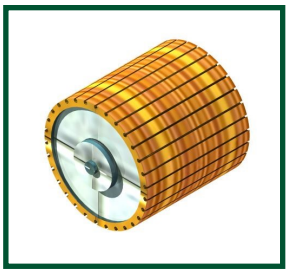
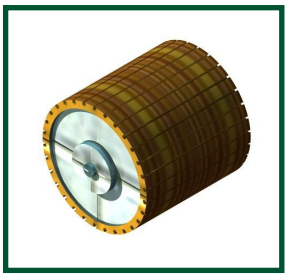
Ohio Carbon Industries

SATISFACTORY COMMUTATOR FILMS



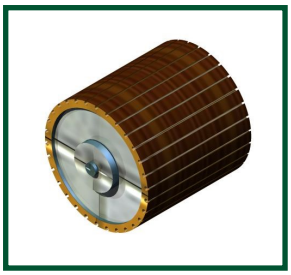
Light Film

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

1025 Faultless Drive Ashland, OH 44805 888-248-5029 419-496-4453 (fax) sales@ohiocarbon.com

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-GRAPHITE

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-GRAPHITE

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 GRAPHITE

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".

	Sparking or burnt trailing edge	Sparking or burnt leading edge	Green pin sparks	Sparking around the commutator	Brushes chatter, chip, break	Excessive brush wear, good commutation	Unequal brush wear or current distribution	Shunts burned off or welded	Excessive commutator wear, surface black	Excessive commutator wear, surface bright	Ridges and grooves on commutator	Commutator has unsymmetrical spots	Commutator has symmetrical spots	Commutator/rings and brushes too hot	Pitted brush contact surfaces	Commutator streaky
Incorrect position of brush holder arms	1	1	1		X		X					1		3	4	
Interpole air-gap too small		6	4													
Interpole air-gap too large	5		5													
Interpole current too strong		2	2													
Interpole current too weak	2		3													
Oil and dirt on commutator, carbon dust				2	X	X						X		X		
Grains of emery in the brush running surface					X	X	X			X	3					
Overload of machine	X	X				1	X	1	1			X		X	X	
Vibration of machine	4	5				3										
Armature winding faulty	X	X										X	1			
Unequal contact resistance between spindles-bus bar	X	X					X	X							X	
Brushes stick in the brush holders	X	X					X	3							X	
Defective holders, brush boxes too large	X	X			X											
Some loose brush circuit connections	X	X					X	X	X		X				X	
Brush holder too far from commutator	X	X			X											
Humidity of air too high	6				2	X		X				X		X	X	
Humidity of air too low					3											
Dusty air						X					2					
Corrosion from gas and acid fumes in the air	7					X	X	X				X		X	X	
Incorrect spring tension	X	3			X	X	1	2	2	1	1	X		2	2	2
Polishing action not sufficient	X			X			2	4				2	2		1	1
Brush friction too strong or polishing action too strong	X				1				3	2	4			1		
Brushes are greased	X			X								X				
Different carbon grades in parallel							X	X				X			X	
Brush shunt faulty					X		X	X								
Unequal brush arm spacing	X	X				X						X				
Mica not undercut	X			1	X	2	X		4			X		X	3	
Commutator or rings untrue	3	4			X	X						X				
Commutator lugs disconnected	X	X										X	X			
Loose, high or low commutator bars	X	X							X				X		X	
Flats on the commutator	X	X							X				X		X	

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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 to high? (May also cause brush chipping)	YES →	Reduce pressure or replace with lighter spring.

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NO

8: Are brush holders set off neutral? (May also cause brush chipping) → YES → Reset holders at neutral.

NO

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

NO

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.

NO

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

NO

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

NO

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.

YES

14: Is there thick film on commutator - may appear black? → YES → Use more abrasive brushes.

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NO

15: Is commutator surface bright and brassy looking? — 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.

NO

16: Is commutator surface contaminated from paint spray, oil or chemical fumes? Is there excessive moisture in air? — YES → Clean commutator and brushes and protect motor from contamination. Install motor with proper enclosure to protect commutator.

NO

17: Is commutator streaked or grooved under one or more brushes? — YES → Be sure all brushes same grade. Replace if some are too abrasive. Check for faulty shunt connections causing unbalanced load; repair.

NO

18: Is commutator rough or eccentric? — YES → Grind commutator round Undercut mica

NO

19: Is mica above bar surface? — YES → Undercut mica.

NO

20: Are some commutator bars too high, too low or lose? — YES → Replace commutator or tighten V-ring bolts to tension recommended by manufacturer and grind commutator.

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NO

21: Are there flat or burned spots on commutator bars caused by unbalanced load in armature circuit? ■YES➡ Balanced load. Grind commutator.

NO

22: Is conductive film carbon dust or copper flaking causing shorts between armature bars? ■YES➡ Undercut mica.

NO

23: Are there any shorts or opens in armature circuits? ■YES➡ Locate and repair.

NO

24: Are there any grounds, shorts or opens in the field wiring circuits? ■YES➡ Locate and repair.

NO

25: Are connections to brush holder poor or broken? ■YES➡ Locate and repair.

NO

26: Is the interpole current weak or the air gap too great? ■YES➡ Increase interpole current or reduce gap.

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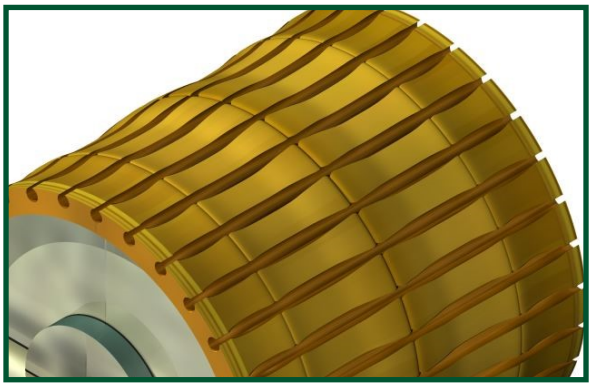
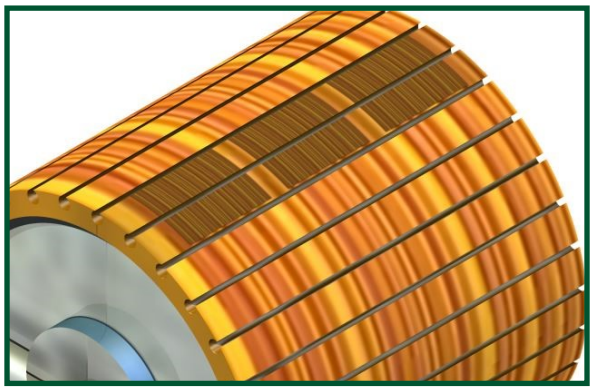
Commutator Conditions



GROOVING

Causes:

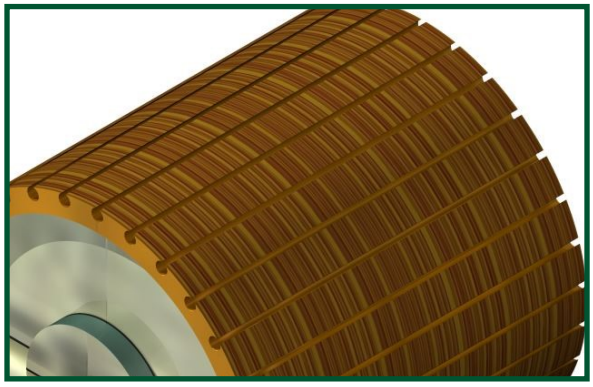
- Arcing due to low spring pressure
- Abrasive brush grades
- Low humidity and temperature
- Contaminated atmosphere
- Vibration



PHOTOGRAPHING

Causes:

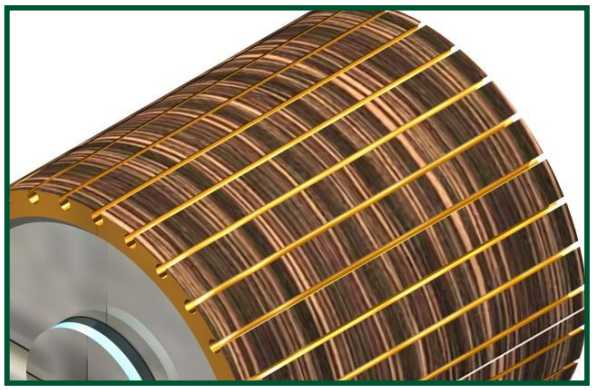
- Condensation under brush face from extended shutdown time
- A jolt on the brushes and interruption of contact or electrical spike at the same point in rotation



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

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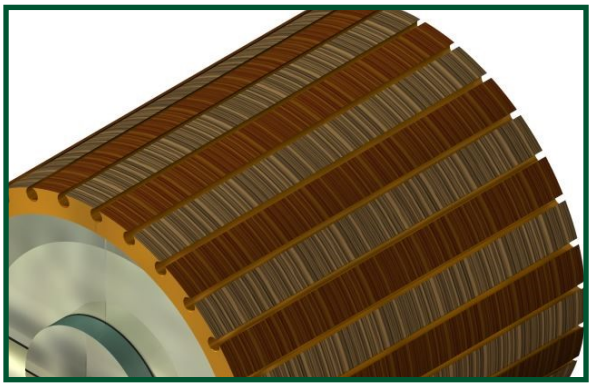
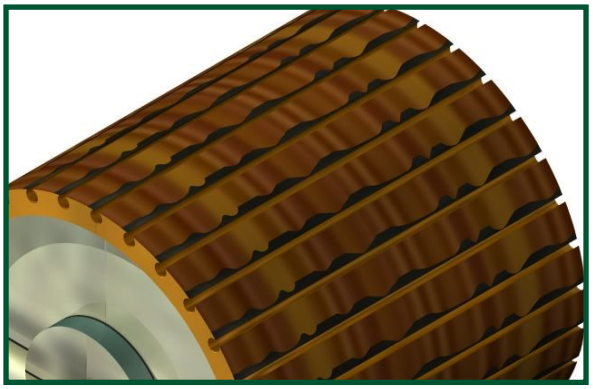
Commutator Conditions



SLOT BAR MARKING

Causes:

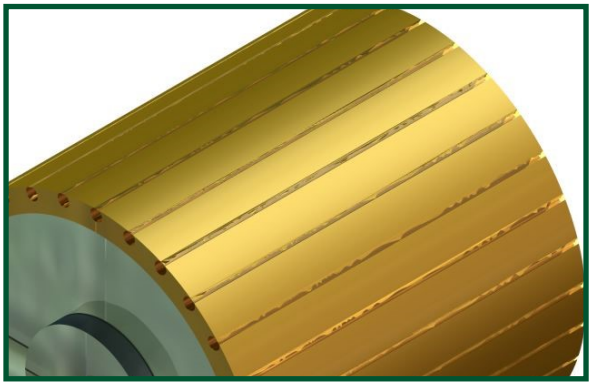
- Uneven current distribution in armature windings
- Unequal number of windings in adjacent slots
- Inconsistency in armature windings related to number of coils, slots and commutator bars



BAR EDGE BURNING

Causes:

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

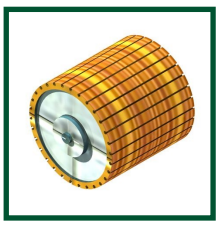


COPPER DRAG

Causes:

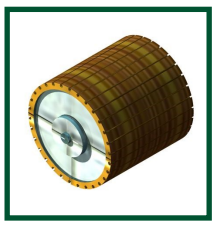
- Overheating and softening of the commutator
- High friction brush grades
- Low spring pressure
- Excessive vibration

ACCEPTABLE COMMUTATOR FILM



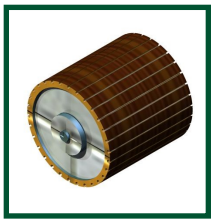
Light Film

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.)

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Brush Sliding Face Appearance

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.

Dense, Shiny Sliding Face
Normal Operation

Slight Porous Sliding Face
Normal Operation

Fine Hairlining
Normal Operation—slight dust influence

Hairlining
Causes: Underload, influence of dust, oil or grease

Tracking with Hairlining and Grooves
Causes: Similar to hairlining above, but stronger

Ghostmarks, Difficult Commutation
Causes: Communication problems, such as false or incorrect position of the neutral zone or interpole

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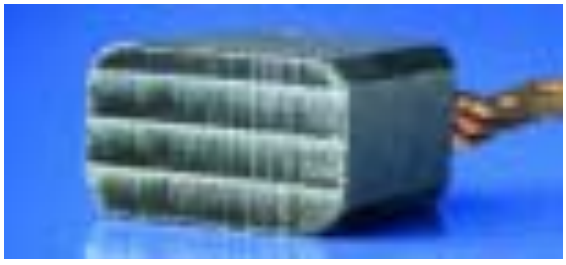
Brush Sliding Face Appearance

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

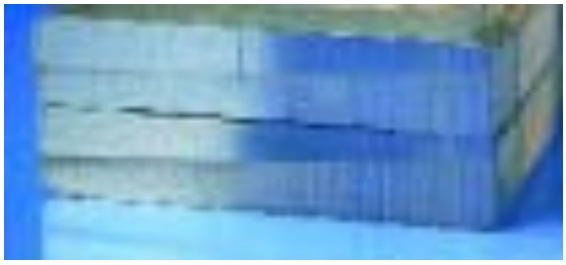
Eroded Brush Face

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.

Drawing Reference Number: _____

Application: _____

Motor Frame: _____ RPM'S _____

Motor Model: _____ Volts: _____

Motor Type: _____ Amps: _____

Motor Style: _____ Kilowatts: _____

DIMENSIONS

Length: _____

Width: _____

Thickness: _____

Wire Length: _____

Size and Type of Terminal Aperture: _____

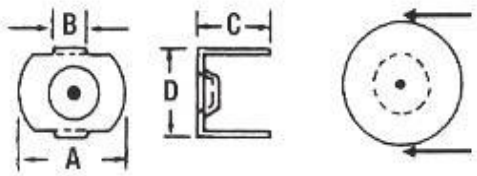
Angle of Bevels (If any) _____
(Use angle picture on Brush Definition Page if necessary)

Other Special Features: _____

Any Writing on Part: _____

Part Number – If Available: _____

Important to fill out information below



A _____

B _____

C _____

D _____

Round Cap. Dia.

_____

SPRING

O.D. (outside diameter): _____

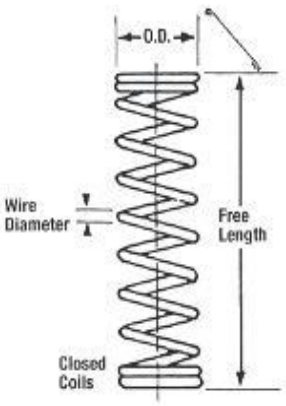
Free Length: _____

Wire Diameter: _____

No. Active Coils: _____

No. Closed Coils: _____

_____ LBS. – OZS. at _____



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