



Blog | By Cam Witt

Keeping Your Fan Motor Running at Maximum Efficiency

HVAC systems play a critical role in enhancing the well-being, comfort, and productivity of building occupants. The motors at the heart of these systems need to be as efficient as possible to maximize performance and longevity while minimizing energy consumption. The reality is that HVAC fans use a lot of energy — the cost of operating a fan over the course of its lifetime is generally about 10 times the amount spent on the motor. Even a modest investment in a more efficient unit can have a big impact.

Another baseline driver for motor efficiency is regulatory; manufacturers must meet minimum efficiency standards set by state and federal authorities. In addition to financial and regulatory incentives, building owners and commercial HVAC providers are motivated to differentiate themselves by offering the latest products or achieving prestigious environmental certifications. Other, less predictable circumstances can also drive the urgency for efficient motors. As the workforce returns to the office after the COVID-19 pandemic, adding more robust air filtration may be part of a building's reentry strategy. Adding an air filter with a higher MERV rating, going from MERV-8 to MERV-13 for example, requires the motor to work harder to pull air through, potentially necessitating a more powerful motor.

There are a number of factors that influence the efficiency of a fan motor. This blog takes a closer look at how the motor Infinitum is pioneering brings a variety of benefits to the fan ecosystem.

Design Choices that Echo Throughout the Lifecycle of the Motor

One of the most common complaints about conventional motor installation is the effort and manpower required for installation and maintenance. Infinitum changed the game by shifting away from conventional motor design and replacing the iron

core stator and copper windings with a copper-etched, printed circuit board. The result is a smaller, lighter electric motor. An Infinitem motor can be carried by one to two people and installed without requiring a crane or other heavy equipment, meaning installation of certain fan systems such as fan arrays can be done with less disruption and cost.

Reducing the size of the motor also has a direct impact on efficiency. In most systems, belts connect the motor to the fan because conventional motors are generally too large to connect directly. Because it's smaller and lighter, an Infinitem motor can be directly mounted on the fan, increasing efficiency by 10-15% and requiring less set-up time, labor, and equipment space. For large commercial applications, where a motor might weigh several hundred pounds and take up a large footprint, an array of smaller, individual fan/motor units is easier to install and service and provides redundancy and resiliency by not relying on a single motor to remain in operation. For instance, rather than installing one 100 horsepower motor, a commercial building can achieve the same result with ten 10 horsepower units within the same footprint.

Another distinctive design choice is that Infinitem integrates our motor and drive into a single package. This is a significant departure from conventional motor system design where these components are separate. Generally, when manufacturers are developing new fans or pumps, a mechanical engineering team is responsible for selecting the motor and an electrical engineering team is responsible for selecting the drive. The evaluation and selection of each is siloed, which increases the cycle time and risk to the end design. An integrated motor system removes the challenges associated with motors and drives from different manufacturers and can dramatically simplify and speed up product development. This also reduces the space required for a control panel and the costs associated with wiring further shortens commissioning time when setting up a new fan application.

Variable Motor Performance

In HVAC systems, cooling and ventilation don't necessarily require the fan to run at the same speed — optimal ventilation can often be accomplished with fans running at lower speeds. But conventional motors have been optimized to operate at one speed because of the fixed voltage of supply lines. Infinitem motors feature a variable frequency drive, or VFD, which makes it possible to adjust motor speed by controlling the frequency and voltage, leading to significant efficiency gains. Because the relationship between RPM and power is cubic, reducing fan speed by half reduces power consumption to just an eighth of what it was previously. For

example, if a fan requires 100 watts to operate at 100%, by reducing the speed by 50%, the energy required to run the fan drops to a mere 12 watts.

It's worth noting that the high frequency VFD in an Infinitem motor also significantly reduces audible noise to provide a quieter motor environment.

Remote Updates and Monitoring

Our motors are also inherently connected so customers can leverage IoT for remote monitoring and control, making it possible to achieve efficiencies ranging from shorter lead times to making the motor and its data more accessible. Motor systems require extensive testing and validation, which could take months to complete before it's ready for a customer. Connectivity opens the door for part of the qualification process to happen after the product is installed because we can update the firmware remotely, reducing lead times significantly and making it possible for companies to put the motors to use more quickly.

Additionally, IoT circuitry embedded in both the VFD and PCB stator provides insights into motor performance data including temperature, vibration, and operational parameters. IoT sensors also allow for predictive and prescriptive maintenance. As more motors operate in an IoT capacity, a larger data set can be collected and used to help predict maintenance needs and identify inefficiencies. Most motor installations today don't collect data at all, but if they do it's typically local to the equipment and requires operators to access the unit directly. When data is difficult to access, operators are blind to potential issues. They're likely to miss early warning signs until an occupant complains and by then the damage may be much more extensive – and costly. User-centric data collection and cloud capabilities open up avenues for better efficiency not only by collecting the data in the first place, but by making it accessible — and actionable — from anywhere and preventing unscheduled downtime as a result of unforeseen repairs.

Overcoming limitations to the physical accessibility of a motor is also an area where IoT capabilities can improve efficiency. To make improvements to a conventional motor, a technician likely must first drive to the location and then climb up on the roof or go down into the basement where the motor is located. Even for a seemingly simple software update, it takes time to corral the right cables and navigate the process of downloading updates from the vendor's website; it could easily take 30 minutes per motor, and at a data center or large hospital where there are multiple systems distributed across campus, updates require a significant investment of time and resources. All of that's avoidable with remote updates.

At a time when the world is adding new motors at a rate of 800 million every year, we've fundamentally changed its footprint and reduced the motor's environmental impact at every stage of its life — from sourcing raw materials to increasing its longevity. For more information about Infinitum's high-efficiency motors, learn about our [IEs Series here](#).

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