LAYCO ELECTRIC INNOVATIONS

Your Premium Provider for Supply and Service of Electric Motors, Industrial Controls, and Power Distribution Solutions

Information Sheet # 12

Your Reliable Guide for Power Solutions

PREVENTIVE MAINTENANCE of Electric Motors and Benefits

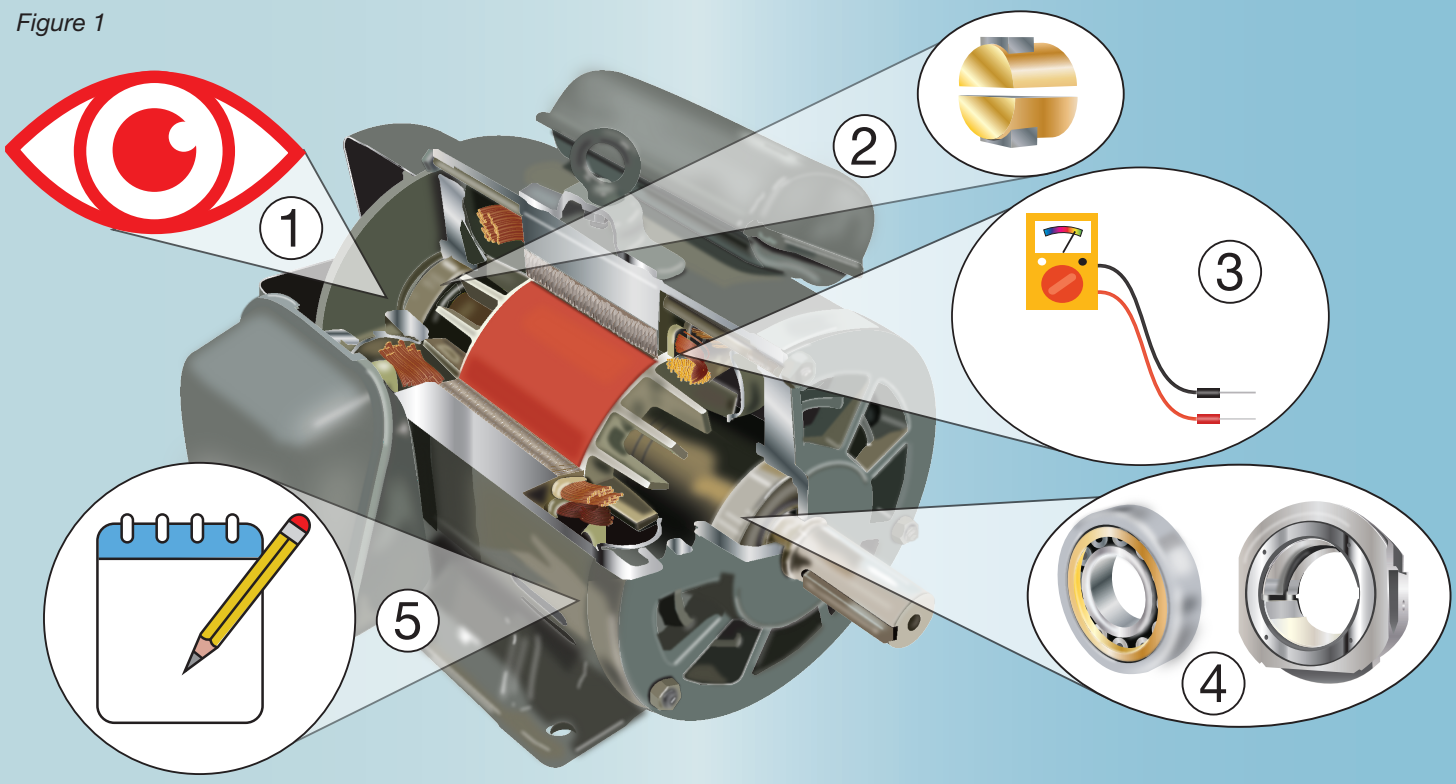
1.0 Introduction:

While most electric motors deployed in industry and commerce are designed and manufactured to provide drive for long periods with minimal maintenance, they are also a key component of the equipment and failure can result in significant disruption both life and economically critical. The best solution for eliminating unplanned shutdown of equipment due to motor failure is to have in place a Preventive Maintenance (PM) program. Along side PM programs there is also Predictive Maintenance (PdM). A PdM is scheduled on the results of PM programs and forecasts the length of time between failure of various structures and components within an electric motor.

This information sheet discusses the benefits of PM and PdM programs, what the programs comprise, and the components tested and method of testing.

Observation and Test During Electric Motor Preventive Maintenance (PM) Program

Figure 1



Main Stages of Electric Motor PM Program

Item #	PM Action	Description
1	Observe	Check out the condition for indications of operating environment
2	Commutator/Brushes	Wear and marks will indicate issues
3	Bearings	Check state of lubrication (if any) type and replace if needed
4	Test Windings	Winding test is looking for anomalies or failures in the windings
5	Documentation	During each PM notes are taken to track trends regarding motor's status

To fulfill our commitment to be the leading supplier, the Layco Electric Innovations team ensures they are always up-to-date with the current industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power and motor control industry.

2.0 The Benefits of Preventive Maintenance Programs for Electric Motors:

Operators and facility managers know the downside of unscheduled shut downs due to equipment failure. While most electric motors are manufactured to provide a high degree of reliable continuous operation, like any other piece of rotating equipment they have components subject to wear over time. Planned, or preventive maintenance (PM) programs look to regularly check on the state of an electric motor at a frequency that identifies issues before they become a problem. The majority of facilities and processes that heavily rely on electric motors to operate have the following benefits when implementing PM programs:

2.1 Greatly reduced unscheduled shutdowns – PM programs are designed to check all the parts of an electric motor that can fail. During PM component status is logged with replacement as required. Less unscheduled shut downs greatly off-set the costs of a PM. In life critical operations there are more than economic considerations to avoid.

2.2 Reduced operational costs – Equipment not maintained can experience component failure that leads to other component failure within the machine. A PM will replace a certain component before its failure leads to other component failure. Over the life of the machine the cost of operation is greatly reduced when a PM program is followed.

2.3 Greater reliability and sustained performance – Equipment that is not serviced will degrade in performance for a variety of reasons a PM program will identify. PM programs ensure continued optimum performance and efficiencies of the processes an electric motor is driving.

3.0 The Difference Between PM and PdM Programs for Electric Motors:

When discussing maintenance programs, references to PM and PdM programs are made. They are closely related and defined as follows:

3.1 PM Program – PM programs at fixed intervals take a planned assessment of a motor's condition. The assessment is based on a set list of measurements and observations. Any tests are to ensure the machine and related parts are performing within defined norms.

3.2 PdM Program – A PdM program on the other hand is a predictive maintenance program. Predictive maintenance includes estimating the length of time before a failure might be expected, or before corrective maintenance (corrective action) should be performed. The advantage of PdM over PM is that predictive maintenance makes use of trends in tests or assessments, and from those results a projection of time to failure or time before corrective action is needed can be made.

4.0 Activities of a PM Program:

A PM program is carried out against a predetermined time period. The time between PMs can vary based on the application, type of motor, etc. Per *figure 1*, observations and testing within a PM program include:

4.1 Visual Inspections – A quick visual inspection of the motor will indicate the conditions the motor has been operating in and there will be signs of corrosion and dirt build up. Inspection of the windings will detect overheating. Visually check relays and contacts for conditions, particularly dust free and showing no corrosion. Debris in the motor will threaten performance.

4.2 Brush and Commutator Inspection – PM checks of these items help prevent inconsistencies or abrupt stoppages. Signs of wear and tear will indicate problems with the commutator before the next PM. The commutator should be checked for dents, grooves, and scratches. Rough spots could be indications of sparking. Inspection is made of the motor mounts, rotor, stator, and belts. All worn-out parts will be replaced.

4.3 Motor Winding Test – A PM winding test looks for anomalies or failures in the windings. Other indicators are burn marks, cracks, and a burning odor. If any of these are detected a winding test is mandatory.

This test involves disassembling the motor to determine the abnormalities of the motor. If the windings are overheated, the chance of serious damage is higher. Rewinding the motor and testing the winding insulation, which reveals information on the resistance level, are also critical parts of the test.

4.4 Check the Bearings – Any noise and vibration will be a strong indicator of potential or existing issues with the bearings. Problems include poor lubrication, dirt buildup, and wear and tear.

If the bearing housing is too hot to touch it could indicate the motor is getting overheated or there is insufficient lubrication to the bearings. Maintenance requirements for bearings vary on where the equipment is applied. The PM program will have defined the different type of bearings with their different maintenance requirements.

4.5 Documentation – Detailed reports are maintained of each PM. This ensures the status of the motor is known and the work undertaken.

5.0 Activities of PdM Program:

Predictive maintenance consists of trending and assessing most of the activities associated with a PM. Typically PdM includes:

5.1 Trending Winding Insulation Resistance Values – Insulation deterioration may be detected and corrective action taken by cleaning and rebuilding a motor without having to rewind it.

5.2 Vibration Analysis – This mechanical test uses a Fast-Fourier Transform (FFT) spectrum analyzer (*see information sheet #9*). These analyzers digitize the vibration signals, calculate the FFT which provides the frequency and amplitude of the vibration, and store the data for trending.

5.3 Infrared Thermography – Images provide a temperature profile of the electric motor by giving heat patterns at several points throughout the motor simultaneously.

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