical installation shown to the right). The HSCT directly measures the very small leakage current in the milliamp (mA) range in the presence of hundreds of amps, a technology that has never before been available to industry. The 3500 interface module conditions and converts the HSCT sensor signal to the direct DF measurement.

In addition to the HSCT, the MSIM monitor uses High Voltage Sensors (HVS) with interface modules, along with motor stator temperature (RTDs or thermocouples) as inputs to the system.

Typical MSIM System components shown above.

Applications

The applications best suited for the MSIM technology are those machines classed as critical or essential. Some application examples are listed here:

Oil & Gas Upstream Offshore/Onshore

- Main Process/Combustion Air Compressors
- Water Injection Pumps/Export Pumps

Oil & Gas Downstream

- Main Air Blower/Plant Air Compressors
- Wet Gas Compressors/Feed Gas Compressors
- Recycle/Regeneration Compressors
- Hydrogen Reciprocating Compressors

Power Generation

- Boiler Feed Pumps/Circulation Pumps
- Reactor Coolant Pumps

Typical MSIM Installation shown here.

Deployment and Data

MSIM has been deployed successfully at several industrial sites in the US. Extensive testing has shown that motor insulation degradation CAN be detected online and trended for the first time to give operators and owners direct line of site to machine condition and early warning of motor failures for their critical machinery, with very high confidence.

For additional information, please contact your local GE Representative. Visit www.ge-mcs.com/bently.

GEA30861 (09/2013)