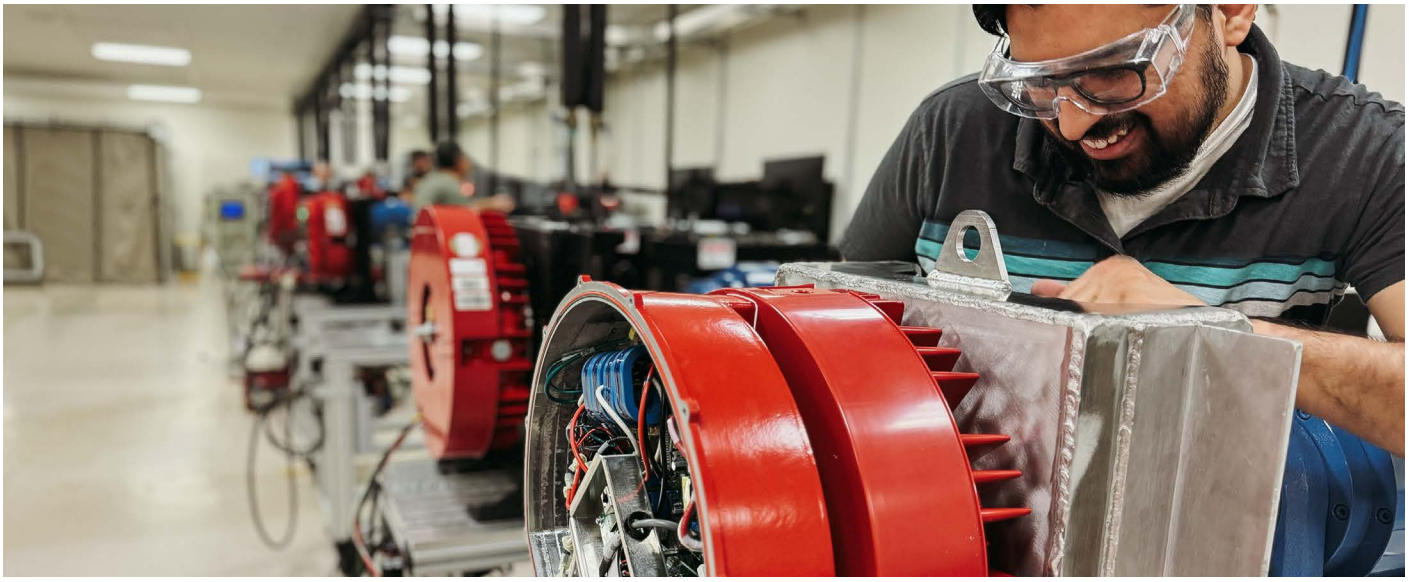
Infinitum

Whitepaper | By Amanda Weilenmann

Designed for Reliability

Where Innovation Meets Endurance



Reliability isn't just an outcome—it's engineered into every stage of our design process. At Infinitum, we begin with intentional material selection, choosing components for their durability, thermal properties, and performance under stress. At the heart of our motor is our patented PCB stator, which eliminates traditional failure points, enhances heat dissipation, and withstands extreme mechanical stress.

By integrating the Variable Frequency Drive (VFD) and utilizing high-quality bearings, we further improve longevity and efficiency. But materials and design are only part of the equation—validation is equally critical. We conduct rigorous testing at both the component and system levels, leveraging third-party verification, advanced simulations, and internal assessments in accordance with UL and NEMA standards. Our commitment to reliability extends beyond performance; it ensures long-lasting, energy-efficient solutions that minimize environmental impact while meeting the demands of mission-critical applications.

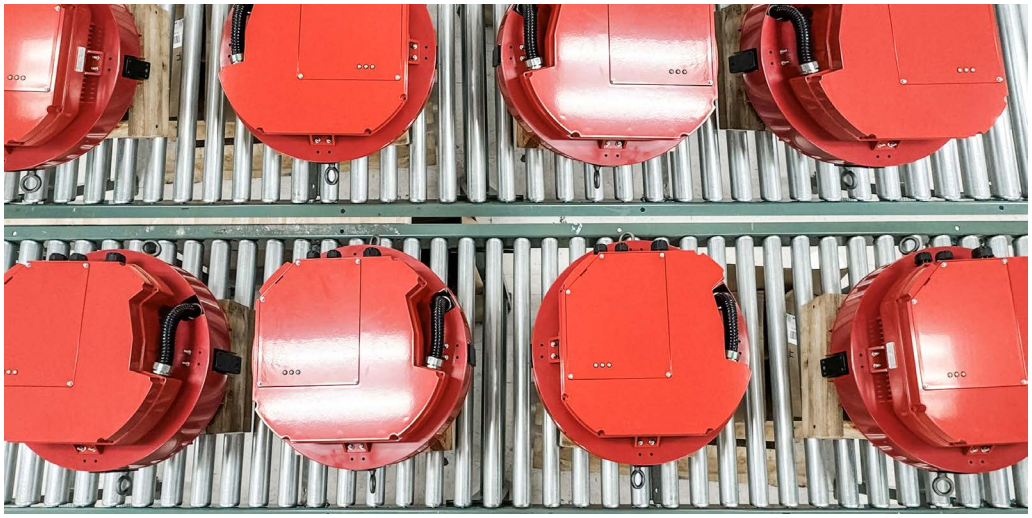
Overview of the Aircore EC motor

At the core of Infinitum's technology is the printed circuit board (PCB) stator. The design, construction and material properties contribute to a durable and rugged product. The absence of stator laminations and conventional copper windings, along with their increased endurance under higher thermal and mechanical stress, gives PCB stators a lifespan of over 100 years.

The Aircore EC motor represents a paradigm shift in motor technology. Unlike conventional motors, it features:

- **PCB-Based Stator:** A patented stator design that replaces traditional iron cores with lightweight and compact printed circuit boards (PCBs), significantly improves energy efficiency and reduces weight.
- **Integrated Electronics:** Incorporating the Variable Frequency Drive (VFD) into the motor's housing eliminates the need for external controllers, streamlining design and improving thermal management.
- **Axial-Flux Architecture:** This innovative design enhances power density, making the motor ideal for applications with space constraints or requiring high efficiency.

These features not only address energy consumption but also reduce material usage and carbon footprint, aligning with global sustainability goals.



How we design for reliability

Overheating prevention

A common failure mode in traditional induction motors is overheating caused by copper windings around a laminated steel core, which degrade over time due to repeated expansion and contraction as the motor heats and cools. The copper windings also generate eddy currents, contributing to energy losses over the motor's operational life.

The PCB stator addresses these challenges by improving heat dissipation. Its automated production ensures consistent quality, and the similar thermal expansion properties of the PCB substrate and copper eliminate thermal induced stresses in the PCB stator structure. The large surface-to-volume ratio of PCB stators facilitates heat dissipation allowing for higher current densities than in conventional wound stators.

Bearing selection for longevity

Infinitum prioritizes bearing longevity by utilizing high-quality materials, which run cooler and significantly extend L10 life. Our motors are equipped with grease optimized for their operating conditions, addressing one of the most common causes of bearing failure. Additionally, we carefully assess bearing lifespan data within consistent environmental and operational contexts to provide accurate and dependable performance insights.

Robustness against vibration and shock

The Aircore EC motor is meticulously engineered to withstand mechanical stress during transportation, installation, and operation, as demonstrated by rigorous vibration and shock testing. At the heart of this durability is the PCB stator, which is inherently more robust than traditional stators. Unlike laminated steel cores, the PCB stator is lightweight, compact, and free from mechanically vulnerable windings, making it less susceptible to damage from vibrations or shock.

How we test for quality

We ensure rigorous quality testing at both the component and system levels through third-party verification, advanced design analysis tools, and internal testing in accordance with UL and NEMA standards.

Validation process

To guarantee reliable performance, all physical tests are conducted using state-of-the-art equipment, including thermal chambers, vibration tables, and humidity chambers. Simulation analysis, such as Sherlock ADA software, further strengthens our validation approach. These methodologies ensure that the Infinitum Aircore EC motor meets the highest reliability standards.

Testing procedures

Third-party reliability testing of the Infinitum Aircore EC motor simulates real-world operating conditions over the motor's expected 20-year lifespan. This includes:

- **Environmental Stress Testing:** Validates durability under extreme temperature, humidity, and mechanical stress conditions.
- **Shock and Vibration Testing:** Ensures resilience during transportation, handling, and installation.
- **Thermal Cycling and Humidity Testing:** Assesses long-term reliability in mission-critical environments.
- **Simulation Analysis:** Uses advanced software to model component stress under real-world conditions.

Quality certification

Infinitum adheres to globally recognized quality and reliability standards. Our Accelerated Life Testing is conducted in collaboration with ISO/IEC 17025:2017 accredited labs, ensuring unbiased validation. Third-party assessments enhance credibility, transparency, and customer confidence in our motors' performance.


PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Organization of:

Infinitum

106 East Old Settlers Boulevard, Bldg. D, Suite 106, Round Rock, TX 78664

and hereby declares that the Organization is accredited in accordance with the recognized International Standard:

ISO/IEC 17025:2017

Whereby, technical competence has been confirmed for the following testing/calibration, in the fields of:

Electrical Calibration
(As detailed in the Appendix)

Reliability for the future

Our commitment to reliability extends beyond performance; it ensures energy-efficient, durable solutions that minimize environmental impact, with a focus on thoughtful material selection. By combining innovative design with rigorous testing, we provide a solution that meets the demands of mission-critical applications while reducing our ecological footprint. Infinitum remains dedicated to advancing motor performance while continuing to prioritize energy efficiency and reliability.