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Reliable Short-Term Operation and Safety Must Take Precedence over Efficiency

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Introduction

This document explains the common position shared by CEMEP and NEMA regarding the reliable operation and safety of electric motors. The position strongly held by both organizations is that safety and reliable operation should never be compromised as a result of striving for higher electrical efficiency. Motor safety concerns should always take precedence. Reliability is a safety concern when loss or diminished operation can result in injury or death.

There are applications such as fire pump motors, which infrequently run, where reliable operation is critical. In these applications, the limited energy savings based on motor efficiency should not be considered a higher priority than the potential loss of life or property. Failure of other types of motors such as smoke extraction motors, brake motors, and motors used in explosive atmospheres, can lead to extreme hazards if they do not operate when needed or fail unexpectedly.

Some Features Increase Efficiency but May Negatively Affect Safety

Many features increase efficiency while negatively affecting motor reliability, thereby making the motor potentially inoperable when needed, or even causing a spark, fire, or explosion, in particular, specific environments. Such features can include but are not limited to, smaller cooling fans, smaller bearings, thinner winding insulation and smaller air gaps between stator and rotor. These features can be used to increase efficiency. Still, if they render the motor inoperable, or lead to a fault in a critical application or environment, the results can be catastrophic.

Applications Where Efficiency Related Features May Affect Safety

Smoke Extraction Motor

Tunnel ventilation motors or smoke extraction motors have two essential functions:

1. Smoke extraction motors typically run a fan to extract smoke and potentially hazardous gases under normal operating conditions from tunnels or areas where natural ventilation may not be sufficient, and

2. During fault conditions, such as a fire, smoke extraction motors are run to ensure that evacuation and access routes are free of smoke, which allows firefighters safe access to the area.

Smoke extraction motors are expected to run for extended periods (e.g., 120 minutes in temperatures of 600°C or higher) under severe conditions and, therefore, must provide increased safety and reliability above the standard motors. They facilitate firefighting by creating a smoke-free layer, preventing/delaying fire flashovers, protecting devices and equipment, minimizing the thermal stress on components, and reducing the subsequent damage caused by fire. This cannot be accomplished using a standard motor.

Fire Pump Motors

A fire pump supplies water to a building or other facility’s sprinkler or other fire mitigation system. If the pump doesn’t run, not only will that equipment be damaged, but the entire facility will be in danger of burning down. Consequently, the primary requirements are to ensure that the pump will start under adverse conditions and keep running.

To ensure the fire pump motor is available and can start under different adverse conditions, there are special requirements that must be met. It must be capable of running at 150% overload for two minutes, capable of running at a 70% reduced voltage for three minutes and running at 80% reduced voltage without exceeding design temperature. It must be capable of multiple restarts in succession or within an hour and may require extremely low starting currents or high starting torques at the same time. Incorporating these design requirements can significantly reduce the efficiency of the motor. Despite having a lower efficiency, fire pump motors run very infrequently, either during decoupled testing, or during an actual fire or trigger event, thereby making efficiency even less of a concern and benefit.

Hazardous Duty or Ex Motors
These motors are located in an area subject to explosive gases and conductive or explosive dust and must be designed with higher reliability and safety in mind. Multiple features are designed into the motor to reduce temperature or arcing that could cause a fire or explosion, but these features are likely to have a negative effect on the efficiency of the motor. Higher volume cooling fans and larger capacity bearings, which decrease temperature and increase reliability and safety, increase energy consumption. Increasing the insulation thickness to reduce the risk of a fault and consequent motor failure will decrease the amount of copper that can be used, which also increases energy consumption. Safety-related features should not be compromised to conserve energy since doing so endangers the public or operators working in the vicinity of the motor.

Brake Motors
Brakes installed on motors are used to stop operation during emergencies or to hold the controlled material in a fixed position against gravity, pressure, and inertia. The use of brakes may increase losses but, if not both available and reliable, could injure nearby operators. Therefore, the reliability of these motors and the presence of brakes in these applications is critical to safe operation. In addition, in many applications, these motors are not intended for continuous operation, so any resulting energy saving due to increased efficiency is minimal. In any event, under such circumstances, safety should take precedence over efficiency.

Conclusion

CEMEP and NEMA are both strongly committed to and active in energy conservation, but we place the safety of individuals first and foremost. Many of the applications cited do not require continuous operation, thereby minimizing energy savings from increasing the efficiency of the motor. In the examples outlined in this paper, consideration must first be given to ensuring the reliability of the operation and whether increasing the efficiency of the motor will yield any meaningful energy savings before contemplating any higher efficiency levels. Energy conservation is important under most circumstances but becomes a secondary concern when safety is involved.

The National Electrical Manufacturers Association (NEMA)

The National Electrical Manufacturers Association (NEMA) represents nearly 325 electrical equipment and medical imaging manufacturers that make safe, reliable, and efficient products and systems. Our combined industries account for 370,000 American jobs in more than 6,100 facilities covering every state. These industries produce $124 billion in shipments and $42 billion in exports of electrical equipment and medical imaging technologies per year.

About CEMEP

CEMEP is the European Committee of Manufacturers of Electrical Machines and Power Electronics, representing an industry with a market value of € 6.3 billion and 130,000 employees. The members of CEMEP are the National Associations in Europe, representing manufacturers of electric motors, variable speed drives, and uninterruptible power supplies.

This organization allows the industry to co-ordinate actions at the European and International level, with the main topics being: market evolution, standardization, regulation, promotion, and connection with other products & professional groups.

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