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The Basics of Airflow

Many motor applications that involve moving air from one place to another, either by fan or by blower, rely all or in part on application air flow to dissipate motor heat. In other words, the motor and fan or blower must operate as a system. Given the importance of application air in these instances, let's look at some of the impediments to air flow that could make the difference between a short motor life and a long-lasting application.

The first thing a service technician needs to consider is whether and where the original motor is located in the air stream. The replacement motor should be positioned as closely as possible to the location of the original motor. This positioning can be critical depending upon whether the motor is belly-band mounted or cradle-mounted, since these mounting methods will affect freedom of movement. If the motor is driving a fan located in a venturi, pay particular attention to positioning the fan blade with respect to the venturi.

Single-phase, split-phase, and capacitor-start motors usually incorporate some system of self-cooling, such as an internal or external cooling fan. This makes these motors somewhat less sensitive to positioning when compared with permanent-split-capacitor or shaded-pole motors. Do be aware, however, that some enclosed motors that are split phase or capacitor start, particularly those designated as totally enclosed non-ventilating (TENV), also rely on application air for cooling.

A second point to remember is that dirt and chemical deposits-over time-can deteriorate the motor's ability to radiate heat and thus compromise its temperature limits. In open motors, such materials can clog not just the visible vent openings of the motor, but also internal air passages that are often part of the rotor core. Nuisance tripping of the motor's thermal protection may indicate clogging of this nature. If you notice this type of material build-up, take care to examine and clean the internal air passages as well as clearing any clogged vents.

Even totally enclosed motors are subject to deteriorating heat dissipation capacity if dirt and chemical residues accumulate on the exterior of the motor. These materials may act as an insulating blanket, preventing the necessary heat radiation that is part of the motor's cooling design. Simply cleaning this material off the exterior will help restore cooling capacity in these applications.

One often-overlooked consideration is application underload. Underload can cause excessive heat in two ways. First, underloading a motor designed to move air may not produce enough cooling air to dissipate motor heat; Second, a motor not operating at its designed load may be operating at less than peak efficiency. This will cause a larger percentage of input power to be turned into heat rather than moving force.

It is important to consider nameplate amps when selecting a replacement motor. This is another instance where it may not be good practice to oversize a motor, since the larger motor may be underloaded. Bigger is not necessarily better in air-moving applications - in fact it could lead to premature failure of the motor. Always be cautious when replacing motors in air-moving applications.

Remember, application air flow is one of those factors that can reduce a motor's life expectancy. Understanding the characteristics of air flow and how they affect a motor's performance will enable you to select the right design and provide proper motor maintenance in the field.