United Equipment Accessories, Inc.
Solving Challenges from the Inside Out.™

The Value of Vibration Testing in Slip Ring Applications

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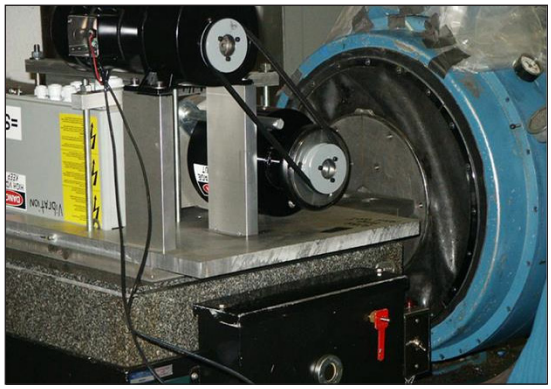
The Value of Vibration Testing in Slip Ring Applications

Testing of real world environments and worst-case scenarios in slip ring applications is just one way to ensure they are ready to endure the unforeseen and to keep product downtime to a minimum. United Equipment Accessories (UEA) conducts essential vibration testing to identify potential issues such as loose nuts and bolts, internal component shifting, contacts opening, parts too close to enclosure, and cable rubbing, which would decrease insulation value, damage critical components, cause intermittent signals, or lead to shorting. Through comprehensive product testing, we have concluded that the UEA brush design performs well in vibration inductive environments that one would expect as part of a normal application usage, and those environments which would not occur except in unusual conditions.

The value of shock and vibration testing, just like the value of any environmental testing, is to verify that a product can function properly for the purpose it was designed. A slip ring assembly can have potentially hundreds of individual parts, which are assembled together to create a working product. Each of these parts has a purpose and without even the simplest part, the whole assembly can fail. This is why the best way to ensure the assembly will work is through product testing.

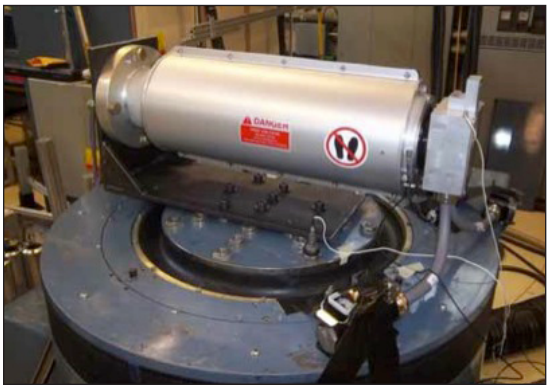
TESTING PROCEDURES:

UEA follows various testing procedures when performing vibration and shock testing. Specific procedures include Mil-Standard-810F or ISO 60068-2-6 along with other similar procedures. These require a product to be vibrated at a certain acceleration, usually measured in G's, at a range of frequencies depending on the application.



Perpendicular (Z) Vibration Test of a Slip Ring in a Horizontal Mount Position

UEA, with the assistance of an independent lab, recently performed a test at 2 G's acceleration and a frequency sweep between 36 and 115 Hz. The test requires the slip ring to be mounted, as it would be in the application, and then to be vibrated as separate tests in all three directions (X, Y & Z). These tests are used to mimic the worst-case situations of a gearless turbine design with the slip ring mounted in the horizontal direction. For geared turbine designs the vibration frequency spectrum covers a much wider range as the increased output rotational speed relates to a higher vibration frequency.



Vertical (Y) Vibration Test of a Slip Ring in a Horizontal Mount Position

Included in these procedure standards is shock testing. This, contrary to sweep vibration, includes a sudden jolt of movement at a high acceleration. Recent tests performed on a UEA slip ring were at 10 G's for 6 microseconds as specified in the ISO procedure 60068-2-6. This high-level shock represents a jolt of acceleration similar to the product falling on the ground or taking other substantial impact. Even during the jolt testing, the UEA design never lost contact across any of the tested circuits. In addition, UEA has conducted successful tests at ranges up to 2000 Hz, while the slip rings were under rotation.

For an 18-circuit slip ring product, UEA ran full end-of-line inspection, performed the vibration testing, and then rcompleted a full end-of-line inspection again. These tests use chatter detectors and circuitry

that will alarm if the slip ring contact is ever opened. During this testing, it was determined that a type of insulation used on a particular contact was not adequate and had worn out because of excessive abrasion between contacts, causing failure during hi-potential testing.

Because of this test, UEA was able to identify a more abrasion-resistant insulation and switched the insulation material. The end-of-line inspection and vibration tests were repeated with this new material and it was determined that this insulation change would perform well in the environment the wind turbine would be exposed to.

CONCLUSION:

Through total product vibration and shock testing, UEA has concluded that the brush design works well in vibration inductive environments and will hold up to real world environments and worst-case scenarios to ensure product longevity and consistent uptime of their applications.