LAYCO ELECTRIC INNOVATIONS

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

Information Sheet # 13

Your Reliable Guide for Power Solutions

NEMA MOTOR REPAIR
Best Practice and Definitions

1.0 Introduction:

The National Electrical Manufacturers Association (NEMA) is a premium organization that sets the standards for the specification, manufacturing, performance, and repair of electric motors. Layco Electric Innovations (LEI) is a fully credited facility to repair motors to NEMA standards.

This information sheet discusses why motors fail, how to determine repair over replacement, the evaluation of a motor repair facility, and realistic expectations for the performance of a repaired motor.

2.0 The Downside of Not Maintaining Motor Performance:

Whether it's a production process that includes several electric motors or a single motor operating one piece of machinery, the original design specifications assumed a certain efficiency, performance, and power output for the overall system to operate as required. While total motor failure will shut down a given system, with the resulting downsides being economical, lack of reputation, and in some cases life critical, a failing motor will also impact the overall efficiency of a system. System designers select NEMA-certified motors because they are designed and manufactured to be best in class.

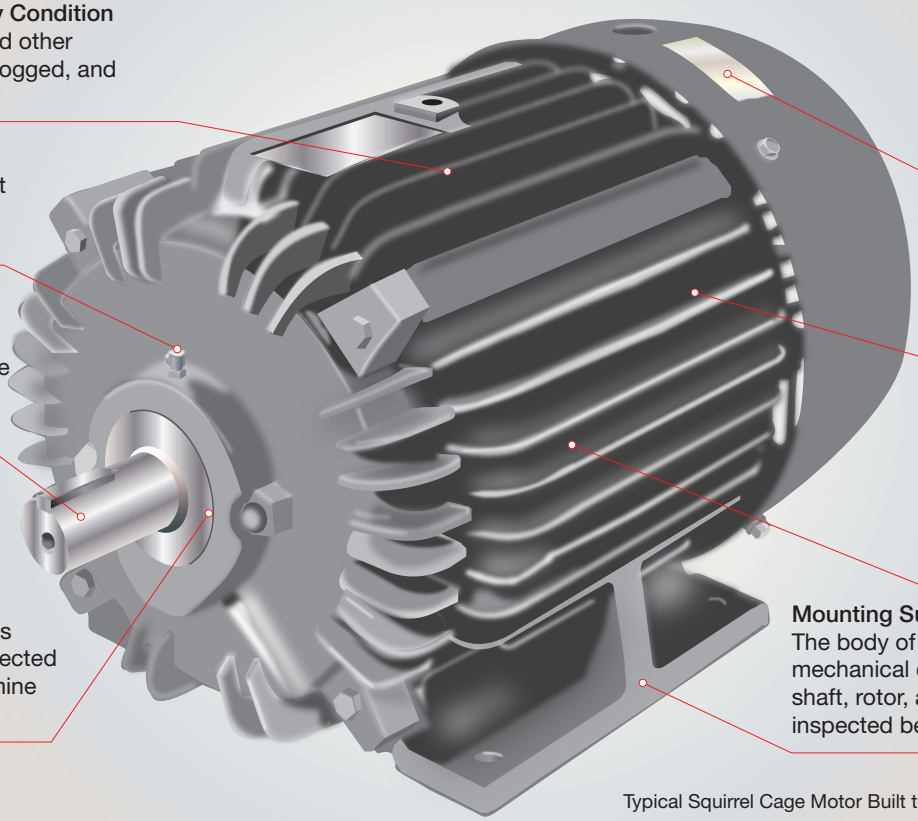
Electric Motor Components a NEMA Service Facility Will Inspect Before Repair

Ventilation and Body Condition
Are cooling vanes and other apertures clean, unclogged, and allowing free airflow.

Lubrication
Grease to surfaces subject to wear are checked, as is the grease.

Mechanical Condition
The body of the motor and mechanical condition of the shaft, rotor, and stator are inspected before rewind.

Wearing Surfaces
Bearings and all surfaces subject to wear are inspected and measured to determine repair or replacement.



NEMA Inspection
A Certified Approved NEMA repair facility follows an inspection protocol as specified by NEMA.

Rotor Inspection
he condition of the rotor is inspected to determine suitability for rebuild, and the condition of the laminations is checked.

Stator Inspection
The condition of the laminations, insulation, and windings are checked. Before rewinding, the condition of the stator body will be checked.

Mounting Surfaces
The body of the motor and mechanical condition of the shaft, rotor, and stator are inspected before rewind.

Figure 1

Typical Squirrel Cage Motor Built to NEMA Standards

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.

3.0 Reasons for Motor Failure and What to Look For in Achieving Best Practice:

NEMA-produced motors are designed to operate for many years with minimal reduction in efficiency. While equipment age can be a factor for failure, if the motors are used as specified for the application, operating hours are not the reason for deterioration. When a motor needs replacing, the operator and repair facility should determine why a failure occurred to avoid repetitive failures. Reasons for failure include:

3.1 Heat:

Excessive heat causes the insulation to deteriorate at a rate that can double for every 5≠≠0°F (10°C). Excessive heat also affects lubrication leading to premature wear and bearing failure. A NEMA-approved repair facility will review heat factors, including:

- Overloading
- Starting frequency
- Ambient conditions, including altitude and temperature, and lack of ventilation
- Low or unbalanced voltage (on 3-phase motors)

3.2 Quality of Electrical Power Supply:

As an electrical mechanical device a motor's performs best within a power range. Negative electrical input affects are:

- Harmonics - resulting in overheating and decreased efficiency
- Voltage - NEMA standards limit between 90% and 110% of rated voltage
- Voltage unbalance across phases - A balance above 1% requires derating and no power connection above 5%
- Voltage Spikes - Spikes from capacitor switching, lighting, variable frequency drives (VFDs), etc., cause insulation failures
- VFDs - In the US, VFDs below 60Hz assume a reduced torque or additional cooling

3.3 Humidity:

Humidity, which usually occurs when the motor is left idle, weakens the dielectric strength of electrical varnish. It also can corrode bearings and other mechanical components. To avoid humidity-caused problems, consider the following:

- Ambient humidity - Keep below 80%
- Heating elements - Specify this accessory when high-humidity environments are expected
- Stored motors - Rotate the shaft periodically to keep the bearing surfaces lubricated

3.4 Contamination:

Excluding all contamination, even on total enclosed and explosion-proof motors is difficult. Contamination will lead to abrasion of bearings and insulation, corrosion of key surfaces, and overheating due to lack of ventilation. If contamination is an issue, a protocol of regulator inspection and cleaning should be carried out.

3.5 Lubrication:

Lack of or too much lubrication can lead to premature wear. Consult with the manufacturer for best practices.

3.6 Mechanical Loads Outside of Design Limits:

Distortion of the motor due to misaligned couplings, over-tightened belts, poor shimming, feet not on the same plane, and miss application of bearings can all lead to bearing failure and distortion of the frame affecting the air gap.

4.0 Deciding to Repair of Replace:

In the majority of cases, a rewound motor is less expensive than a replacement (any salvage value). However, the system operator or user must consider other factors. Work with an approved NEMA repair and supplier company for full motor inspection: - *See Figure 1*

- Will the efficiency of a new motor match the efficiency of a rewound/replacement motor?
- The cost of downtime off the shelf versus time to rewind/repair the existing motor. The availability of each is a consideration.
- The practicalities of remounting another motor with different dimensions to the original.

5.0 Selecting a NEMA Approved Repair Facility:

To ensure quality repair and supply, it is important to verify the credentials of the supply/service motor provider. Not all facilities are equal. In evaluating a service provider, the user should consider the following:

5.1 In-house Quality Control Programs:

A repair facility with the ability to repair and rewind to NEMA standards will have the following accreditations:

- ISO 9000 Program - This demonstrates work practices at a consistent level through all processes.
- Electrical Apparatus Service Association (EASA) - A member of EASA has demonstrated they have the assets and trained personnel to repair motors to the required NEMA standards and efficiencies.
- EASA-Q program that covers all the elements of ISO 9000, requiring a service center audit and customer survey.

5.2 Repair Facilities Test Equipment:

A premier repair facility should be equipped with test equipment that, at a minimum, includes:

- Core loss tester or EASA loop test setup, surge comparison tester, voltage-regulated power supply for running at rated voltage, and vibration testing equipment. The correct method of insulation removal and other work practices.
- The service facility should have a record-keeping system to maintain records of all serviced motors.

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