Satisfactory Commutator Films

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

**Medium Film**
Ideal commutator conditions 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 rate grades. (Colors not in the brown tones indicate contamination, resulting in high friction and high resistance.)

Carbon Brush Troubleshooting Guide
Welcome to Ohio Carbon Industries (OCI).

Ohio Carbon Industries is a manufacturer and distributor of a variety of carbon, graphite, and metal-graphite products, as well as materials for brush and mechanical carbon applications. While the company’s main focus centers around carbon brushes for fractional horsepower and industrial applications, OCI also sells brush holders, springs, new DC motors, and rebuilds contacts. The engineering staff at OCI has over fifty years of experience meeting the needs of customers. From small end-user and motor repair, to large OEM, OCI is honored to be of service to a wide variety of clientele.

Ohio Carbon Industries is a corporation based in Ashland, Ohio. The company has an extensive, colorful history and has seen many changes since it’s inception in Cleveland in 1915. The continued existence of the products and manufacturing capabilities is a testament to the enduring quality of it’s materials supplied to markets around the world.

Ohio Carbon Industries is a vertically integrated company utilizing multiple locations to ensure production of quality products from concept to completion. For more information, please contact our sales office at 1-888-248-5029.

Thank you for giving Ohio Carbon Industries an opportunity to serve your carbon requirements.

This booklet is a general guide of how to troubleshoot common issues relating to carbon brushes and is comprised of six sections:

Section 1. Brush Grade Information
Section 2. Brush and Commutator Trouble Chart
Section 3. Carbon Brush Troubleshooting Decision Tree
Section 4. Commutator Conditions with Pictures
Section 5. Brush Sliding Face Appearances with Pictures
Section 6. Helpful Carbon Brush Order Form

Ohio Carbon Industries has literature for other applications. Please call our sales staff if you require any of the following:

- **Vintage Fractional Horsepower Carbon Brushes** (Catalog 19G)
- **Power Tool Brush Catalog** (Catalog 20E)
- **Industrial Motor and Generator Brush Catalog** (Catalog 100A)
- **Additional Popular Fractional Horsepower Brushes** (Catalog 20G)
- **Brush Grade Selector Guide**—For engineers and application specialists (Catalog 201)
BRUSH GRADES

Brushes ordered from Ohio Carbon Industries will be made from high-quality brush materials ranging from electro-graphite to heavy metal compositions. If the same grade is not available, a comparable grade will be used. If you feel that your current brush is unsatisfactory, our engineers will gladly recommend an appropriate grade for your application.

ELECTRO-GRAFITE

Electro-graphite is the most common of motor brush materials. The composition of carbon, graphite, and appropriate binders provides for better commutation for industrial motors and generators than any other customarily used in motor brushes. Electro-graphite grades, as a rule, are harder, denser, and have longer brush life than the carbon-graphite series.

CARBON-GRAFITE

Carbon-graphite materials contain various proportions of carbon and graphite mixed with a binder, usually a coal tar pitch, molded under pressure and baked or sintered. Graphite-carbon is a variant of this, used when graphite predominates the composition. These materials are relatively strong and are higher in friction and abrasiveness than electro-graphite materials.

GRAPHITE

Graphite brushes contain graphite in a powdered form, which is mixed with a suitable binder and baked. Variations in processing make it possible to offer graphite materials with a wide variety of properties. In general, graphite brushes have comparatively low resistance and friction and are used primarily on low-voltage motors, generators, and on slip-rings.

METAL-GRAFITE

Metal-graphite grades contain 75% metal, usually copper, which is mixed with graphite. They are manufactured similarly to graphite brushes with metal powders added to the graphite and binder. Metal-graphite brushes are used primarily on slip-rings and low-voltage motors and generators.

METAL

Metal grades are composed of more than 75% metal, principally copper or alloys of copper. They are used on some types of slip-rings and also in plating generators, annealers, continuous welding machines and other applications where a large amount of current must be transferred to moving parts.
**Brush and Commutator Trouble Chart**

**DIRECTIONS FOR USE:**
Locate trouble at top of vertical columns. Possible causes can then be located by looking down the column and reading item on horizontal rows indicated. Most frequent causes are numbered 1, 2, 3 etc. Other possible causes are marked with an "X".

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
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<td>Interpole current too strong</td>
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<td>Oil and dirt on commutator, carbon dust</td>
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<td>Grains of emery in the brush running surface</td>
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<td>Vibrations of machine</td>
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<td>Unequal contact resistance between spindles-bus bar</td>
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<td>Brushes stick in the brush holders</td>
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<td>Defective holders, brush boxes too large</td>
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<td>Humidity of air too low</td>
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<td>Dusty air</td>
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<td>Corrosion from gas and acid fumes in the air</td>
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<td>Polishing action not sufficient</td>
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<td>Brush friction too strong or polishing action too strong</td>
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<td>Brushes are greased</td>
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<td>Different carbon grades in parallel</td>
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<td>Unequal brush arm spacing</td>
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<td>Mica not undercut</td>
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<td>Commutator or rings untrue</td>
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<td>Commutator lugs disconnected</td>
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<td>Loose, high or low commutator bars</td>
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<td>Flats on the commutator</td>
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Ohio Carbon Industries  1025 Faultless Drive  Ashland, Ohio 44805  888-248-5029  sales@ohiocarbon.com
Brushes sparking excessively; may be accompanied by brush chatter and/or excessive wear and chipping.

1: Is motor overloaded?  
   YES ➜ Reduce overload or install larger motor.
   NO ➜

2: Is vibration from driven machine or motor present?  
   YES ➜ Locate source of vibration and reduce.
   NO ➜

3: Check brushes and brush holders. Are brushes worn too short?  
   YES ➜ Replace brushes.
   NO ➜

4: Does each brush fit commutator as indicated by polished surface over entire brush face?  
   NO ➜ Refit brushes to commutator.
   YES ➜

5: Are brushes hanging up in holders?  
   YES ➜ Clean brushes and holders. Remove rough surfaces that cause extra friction.
   NO ➜

6: Are brush springs broken or is spring pressure too light?  
   YES ➜ Replace spring or increase pressure. Be sure pressure is equal on all brushes.
   NO ➜

7: Is spring pressure too high? (May also cause brush chipping)  
   YES ➜ Reduce pressure or replace with lighter spring.
8: Are brush holders set off neutral? (May also cause brush chipping)  
   ▶️ YES ◀  Reset holders at neutral.

9: Are brushes set a wrong angle? (May also cause brush chipping)  
   ▶️ YES ◀  Reset holders for brush angle recommended by motor manufacturer.

10: Is brush holder set for more than 1/8" clearance above commutator? (May also cause brush chipping)  
    ▶️ YES ◀  Reset holder for 1/8" clearance.

11: Chipping brushes may also indicate wrong brush material. Are brushes too weak for duty?  
    ▶️ YES ◀  Consult motor manufacturer for recommendations.

12: Check commutator. Is commutator surface under brushes polished brown color?  
    ▶️ YES ◀  Normal condition. Go to Step 18.

13: Is commutator surface black (generally caused by sparking)?  
    ▶️ YES ◀  Check for overloads, low spring tension, poorly undercut mica, loose commutator bars, etc. Correct sparking. Dress commutator.

14: Is there thick film on commutator - may appear black?  
    ▶️ YES ◀  Use more abrasive brushes.
15: Is commutator surface bright and brassy looking?  YES

16: Is commutator surface contaminated from paint spray, oil or chemical fumes? Is there excessive moisture in air?  YES

17: Is commutator streaked or grooved under one or more brushes?  YES

18: Is commutator rough or eccentric?  YES

19: Is mica above bar surface?  YES

20: Are some commutator bars too high, too low or loose?  YES

If humidity is below 2 grams per cu. ft., increase humidity OR reduce spring pressure, use low friction brushes or use less abrasive brushes.

Clean commutator and brushes and protect motor from contamination. Install motor with proper enclosure to protect commutator.

Be sure all brushes same grade. Replace if some are too abrasive. Check for faulty shunt connections causing unbalanced load; repair.

Grind commutator round. Undercut mica.

Undercut mica.

Replace commutator or tighten V-ring bolts to tension recommended by manufacturer and grind commutator.
21: Are there flat or burned spots on commutator bars caused by unbalanced load in armature circuit?  
   NO  →  YES  Balanced load. Grind commutator.
   NO  →  YES  Undercut mica.

22: Is conductive film carbon dust or copper flaking causing shorts between armature bars?  
   NO  →  YES  Locate and repair.

23: Are there any shorts or opens in armature circuits?  
   NO  →  YES  Locate and repair.

24: Are there any grounds, shorts or opens in the field wiring circuits?  
   NO  →  YES  Locate and repair.

25: Are connections to brush holder poor or broken?  
   NO  →  YES  Locate and repair.

26: Is the interpole current weak or the air gap too great?  
   NO  →  YES  Increase interpole current or reduce gap.
Ohio Carbon Industries

Commutator Conditions

GROOVING

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

PHOTOGRAPHING

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

THREADING

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

STREAKING

Causes:
- Copper particle pickup from commutator
- Low current loads
- Low spring pressure
- Contaminated atmosphere
- High humidity
**Ohio Carbon Industries**

**Commutator Conditions**

---

**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
- High friction brush grades
- Low spring pressure
- Excessive vibration

---

**ACCEPTABLE COMMUTATOR FILM**

- **Light Film**: Indicates good brush grade performance. Lighter color results from light current loads, low humidity conditions, film-reducing contamination or brush grades with low filming rate.

- **Medium Film**: Ideal commutator conditions 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 rate grades. (Colors not in the brown tones indicate contamination, resulting in high friction and high resistance.)

---

1025 Faultless Drive  Ashland, Ohio 44805  888-248-5029  sales@ohiocarbon.com
The following images show different brush sliding faces for comparison. The first three photos indicate satisfactory sliding faces, where no mechanical or electrical problems exist. The balance of photos show different conditions and the typical cause is listed.

<table>
<thead>
<tr>
<th>Sliding Face</th>
<th>Condition</th>
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<tbody>
<tr>
<td>Dense, Shiny Sliding Face</td>
<td>Normal Operation</td>
</tr>
<tr>
<td>Slight Porous Sliding Face</td>
<td>Normal Operation</td>
</tr>
<tr>
<td>Fine Hairlining</td>
<td>Normal Operation—slight dust influence</td>
</tr>
<tr>
<td>Hairlining</td>
<td>Causes: Underload, influence of dust, oil or grease</td>
</tr>
<tr>
<td>Tracking with Hairlining and Grooves</td>
<td>Causes: Similar to hairlining above, but stronger</td>
</tr>
<tr>
<td>Ghostmarks, Difficult Commutation</td>
<td>Causes: Communication problems, such as false or incorrect position of the neutral zone or interpole</td>
</tr>
</tbody>
</table>
Burning Edge of the Leaving or Trailing Edge
Causes: Difficult commutation, heavy sparking, interruption of contact due to out of round commutator or insufficient brush holder spring pressure

Eroded Brush Face
Causes: Electrical overload, interruption of contact

Lamination of Sliding Face
Causes: Burned segments of the sliding face caused by a winding fault giving a voltage surge during commutation

Double Facing—Twin Brush
Causes: Tilting of the brush in dual direction machine

Copper Nests
Causes: Pick up of copper particles, often following copper drag

Broken Edges
Causes: High raised lamination, commutator seriously out of round, brush chatter by low load and idle running
## REQUIRED ORDERING INFORMATION

The following information should be gathered before placing an order. The ordering process will be much faster and we can efficiently serve your needs.

<table>
<thead>
<tr>
<th>Drawing Reference Number:</th>
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<tbody>
<tr>
<td>Application:</td>
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<tr>
<td>Motor Frame:</td>
<td>RPM'S</td>
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<tr>
<td>Motor Model:</td>
<td>Voits:</td>
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<tr>
<td>Motor Type:</td>
<td>Amps:</td>
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<td>Motor Style:</td>
<td>Kilowatts:</td>
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### DIMENSIONS

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<tr>
<td>Width:</td>
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<tr>
<td>Thickness:</td>
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<tr>
<td>Wire Length:</td>
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<tr>
<td>Size and Type of Terminal Aperture:</td>
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<tr>
<td>Angle of Bevels (If any)</td>
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</tbody>
</table>
  (Use angle picture on Brush Definition Page if necessary) |
| Other Special Features: |  |
| Any Writing on Part: |  |
| Part Number – If Available: |  |

**Important to fill out information below**

### SPRING

<table>
<thead>
<tr>
<th>O.D. (outside diameter):</th>
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<tbody>
<tr>
<td>Free Length:</td>
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<tr>
<td>Wire Diameter:</td>
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<td>No. Active Coils:</td>
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<td>No. Closed Coils:</td>
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<tr>
<td>LBS. – OZS. at</td>
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</table>

### Diagram

- A
- B
- C
- D
- Round Cap. Dia.
- Wire Diameter
- Free Length
- O.D.
- Closed Coils

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