

Carbon brushes are used in various types of rotating electrical equipment. While these brushes are simple in design, they require rather narrow operating parameters to maintain optimum performance. Neglecting these parameters can lead to costly failures and forced downtime of critical machines.

During normal carbon brush operation, a film or patina is developed on the surface of the collector ring. This film is critical for allowing current transfer between the carbon brush and main field ring (also referred to as the collector ring) and provides a low friction substrate that minimizes carbon brush wear.

One of the most commonly overlooked operating parameters in carbon brushes is **current density**. For electrical equipment, current density is the amount of excitation current flowing through a given cross-sectional area of the carbon brush. If the current density is too low, the film layer is not developed on the collector ring and rapid brush wear is likely to occur (Figure 1). This condition occurs when a brush rigging is “over brushed”. If the current density is too high, the brushes can become overloaded and damage the copper brush leads (Figures 2 & 3). This condition can occur when a brush rigging is “under brushed” or there are a significant number of brushes not making a good electrical contact on the collector ring.

The optimum current density for a brush is stated by the carbon brush manufacturer. For most turbo generator applications, this current density range is approximately 40–65 amps/inch<sup>2</sup> (6.2–10 amps/cm<sup>2</sup>) but can vary slightly based on the specific carbon brush formulation.

Generator original equipment manufacturers supply the generator with enough carbon brushes to run the generator at maximum nameplate capacity. However, if the generator is normally operated at an excitation current lower than the nameplate, some brushes may need to be removed to maintain *PSIB-20200909A* proper current density. For GE customers, please refer to Product Service Information Bulletin *Carbon Brush Optimization As Per Unit Operating Profiles* for additional information.

In most cases, Cutsforth will retrofit enough brush holders and brushes to accommodate operation of the generator at the excitation current listed on the generator nameplate (i.e., “full load”). However, the customer must know their actual historical excitation current limits and may need to remove brush holders and brushes to optimize the current density.

For questions regarding current density or carbon brush holder problems, please contact Cutsforth at [support@cutsforth.com](mailto:support@cutsforth.com). For assistance calculating current density, please visit [www.cutsforth.com/calculator](http://www.cutsforth.com/calculator).

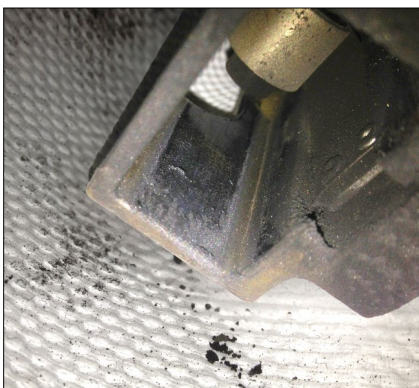
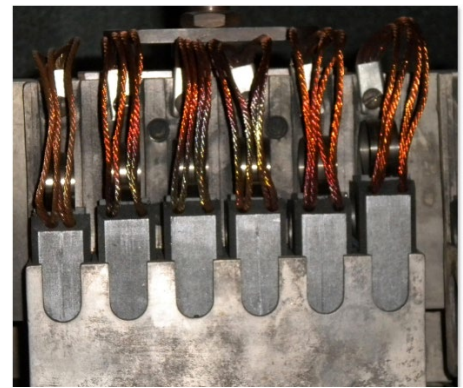


Figure 1: Excessive carbon dust – can be a result of poor film and low current density



Figures 2 & 3: Discolored Leads – result of too much current on a given brush