Service Bulletin

Common Causes of Irregular Commutator Conditions and Brush Wear

Poor motor conditions can result in an irregular commutator surface, accelerated brush and spring wear, and cause an increased risk for flashovers. Commutator, brush, and spring degradation can be rooted in various operational or running modes or environmental factors.

Operational & Running Modes

Extended periods of in-current-limit shredding or high current, low speed operation creates excessive and instantaneous heating in the commutators of direct current motors. This high heat causes the commutator to become malleable and easily distorted. Subsequent or frequent shock loading, such as unshreddable materials, unprocessed bales/logs, or stalling may result in commutator distortion.

This distortion may be in the form of high or low commutator bars, flat spots, brush witness marks, copper drag, photographing, heavy film, or an overall oblong shape (Figures 1-5). Once distortion begins, brushes and springs may be worn irregularly and will be consumed more rapidly. The condition can ultimately cause a flashover due to a break in commutation under load.

Commutator distortion is a degrading condition that can only be fully rectified by a factory level service where the commutator is machined back into tolerance. Alternately, resurfacing the commutator in the field may be attempted. This in-field resurfacing can have marginal results and should only be used as a tactic to delay removing the motor for factory level servicing.

Figure 1: Regular shock loading from heavies or unprocessed bales or logs

Figure 2: Excessive heavy loads, high current at low RPM for long periods of time

Figure 3: Copper Drag

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Figure 4: Long periods of high current low RPM operation in addition to photographing

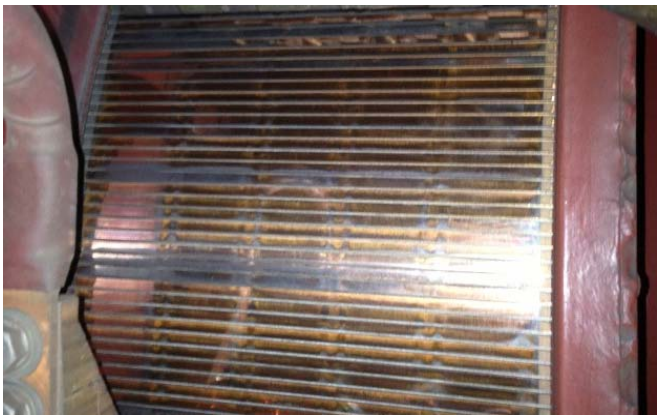

Figure 5: Frequent stalling and excessive contamination

Environmental Conditions

In addition to operating conditions, environmental factors can contribute to commutator, brush, and spring wear. Vibration severity in excess of levels set by Published Industry Standards (NEMA, IEC, ANSI, etc.) is detrimental to the commutator, brushes, and springs of a motor.

Vibration degrades spring tension, wears brushes, and causes excessive pin firing which, in turn, increases arc potential and instantaneous heating of commutator.

Often times, the first place in which excessive vibration manifests itself is at the welded joints of the blower housing or structure (Figure 6). Inspect blowers regularly to determine if harmful vibration levels are present.

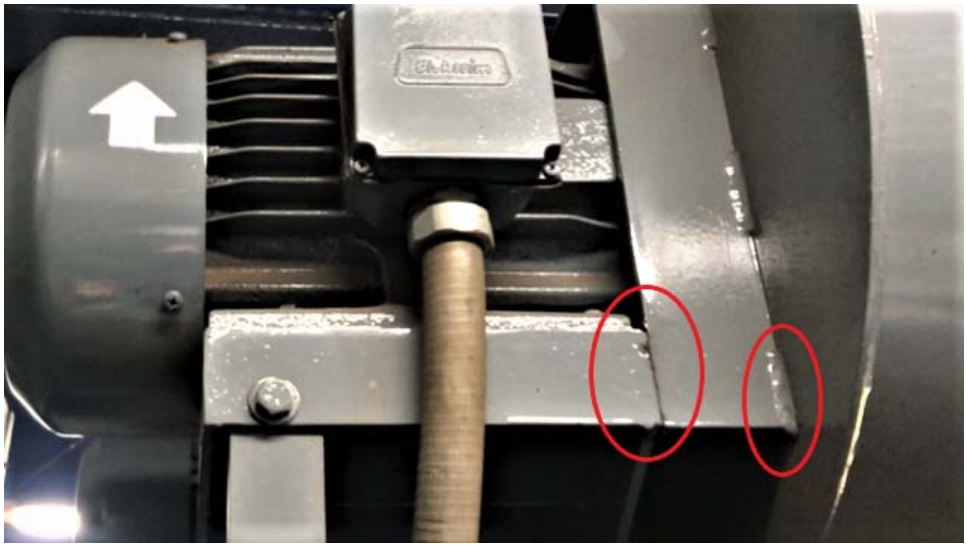

Figure 6: Cracked blower housing due to excessive vibration

Humidity or contamination in any form (i.e. particulate, oil, vapor, gases) can also adversely affect commutator and brush wear (Figures 7-8). Contaminants saturate filter media and can reduce the volumetric flow rate of cooling air through the motor. Internally, contaminants can accumulate reducing air gaps which may result in an electrical short or prevent proper cooling. Lack of adequate cooling over time reduces the serviceable life of the motor.

Furthermore, contaminants can cause the electrical insulation to break down over time resulting in decreased insulation resistance and an increased potential for an electrical failure. Specifically, gaseous contamination may create chemical reactions that adversely affect brush life or create a high resistance coating on the surface of the commutator.

Figure 7: Contamination, vibration, and copper drag

Figure 8: Threading caused by excessive humidity, contaminants, and/or low spring tension

For comparison, Figures 9, 10, and 11 are commutators in acceptable condition.

Figure 9: Acceptable condition, light film

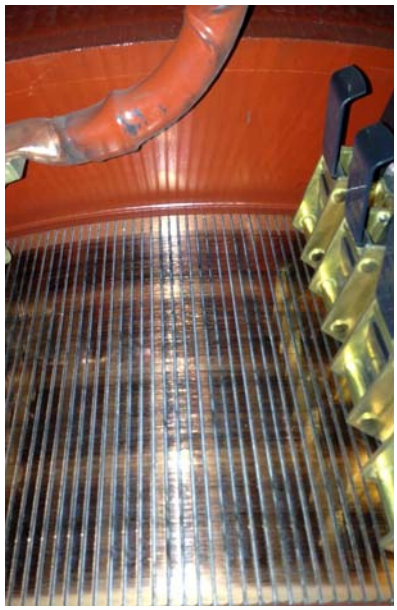

Figure 10: Acceptable condition, medium film

Figure 11: Acceptable condition, medium film

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Summary

Brief, isolated incidents of in-current-limit shredding, high current, low speed running, shock loading, or stalling are anticipated and tolerable; however, extended time in these conditions or high frequency of these events are harmful to the system. Proper material preparation, material inspection, and running the system within the designed production capabilities of the shredder are key to reliability of your shredder drive system.

The installation and maintenance of the shredder drive system are also imperative to the reliability of the system. Each compromise that is made during machine foundation design or air intake quality erodes the potential reliability of the system. Concrete motor piers (foundations) are traditionally used in shredding applications. These concrete foundations absorb and reduce vibrations induced in the motors. Other foundation methods are used within the recycling industry. These other foundation methods transmit higher vibration to the motor, often exceeding any published standards. It is imperative for owners of shredders with non-traditional foundations that vibration and mill balance be managed very carefully. Actively managing this vibration greatly reduces the possibility of creating an unacceptable commutator condition.

Air quality, air flow, and contamination must be addressed to ensure a long motor life. Changing pre-filter media as often as necessary is critical to manage motor temperatures and reduce contaminates within the motor. Sources of gaseous contamination must be identified and aggressively eliminated.

Irregular commutator conditions, accelerated brush wear, and electrical failures are often the result of some combination of factors mentioned above. *Operating the shredding system as designed and providing a quality environment for it are imperative for the reliability and longevity of the system.*

As your Engineering and Technology Partner, Quad Plus has tremendous experience with many applications and machine manufacturers. Use our experience and let Quad Plus help you improve your operation to maximize reliability and reduce unplanned downtime.