HELWIG CARBON
PRODUCTS, INC.

The Helwig Commutator Condition Guide

Commutator Troubleshooting

Carbon Brush Installation

Proper Commutator Film Colors

Commutator films are dynamic and are affected by current load, temperature, humidity, spring tension and contamination. Commutators exposed to seasonal changes will be particularly affected.

Light Film
Light Film is considered acceptable. Possible causes are low humidity, low temperatures, light current loads and low filming rate grade.

Medium Film
Ideal Commutator Condition
When a machine runs well, the patina/film on a commutator will be even, slightly shiny, and the color is coppery brown to dark brown.

Heavy Film
Results from high load, high humidity or heavy filming rate grades. Colors not in the brown tones indicate contamination, resulting in high friction and high resistance.

Commutator Conditions

Streaking

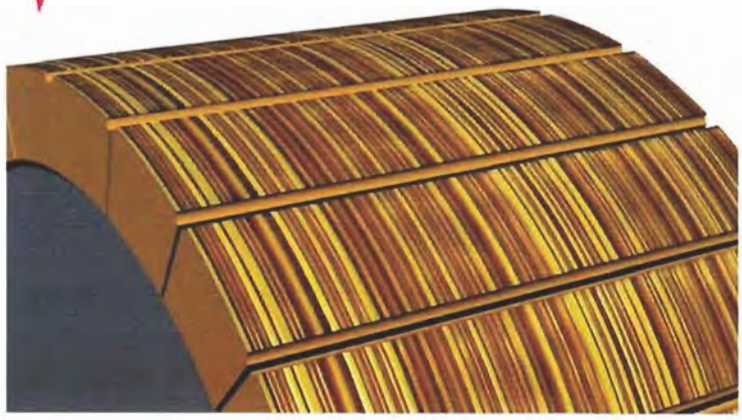
Causes

- Low or unequal spring pressure
- Low current loads
- Contaminated atmosphere
- High humidity
- Copper particle pickup from commutator

Threading

Causes

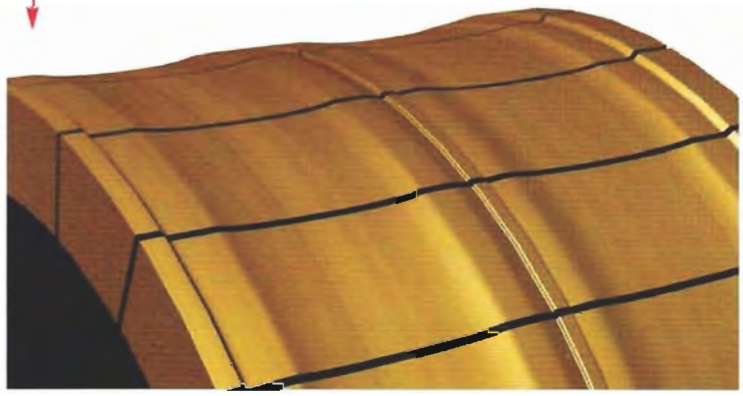
- Low or unequal spring pressure
- Low current loads
- Contaminated atmosphere
- High humidity
- Uneven current distribution
- Conditions have been maintained for a long period of time and caused commutator damage



Grooving

Causes

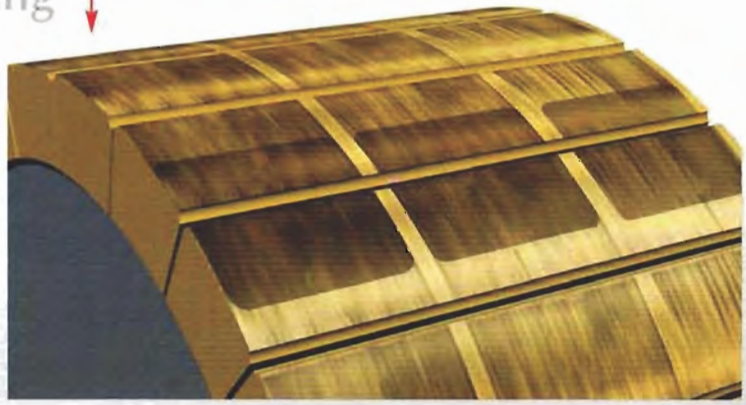
- Low or unequal spring pressure
- Contaminated atmosphere
- Low humidity and temperature
- Abrasive brush grade



Photographing

Causes

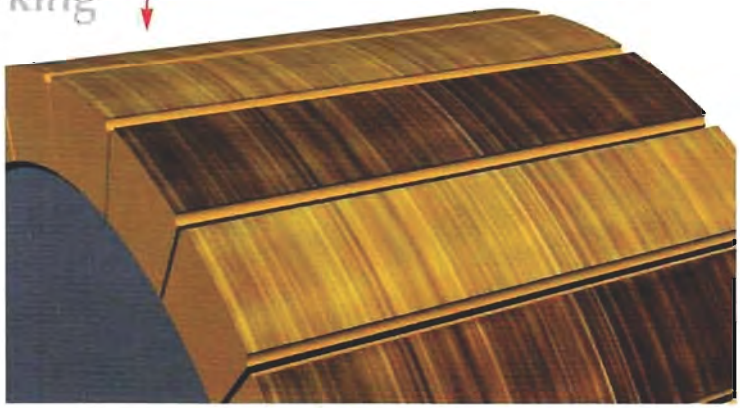
- Condensation under brush face when motor is idle.
- Caused by electrical or mechanical jolt. Results from interruption of contact or electrical spike at the same point in rotation.



Slot Bar Marking

Causes

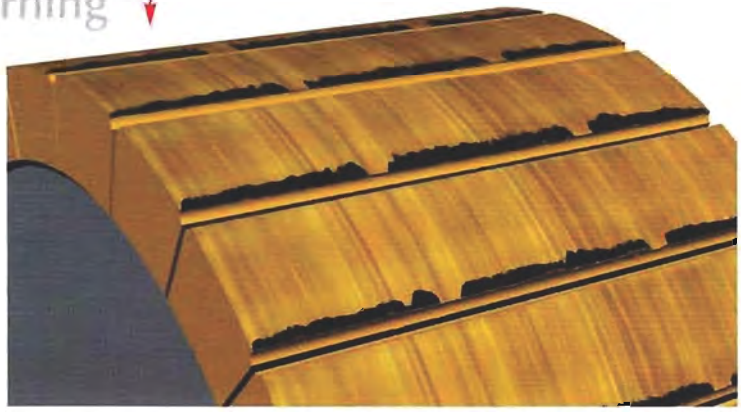
- Uneven current distribution in armature windings
- Unequal number of windings in adjacent slots
- Inconsistency in armature windings related to number of coils, slots, and commutator bars



Bar Edge Burning

Causes

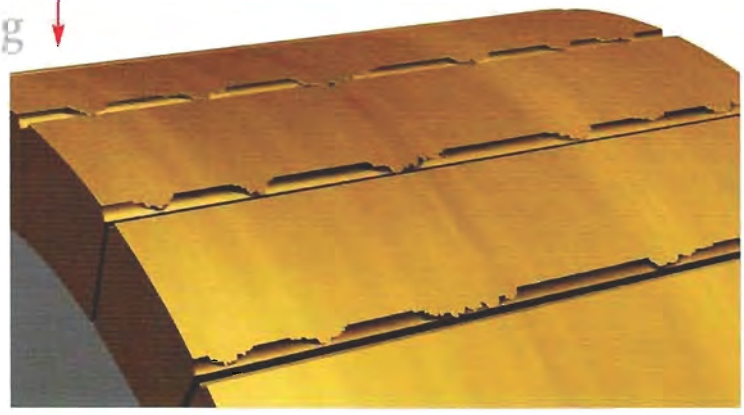
- Low or unequal spring pressure
- Incorrect brush alignment/off neutral
- Wrong brush grade
- Sparking caused by commutation problems
- Incorrect interpole strength



Copper Drag

Causes

- Low or unequal spring pressure
- Excess vibration
- Wrong brush grade
- Commutator becomes overheated and softened
- High Friction



Spring Pressure Chart

The most common cause of carbon brush failure is incorrect spring tension. Once the proper force is applied, grade selection can be fine-tuned to ensure optimum brush and machine performance. For reference, the chart below indicates the recommended ranges of spring pressure for various applications and the method of calculating spring pressure from the measured spring force.

	Spring Pressure	
Industrial D.C Applications	4-6 psi	280-420 g/cm²
WRIM & Sync. Rings	3.5-4.5 psi	240-310 g/cm²
High Speed Turbine Rings Soft Graphite Grades	2.5-3.5 psi	170-240 g/cm²
Metal Graphite Brushes	4.5-5.5 psi	310-390 g/cm²
FHP Brushes	4-7 psi	280-490 g/cm²
Traction Brushes	5-8 psi	350-560 g/cm²

For brushes with top and bottom angles greater than 25 degrees, add an extra .5-1 psi = 35-70 g/cm²

$$\text{Spring Pressure (P.S.I.)} = \frac{\text{Measured Force (lbs.)}}{\text{Brush Thickness (in.)} \times \text{Brush Width (in.)}}$$

Commutator Surface Conditions

Learn how to avoid costly motor and generator repairs and unscheduled downtime by recognizing possible problems before they cause serious damage.

Indicators of Problems

The two major indicators of possible problems are: commutator irregularities and inconsistent film formation. Compare the condition of your commutator to one of the pictures shown to determine whether you have a particular problem. Your Helwig representative and our technical staff will assist you.

Solutions

The proper solution may include:

- Increasing and equalizing spring tension. (See chart below)
- Upgrading the brush holders to the constant pressure type.
- Applying the brush grade best suited to the current load.
- Removing brushes on lightly loaded machines.
- Reconditioning of the collector including turning the commutator and/or undercutting the slots and chamfering the commutator bars

Inspections

Call your Helwig representative to inspect your motor and recommend the appropriate carbon brush grade to ensure optimum performance.

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Helwig Carbon Products

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- Sliding contacts
- Specialty products
- Press to size product line for high volume runs

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- Motor testing
- Identify, recommend and develop the best brush for your application
  - Material analysis and development
  - Material selection
  - Test samples
  - Motor testing
- On-site services
  - Plant surveys
  - In plant inventory stocking programs
  - On-site field consultations
- Sensor and diagnostic systems and equipment

Markets Served

Motor Repair & Service
Steel & Metal
Power Generation
Mining
DC Motor Manufacturers
Elevators
Paper
Railroad & Transportation
Consumer & Professional Power Tools
Lift Trucks
Off Road Vehicles
Food Processing
Automotive
Medical
Household Appliances
Any market that uses a motor

Carbon Brush

Installation Steps

1. **Disconnect the power** to the machine using approved lock-out procedures.

2. **Remove all old brushes** from the holders. Make note of any unusual conditions of the brushes including roughness or burning of the contact face, polished sides on the carbon, excess heat on the wires, or frayed shunt wires. Unusual brush conditions are indications of the need for an improved brush design or for maintenance on the machine.

3. **Inspect the commutator** for unusual conditions as described on Helwig Troubleshooting Article TA4 and for high bars and mica. Make note for required maintenance.

4. **Check the inside holder cavity** for dust, dirt, oil, deposits, carbon buildup, corrosion, or burned areas and clean as needed.

5. **Check the terminal connection** area and clean, as needed.

6. **Brush holders should be secured** to their mount and checked that none have become loosened or are out of alignment.

7. **Measure spring forces** to ensure there is consistent contact force at the recommended level. Use the measured force to calculate the spring pressure for comparison with recommended level of 4.0 + PSI.

8. **Remove the old film** from the brush tracks, if the new brushes are made from a different grade. Dry untreated canvas applied with a pressure block or a rubber abrasive. Seater stone can be used as an alternative. However, the remaining dust must be vacuumed or blown out of the machine.

9. **Install new brushes** in all holders with attention to the orientation on angled designs. Ensure that the brushes can move freely in the radial direction and that there is a relatively close fit in the tangential and axial directions.

10. **Apply the pressure spring** to the top of the brush.

11. **Pull up on the brush** and allow to gently return to contact with the commutator or ring to ensure there is no binding of the brush and spring.

12. **Connect the terminals.** Be sure all terminal connections are tight and secure.

13. **Seat the brushes** to the contour of the commutator using non-metal bearing sandpaper or garnet paper. Do NOT use emery. Medium coarse grade paper pulled under the brush face in the direction of rotation improves the quality of the brush contact surface and speeds the process. There should be at least 90% of the brush face seated to the contour of the contact surface prior to operating the machine at load. Once this level has been achieved, then the resulting dust in the machine around the brushes, holders, and commutator should be vacuumed or blown out.

14. **Operate the machine at no load** for the final wear-in contour of the contact surfaces in order to ensure complete electrical contact of the brushes. This procedure allows the brush to make intimate contact in its operating position in the holder.

15. **The machine is ready for use.** The film process on the contact surface can be enhanced with the use of an untreated hardwood burnishing block or a rubber polishing stone. This procedure can reduce the high friction and brush dust developed during the initial film forming period.

NOTE: In some cases time allotment, operating conditions, or performance issues may require the replacement of less than a full set of brushes without normal seating. Then, it is especially important to adhere to step 11 with extended operation at no-load.

Short cuts on procedures for brush installation will result in excess electrical damage to the brush face and the contact surface.

HELWIG CARBON PRODUCTS, INC.
MADE IN AMERICA

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