Electric Motor Insulation Testing

Electric motors are critical to many businesses, and preventative maintenance procedures can be used to help maximize insulation life, reduce equipment failures and prevent unscheduled outages. Electric motor insulation testing can help predict the condition and remaining life expectancy of the motor's insulation and may aid in maintenance planning. Electric motor insulation has a finite life expectancy, and factors such as usage, working environment and preventative maintenance can have a significant impact. The following information explains electric motor insulation breakdown and the benefits of insulation testing.

Insulation Breakdown

- Electric motor insulation deteriorates over time due to normal operation and working environment. This deterioration lowers the insulation's resistance value and may also lead to material failure and electrical faults. Thus, motor insulation has a limited life expectancy which is normally specified by the manufacturer for replacement.
- Common causes of insulation deterioration that can lead to failure ahead of life expectancy include:
  - Electrical problems such as overloading, low/high voltage conditions, and phase imbalances that result in higher operating temperatures.
  - Overheating due to contamination (dust, dirt, debris, pests, etc.) that interferes with the flow through cooling air passages in motor casings.
  - Winding contamination by moisture, corrosive fumes, and conductive dust/debris that lowers the electrical resistance of the insulation.

Insulation Testing

- Electrical insulation is designed with a specified electrical resistance. This insulation resistance can be measured by a testing device which functions by applying a voltage between a conductor and the equipment frame or ground. Resistance measurements lower than the designed insulation resistance can indicate deterioration or contamination. Several tests can be used to measure electrical resistence:
  - Insulation Resistance Testing is used to directly measure the insulation resistance value.
  - Dielectric Absorption Ratio Testing is used to show the overall condition of the insulation by reading the insulation's resistance to an applied voltage over time.
  - Polarization Index Testing is used to determine the condition and performance of motor winding insulation due to contaminants such as dirt, oils and moisture.
- Performing insulation resistance testing periodically and recording the results over time can help show a downward trend of the insulation resistance as it deteriorates from normal service, aging, and contamination. The trended results can be used to forecast when remedial action should be scheduled. A sudden decrease in insulation resistance may indicate a fault condition, moisture contamination, or recent overheating, all of which require immediate remedial action.
- If the insulation test results indicate insulation contamination or deterioration, repairs may be an option in lieu of complete motor replacement. A qualified electric motor repair facility should be consulted to determine the best course of action based on available testing results.
- Electric motor insulation testing involves high voltages. When performed improperly, it could be hazardous to equipment and personnel. This type of testing and predictive maintenance should only be performed by qualified technicians or personnel. It may be necessary to consult with a qualified electrical testing service to determine the best application and frequency of electrical testing for motors at your facility.

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