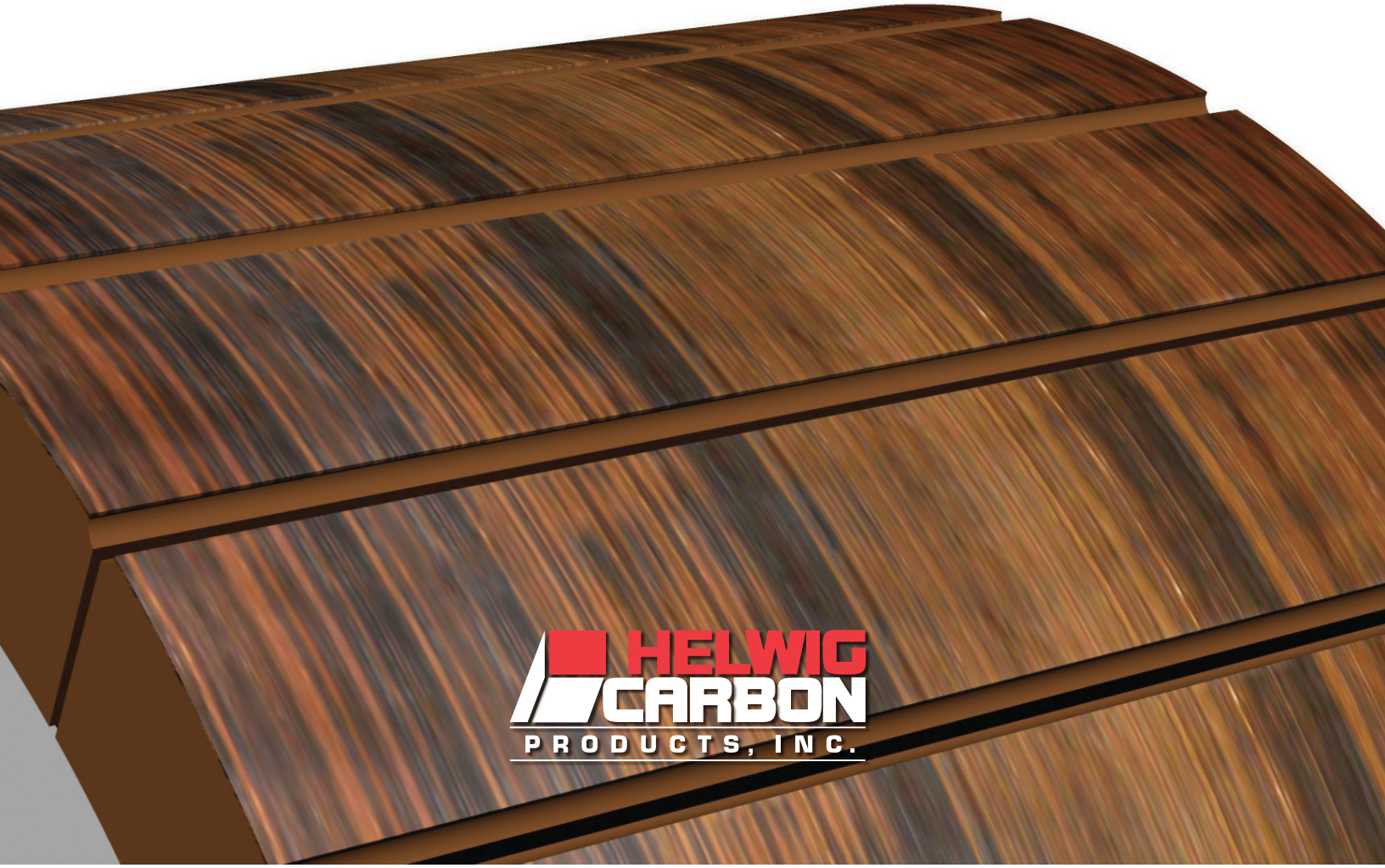
The Helwig Commutator Condition Guide

Commutator Troubleshooting & Carbon Brush Installation



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Acceptable Commutator Film

Light Film

Indicates good brush performance. Lighter color results from light current loads, low humidity conditions, film-reducing contamination, or brush grades with low filming rates.

Medium Film

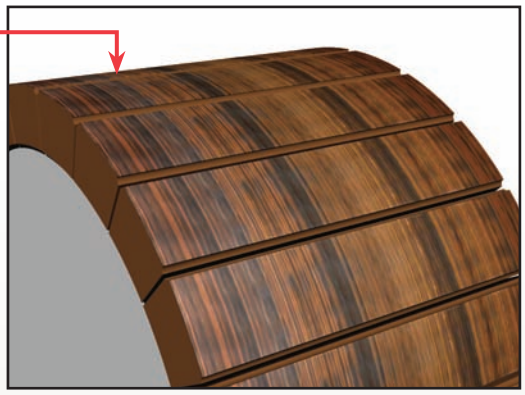
Ideal commutator condition for maximum brush and commutator life. The film will be even and the color is coppery brown to dark brown.

Heavy Film

Results from high current load, high humidity, high temperature or heavy filming grades. (Colors not in the brown tones indicate contamination, resulting in high friction and high resistance.)

Commutator Conditions

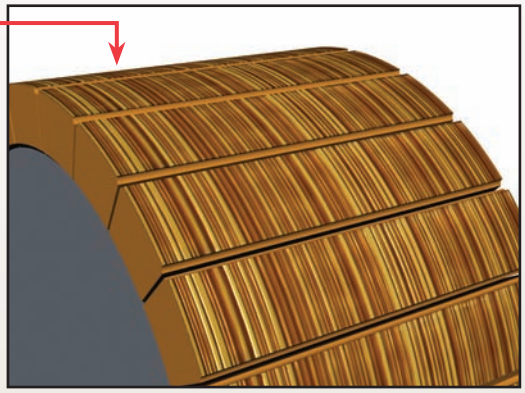
Streaking



Causes

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

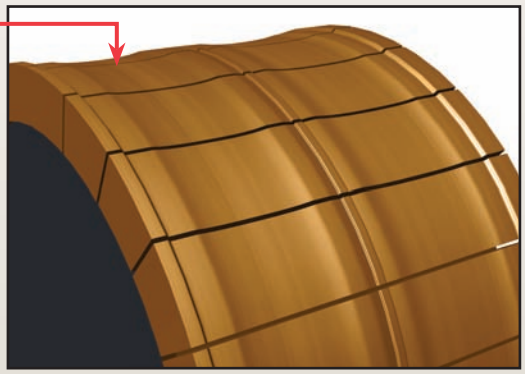
Threading



Causes

- Commutator damage from long term streaking conditions
- Low spring pressure
- Low current loads
- Contaminated atmosphere
- High humidity

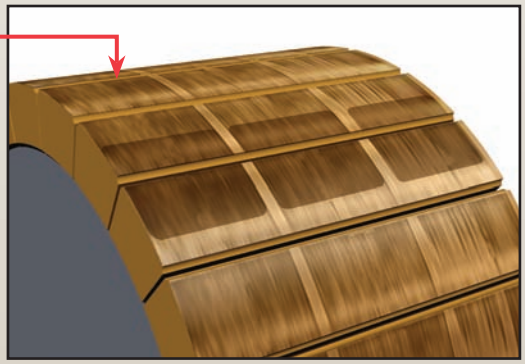
Grooving



Causes

- Arcing due to low spring pressure
- Abrasive brush grades
- Vibration
- Contaminated atmosphere
- Low humidity and temperature

Photographing



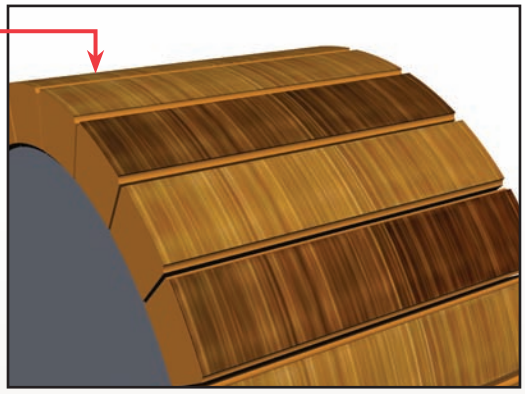
Causes

- Condensation under brush face from extended shut-down time
- A jolt on the brushes and interruption of contact or electrical spike at the same point in rotation

Slot Bar Marking

Causes

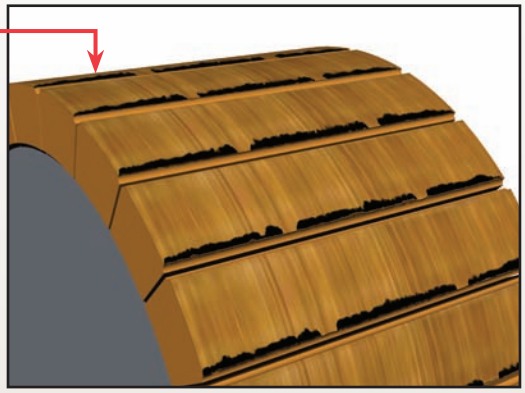
- Uneven current distribution in armature windings
- Unequal number of windings in adjacent slots
- Inconsistency in armature windings related to number of coils, slots, and commutator bars



Bar Edge Burning

Causes

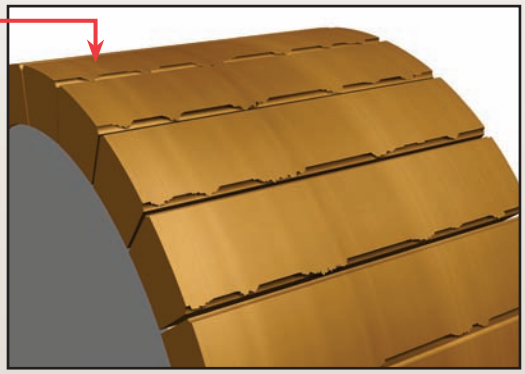
- Incorrect brush alignment/off neutral
- Incorrect interpole strength
- Inappropriate brush grade
- Low spring pressure
- Sparking caused by commutation problems



Copper Drag

Causes

- Overheating and softening of the commutator
- Low spring pressure
- High friction brush grades
- Excessive vibration



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/cm^2
WRIM & Sync. Rings	3.5-4.5 psi	240-310 g/cm^2
High Speed Turbine Rings Soft Graphite Grades	2.5-3.5 psi	170-240 g/cm^2
Metal Graphite Brushes	4.5-5.5 psi	310-390 g/cm^2
FHP Brushes	4-7 psi	280-490 g/cm^2
Traction Brushes	5-8 psi	350-560 g/cm^2

For brushes with top and bottom angles greater than 25 degrees, add an extra .5-1 psi = 35-70 g/cm^2

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

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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CARBON BRUSH
Installation Steps

Helwig Carbon Products

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- Mechanical Carbons
- Sliding contacts
- Spring assemblies
- Press to size product line for high volume runs

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- Over 2,000 in-stock brushes for same day shipping
- 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

Markets Served

- Motor & Repair Service
- Steel & Metal
- Power Generation
- Wind Power
- 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!

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 Trouble-shooting 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 levels.
8. **Remove the old film** from the brush tracks, if the new brushes are made from a different grade. Use dry, untreated canvas applied with a pressure block or a rubber abrasive. A 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 restraints, 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 14 with extended operation at no-load.

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

Call Helwig's Expert Technical Services Staff
800-962-4851

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TA4-1/2012