Infinitum

Whitepaper | By Stephen Mathew

High Resistance Grounding (HRG)

Enhancing System Reliability and Reducing Costs with the Aircore EC Motor

Introduction

Infinitum's Aircore EC motor combines the advantages of a permanent magnet axial flux motor with an integrated variable frequency drive (VFD) for unparalleled efficiency and performance. This innovative design has revolutionized the electric motor industry by offering a compact, lightweight, and powerful solution for various applications particularly those with mission critical requirements. However, like any electrical system, the Aircore EC motor is susceptible to various electrical disturbances that can lead to malfunctions and even damage. One such issue is how grounding can affect the safety and reliability in mission critical applications. Grounding choices can expose the motor to ground faults and potentially lead to catastrophic failure and injury to service personnel.

This white paper explores the advantages of high resistance grounding (HRG) in the Aircore EC motor compared to other grounding schemes and elaborates on the compelling advantages of integrating HRG directly into the product. The paper will also delve into the cost savings that HRG integration can bring to end-customers.

Disadvantages of Low Resistance Grounding (LRG)

When low resistance grounding (LRG) or solid grounding is utilized, the motor is vulnerable to a multitude of electrical issues. A key drawback of LRG systems when it comes to motors is that upon a LRG ground fault, the motor works as if in a brown out. The imbalance creates reduced power (i.e. cooling), higher power consumption and potential long-term effects unless remedied immediately.

Disadvantages include:

- Severe Ground Faults: When an electrical current flows through an unintended path, such as between the motor's internal components and ground, it constitutes a ground fault. These faults can occur due to various reasons, such as insulation breakdown, wire damage, or external factors like water ingress. LRG ground fault surges can damage internal components of the motor.
- Reliability: For mission critical applications a damaging ground fault has a negative impact on the reliability of the system since the motor would have to be stopped for repair or replacement.
- Cost: Ground faults are one of the most common faults seen by repair crews. Avoiding ground faults leads to reduced repair costs. It could also mean Ground fault protection may need to be upgraded.

The Advantages of Integrated High Resistance Grounding (HRG)

Integrating HRG directly into the Aircore EC motor offers a superior and more cost-effective solution compared to LRG. HRG is a passive, High-impedance path to ground, designed to provide a safe and reliable route for stray currents while minimizing the impact of ground faults and transients.

Here's how HRG benefits the Aircore EC motor and mission critical applications.

- Increased System Reliability: With HRG integrated into the motor, the system becomes less susceptible to various electrical disturbances. With HRG, the motor can continue to operate in case of a low-current ground fault. This leads to improved reliability and longer lifespan, highly advantageous in mission critical applications
- Mitigation of Transient Effects: HRG acts as a "sink" for voltage surges, absorbing excess energy and preventing damage to the motor's sensitive electronic components. HRG systems reduce the dip in line voltage during a ground fault.
- Safety: HRG-enabled systems reduce the risk of electrical shocks and arc flashes protecting personnel and equipment.
- Reduced stress: HRG systems reduce the mechanical stress in circuits that carry ground faults.
- Reduced Maintenance: Ground faults are one of the most common type of faults seen by maintenance personnel. As an integral part of the motor system, HRG requires no additional maintenance, thereby saving time and resources for end-users.

Cost Savings for End-Customers

Integrating HRG into the Aircore EC motor offers significant cost savings for end-customers:

- Reduced Maintenance Costs: With enhanced reliability and reduced susceptibility to failure, the motor requires fewer repairs and replacements, leading to lower maintenance costs.
- Extended Lifespan: By protecting the motor from damage caused by electrical faults and transients, HRG extends the motor's operating life, delaying the need for replacement and minimizing capital expenditure.
- Reduced Risk of Downtime: HRG's improved reliability minimizes downtime due to unexpected failures, ensuring smooth operation and minimizing production losses. This reduced risk of downtime is essential for high-reliability, mission critical applications.

Conclusion

Integrating high resistance grounding (HRG) into the Aircore EC motor provides a comprehensive solution to address the inherent challenges associated with low resistance grounding. By enhancing ground fault protection and mitigating transient effects, HRG significantly improves the motor's reliability and lifespan. This integrated approach not only enhances safety and performance but also offers substantial cost savings for end-customers through reduced maintenance, increased efficiency, extended lifespan, and improved productivity. The benefits of HRG outweigh the initial investment, making it an essential feature for mission critical and high-reliability applications.