



Morgan Advanced Materials (Group)

Established in 1856
A global advanced materials company
Headquartered in Windsor, United Kingdom
Listed on the London Stock Exchange

Morgan AM&T(Shanghai) Co.,Ltd.

Morgan AM&T(Shanghai) Co.,Ltd. Established in 1992 Joint venture between Morgan Advanced Materials plc. and Shanghai Prime Machinery Co., Ltd.

What differentiates us?

Advanced materials science and processing capabilities Extensive applications engineering experience Consistent and reliable performance A strong history of innovation and reinvention A truly global footprint You can contact us or our authorized distributor through the following channels:

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Morgan 1856

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We specialize
in addressing various motor
application challenges
in the automotive and consumer fields.



By understanding the specific needs of automobile and consumption sectors, as well as the opportunities and challenges faced in the industry, Morgan is committed to provide professional solutions to improve motor performance and prolong its service life. Based on hundreds of years' experience on material science and application practice, complete team of experts and service system, we provide our world-renowned partners in automobiles, electric tools, and household appliances with carbon brushes and components suitable for various motor applications, and customized solutions in accordance with customer needs.



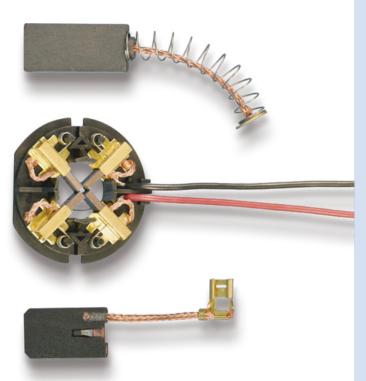
Morgan Applied Materials Classification

Grade	Description	Contact drop	Friction coefficient	Applications
MH Epoxy resin bonded	High contact and outstanding commutating ability	Medium to very high	Very low	120V&230V tools with low current density & home appliance with high speed
MF Phenolic resin bonding type	Low resistivity with capability to withstand a wide range of current density	Medium	Low	Lower than 120V AC&DC motor & home appliance with high current density and BEV motor
CH Electrographite type	High thermal and electrical conductivity; has good strength and filming properties, very resistant to effects of electrical discharges	Low	Low	120V professional tools with high current density
MG Metal graphite type	Low resistivity to cover high current, low voltage applications.	Low	Medium to high	12V&24V DC motors, automotive motors, portable appliances; 120V&230V DC motors with high current density
MP Asphalt bonding type	High contact resistance without using a resin binder, less affected by sparking and overloading	Medium to high	Medium to high	120V&230V professional tools with medium to high current density



Carbon brush for automobile and consumption applications

Morgan carbon brush has become an industry model by virtue of reliable performance that relies on its scientific research experience over 160 years in carbon and graphite materials, its global operation network, advanced testing equipment and instruments, and rich material knowledge and application experience. Aiming at their characteristics and application conditions of motors in different industries such as automobiles, electric tools, and household appliances, Morgan can provide customized overall solutions to help customers reduce total costs and improve motors' overall performance.



Product features:

- Reliable material performance
- Unique and exclusive formula
- Excellent product compatibility
- Good commutation performance
- Stable ability to suppress spark
- Nice noise resolution

Main advantages:

- A century's professional experience in manufacture and application of carbon brushes
- Advanced R&D and design ability
- Complete manufacturing equipment and operation capability
- Advanced test facility and detecting instruments
- Professional technical team and global application support
- Complete service system and quick response support
- Customized according to customers' specific needs

Benefits to customers:

- An excellent overall solution
- Timely pre-sales and post-sales services
- Professional technical applications support



Performance Recommendation Form of Carbon Brush for Household Appliances

	Grade	Resistivity $\mu\Omega m$	Bending strength MPa	Shore hardness	Density	Contact voltage drop	Friction coefficient	Rated current density A/cm²	Allowable circumferential speed m/s	Typical applications
	MG1032	0.15	44.0	22	4.18	L	L	45	30	1.8-7.2V shaver, smart door lock
	MG1033	0.10	66.0	23	4.30	L	L	45	30	I.8-7.2V shaver, smart door lock
	MG958	0.08	50.5	20	3.74	L	L	45	30	3V-9V robotic vaccum
	MG950	0.22	40.9	19	3.47	L	L	40	30	3V-9V robotic vaccum
	MG1043	0.65	34.0	23	2.92	L	L	40	30	12-18V cordless hair dryer
Personal Care and Smart Home	MG970	1.65	21.0	23	2.35	L	L	20	30	18-24V cordless hair dryer
omare riome	MF904	28.0	24.5	32	1.75	L	L	13	35	I 20V hair dryer
	MF900	165	17.5	30	1.62	L	L	13	35	100V motor for massage chair
	MH908	350	25.0	25	1.70	М	VL	12	50	I 20V hair dryer
	MH981	900	19.6	23	1.56	М	VL	12	50	I20V/240V hair dryer
	MH906	1522	13.6	22	1.41	Н	VL	9	50	I 20V/240V hair dryer
	MP900J	940	18.0	35	2.00	М	L	13	30	220V hair dryer, I20V/240V hand dryer
	MG910	0.59	25.2	23	3.17	L	L	40	30	9-14V cordless vacuum cleaner
	MG972	0.53	24.8	23	2.65	L	L	30	30	14-18V cordless vacuum cleaner/floor brush
Floor Care	MG953	1.29	21.4	23	2.41	L	L	35	30	18-24V cordless vacuum cleaner/floor brush
	MG986	2.59	17.2	18	2.32	L	L	25	30	18-24V cordless vacuum cleaner/floor brush
	MG931A	31.3	23.8	30	2.13	L	L	25	30	18-36V cordless vacuum cleaner

Friction coefficient								
Very Low	≪0.10							
Low	0.10~0.22							
Medium	0.22~0.40							
High	≥0.40							
	Very Low Low Medium							

Contact voltage drop								
Low	0.8~I.3V							
Medium	1.3~2.3V							
High	2.3~3.6V							
Very High	≥3.6V							

Quality assurance

Morgan took the lead in passing the ISO9001:2015 quality system certification in the electric carbon industry in China, ensuring that the production process conforms to international quality and safety standards.

The product technical parameters are subject to change without prior notice. Please consult the sales representative for the specifications of actual shipment.

The user takes sole charge of the safe use of the product as the actual use conditions of the product are beyond the control of Morgan Advanced Materials (Shanghai) Co., Ltd. This product manual has no legal effect, nor is it regarded as any patent invention license or suggestion under the condition of no license. It is only for reference, research and verification.

Performance Recommendation For	rm of Carbon Brush f	for Household Appliances
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	Grade	Resistivity $\mu\Omega \mathrm{m}$	Bending strength MPa	Shore hardness	Density	Contact voltage drop	Friction coefficient	Rated current density A/cm²	Allowable circumferential speed m/s	Recommended applications
	MH927	330	30.0	22	1.59	М	VL	12	50	I 20V vacuum cleaner
Floor	MH907	460	25.5	22	1.65	М	VL	13	50	I 20V vacuum cleaner
Care	MH931	505	26.2	22	1.65	М	VL	12	50	I 20V vacuum cleaner
	MH981	900	19.6	23	1.56	М	VL	12	50	I 20V/240V vacuum cleaner
	MH917	1100	19.6	22	1.52	Н	VL	12	50	I 20V/240V vacuum cleaner
	MH906	1522	13.6	22	1.41	Н	VL	9	50	I 20V/240V vacuum cleaner
	MG916	126	25.7	20	2.01	L	L	13	40	120V/240V high-voltage DC appliances
	MF900	165	17.5	30	1.62	L	L	13	35	I 20V blender
	MH901	194	29.0	30	1.75	L	VL	13	40	I 20V blender
	MH927	330	30.0	22	1.59	М	VL	12	50	120V vacuum cleaner
Kitchen appliances	MH908	350	25.0	25	1.70	М	VL	12	50	120V blender/high speed blender
	MH905	781	15.0	22	1.45	М	VL	12	50	I 20V blender
	MH900	1400	22.0	23	1.56	Н	VL	10	50	I 20V blender
	MH906	1522	13.6	22	1.41	Н	VL	9	50	I 20V blender
	MP954	1470	25.4	32	1.88	Н	L	12	25	220V high-voltage DC blender
	MP949	1900	18.0	26	1.51	Н	L	12	30	230V blender with E-brake





Performance Recommendation Form for Carbon Brushes of Electric Tools

	Grade	Resistivity $\mu\Omega \mathrm{m}$	Bending strength MPa	Shore hardness	Density	Contact voltage drop	Friction coefficient	Rated current density A/cm²	Allowable circumferential speed m/s	Recommended applications
	MG958	0.08	50.5	20	3.74	L	L	45	30	3-9V DC cordless electric tools, DC motors
	MG910	0.59	25.2	23	3.17	L	L	40	30	9-14V DC cordless electric tools
	MG945	1.13	20.2	23	2.89	L	L	40	30	9-14V DC cordless electric tools
	MG972	0.53	24.8	23	2.65	L	L	30	30	14-18V DC cordless electric tools
	MG953	1.29	21.4	23	2.41	L	L	35	30	18-24V DC cordless electric tools
	MG986	2.59	17.2	18	2.32	L	L	25	30	18-24V DC cordless electric tools
Power	MG931A	31.3	23.8	30	2.13	L	L	25	30	36-60V DC cordless electric tools
tool drill	CH937	68.0	30.0	70	1.64	L	L	15	40	I I OV drill, hammer drill, impact drill
	MF900	165	17.5	30	1.62	L	L	13	35	I I OV drill, impact drill, hammer drill
	MH955	1500	11.8	20	1.42	Н	VL	9	50	230V impact drill
	MH906	1522	13.6	22	1.41	Н	VL	9	50	230V drill, impact drill
	MP900	940	18.0	35	2.00	М	L	13	25	230V drill, impact drill, hammer drill
	MP933D	1100	20.0	26	1.68	Н	L	12	30	230V drill
	MP946F	1200	16.4	23	1.66	Н	L	12	30	230V impact drill, electric screwdriver
	MP916B	2100	18.0	26	1.50	Н	L	10	25	230V drill, impact drill, hammer drill
	MP945D	2200	8.0	18	1.53	Н	L	10	25	230V impact drill



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Performance	Recommendation	Form for	Carbon	Brushas of	f Flactric Tools
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	Grade	Resistivity $\mu\Omega m$	Bending strength MPa	Shore hardness	Density	Contact voltage drop	Friction coefficient	Rated current density A/cm²	Allowable circumferential speed m/s	Recommended applications
	MG958	0.08	50.5	20	3.74	L	L	45	30	3-9V DC cordless power tool
	MG910	0.59	25.2	23	3.17	L	L	40	30	9-14V DC cordless power tools
	MG945	1.13	20.2	23	2.89	L	L	40	30	14-18V DC cordless power tools
Garden	MG972	0.53	24.8	23	2.65	L	L	30	30	14-18V DC cordless power tools
electric tools	MG953	1.29	21.4	23	2.41	L	L	35	30	18-24V DC cordless power tools
	MG986	2.59	17.2	18	2.32	L	L	25	30	18-24V DC cordless power tools
	MG931A	31.3	23.8	30	2.13	L	L	25	30	36-60V DC cordless power tools
	MF907	23.0	26.0	32	1.73	L	L	13	35	60-110V DC brush cutter, lawn mower
	MF900	165	17.5	30	1.62	L	L	13	35	110V brush cutter, hedge trimmer, lawn mower, chain saw
	MP903	760	20.0	34	1.57	М	L	13	25	230V chain saw, jig saw
	CH940	66.0	15.8	50	1.60	L	VL	15	40	110V angle grinder, polishing machine
	MF904	28.0	24.5	32	1.75	L	L	13	35	110V belt sander, sander
	MH917	1100	19.6	22	1.52	Н	VL	12	50	110V belt sander, 230V angle grinder and polisher
	MH955	1500	11.8	20	1.42	Н	VL	9	50	120V/230V angle grinder
Power tool grinder	MP903	760	20.0	34	1.57	М	L	13	25	230V belt sander, chain saw, jig saw, I 10V/230V electric circular saw, cutting machine
g. maci	MP911	810	22.0	34	1.66	М	L	13	30	110V/230V angle grinder and polisher, 230V belt sander and polisher
	MP902	980	21.0	34	1.62	М	L	12	25	230V angle grinder, polishing machine
	MP933D	1100	20.0	26	1.68	Н	L	12	30	230V belt sander, grinder, angle grinder
	MP946F	1200	16.4	23	1.66	Н	L	12	30	230V angle grinder
	MP958X	1838	12.8	24	1.63	Н	L	12	30	230V angle grinder
	MP949	1900	18.0	26	1.51	Н	L	12	30	230V angle grinder

arformanca	Recommenda	tion Form	for Carbon I	Bruchae of	Flectric Tools

	Grade	Resistivity	Bending strength	Shore hardness	Density	Contact voltage drop	Friction coefficient	Rated current density	Allowable circumferential speed	Recommended applications
		μΩm	MPa		g/cm³	V		A/cm ²	m/s	
	MG958	0.08	50.5	20	3.74	L	L	45	30	3-9V DC cordless power tool
	MG910	0.59	25.2	23	3.17	L	L	40	30	9-14V DC cordless power tools
	MG945	1.13	20.2	23	2.89	L	L	40	30	14-18V DC cordless power tools
	MG972	0.53	24.8	23	2.65	L	L	30	30	14-18V DC cordless power tools
	MG953	1.29	21.4	23	2.41	L	L	35	30	18-24V DC cordless power tools
Power tool	MG970	1.65	21.0	23	2.35	L	L	20	30	18-24V DC cordless power tools
saw	MG986	2.59	17.2	18	2.32	L	L	25	30	18-24V DC cordless power tools
	MG931A	31.3	23.8	30	2.13	L	L	25	30	36-60V DC cordless power tools
	CH940	66.0	15.8	50	1.60	L	VL	15	40	110V circular saw and cutting machine
	MH917	1100	19.6	22	1.52	Н	VL	12	50	110V saw
	MP903	760	20.0	34	1.57	М	L	13	25	230V jig saw, I I OV/230V electric circular saw, cutting
	MP911	810	22.0	34	1.66	М	L	13	30	110V circular saw and cutting machine
	MP946F	1200	16.4	23	1.66	Н	L	12	30	230V circular saw
	MP958X	1838	12.8	24	1.63	Н	L	12	30	230V profiles cutting machine
	MP916B	2100	18.0	26	1.50	Н	L	10	25	230V circular saw
	MH907	460	25.5	22	1.65	М	VL	13	50	110V jetting machine, air compressor
	MH910	700	14.0	22	1.50	М	VL	12	50	110V air compressor
	MH929	1400	14.2	22	1.45	Н	VL	12	50	230V air compressor
High-pressure washer/air compressor/other	MH906	1522	13.6	22	1.41	Н	VL	9	50	230V air compressor/jetting machine
tools	MP951X	240	21.6	24	1.76	L	L	12	30	I I OV air compressor
	MP946F	1200	16.4	23	1.66	Н	L	12	30	230V jetting machine
	MP958X	1838	12.8	24	1.63	Н	L	12	30	230V jetting machine







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Performance Recommendation For	m of Automobile Carbon Brush
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									Allowable			
	Grade			Shore hardness	Density	Contact voltage drop	Friction coefficient	Rated current density	Allowable circumferential speed	Recommended applications		
		μΩm	MPa		g/cm ³	٧		A/cm ²	m/s			
Heating ventilation and air conditioning	MG902	0.89	21.0	24	2.57	L	L	35	30	12V blower motor		
	MG936	1.03	21.6	24	2.62	L	L	35	30	12V blower motor		
	MG977	1.15	22.0	23	2.62	L	VL	35	30	12V blower motor		
	MG900	1.79	21.9	22	2.50	L	L	25	30	24V blower motor		
	MG948	2.06	15.6	20	2.55	L	VL	35	30	24V low noise blower motor		
	MG983	2.14	14.9	18	2.67	L	VL	30	30	12V/24V low noise blower motor		
	MG933	33 2.56		22	2.48	L	L	25	30	24V heater/air blower motor		
	MG926	0.41	29.7	23	3.02	L	L	40	30	12V engine cooling fan motor		
Engine cooling	MG902	0.89	21.0	24	2.57	L	L	35	30	12V engine cooling fan motor		
fan motor	MG936	1.03	21.6	24	2.62	L	L	35	30	12V engine cooling fan motor		
	MG933	2.56	22.7	22	2.48	L	L	25	30	12V engine cooling fan motor		
	MG950	0.22	40.9	19	3.47	L	L	40	30	12V stretching oil pump		
DC =	MG903	0.46	44.3	19	3.41	L	L	40	30	12V stretching oil pump		
DC pump motor	MG901	0.51	44.0	22	3.75	L	L	40	30	12V stretching oil pump		
	MG923 GT	0.56	22.2	10	5.38	L	L	45	30	12V stretching oil pump		
	MG900	1.79	21.9	22	2.50	L	L	25	30	24V/48V DC pump, swimming pool washer		





Performance Recommendation Form of Automobile Carbon Brush

	Grade	Resistivity $\mu\Omega m$	Bending strength MPa	Shore hardness	Density	Contact voltage drop	Coefficient of Friction	Rated current density A/cm²	Allowable circumferential speed m/s	Recommended applications
Alternator	MG942	1.72	33.8	24	2.62	L	L	30	30	12-24V alternator
7 iteritator	CH935	20	34.0	60	1.63	L	L	18	30	Long life of 24V alternator
	MG950	0.22	40.9	19	3.47	L	L	40	30	12V starter, motorcycle starter
Starter	MG903	0.46	44.3	19	3.41	L	L	40	30	24V Starter
Starter	MG901	0.51	44.0	22	3.75	L	L	40	30	12V starter, snowmobile starter
	MG955	0.80	30.0	22	3.45	L	L	35	30	12V Starter
Fuel pump motor	MF910 GT	50.0	13.0	19	2.00	L	VL	15	35	12V Fuel pump motor
ABS	MG926	0.41	29.7	23	3.02	L	L	40	30	12V ABS motor
motor	MG977	1.15	22.0	23	2.62	L	VL	35	30	12V ABS motor
	MG911	2.04	32.6	23	2.90	L	L	30	40	48-72V electric vehicle motor, traction motor
Motor of new-energy	CH935	20.0	34.0	60	1.63	L	L	18	30	48V BSG starter generator
vehicles	MF907	23.0	26.0	32	1.73	L	L	13	35	24-100V BEV motor
	CH937	68.0	30.0	70	1.64	L	L	15	40	72-100V BEV motor
	MG926	0.41	29.7	23	3.02	L	L	40	30	12V window-lift motor
Other motor	MG948	2.06	15.6	20	2.55	L	VL	35	30	12V brake vacuum booster motor
applications	MG983	2.14	14.9	18	2.67	L	VL	30	30	12V wiper motor, sunroof motor
	MG1004	2.85	30.0	23	2.45	L	L	25	30	24V wheelchair motor



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Surface appearance of brushes



Smooth Polished Surface (S1)

This indicates good performance. However, if the polish is mirror-like(glazed), high frequency chatter due to low current may be the cause. Check the side-faces of the brush for signs of vibration.



Burnt Edges (S7)

Normally occurs on the trailing edge of the brush. Caused by poor commutation and heavy sparking.



Patina

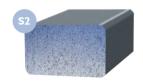
Light Film (P1)

Over the entire commutator surface is one of the many normal conditions often seen on a well-functioning machine. Film tone is dependent on the brush grade and current density.



Bar Burning (P7)

Is the erosion of the trailing edge of the commutator bar. Failed machine components, maladjusted electrical symmetry of the machine or a poor commutating brush can result in bar burning. If not corrected, this condition can cause severe commutator damage or a flashover.



Open Textured Surface (\$2)

This, again, indicates that brush performance is satisfactory. Actual appearance will depend on the type of grade.



Pitted Surface (S8)

Indicates heavy under-brush sparking as a result of current overload or brush instability.



Patina Dark (P2)

Good condition. Film can be light to dark in colour but the important feature is that it is uniform and even. Normally, a good film will have a slightly polished appearance.



Slot Bar Burning (P8)

Results in commutator erosion of every second, third, or fourth bar depending on the winding design of the armature. Improper brush material, brush design or electrical ad justment of the machine can cause this condition. This condition severely damages the commutator and reduces brush life.



Finely Lined Surface (S3)

Another satisfactory condition. Fine lines indicate the presence of dust in the atmosphere. This may be overcome by the use of filters or ducting the machine's air supply from another area.



Laminated Surface (S9)

This is an unusual condition caused by an armature winding fault giving rise to poor commutation.



Blotchy Film (P3)

This non-uniform filming condition is the most common appearance. The accumulated tolerances in the machine such as commutator roundness, brush contact pressure, unequal magnetic fields and chemical vapors all contribute to this type of film development.



Patina Streaked Without Collector Wear (P9)

A streaky film with no commutator wear, tracks can vary in width and colour. Caused by atmospheric conditions (humidity, oil vapour or other gases) or insufficient load.



Finely Serrated Surface (S4)

This is a further development of (S3) above. The causes are normally atmospheric contamination or lack of load current.



Double-bedded Surface (S10)

This occurs as a result of brush tilting on a reversing machine, i.e. the brush beds itself in both directions of rotation. In itself this does not give any cause for concern.



Slot Bar Filming (P4)

Repeating light and dark filming patterns related to the number of armature coils per slot. This pattern is dependent on the machine design and usually not a function of the brush grade.



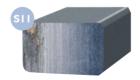
Grooving (P10)

Is the uniform circumferential wear, the width of the brush, that is exhibited on the commutator. Excessive abrasive dust in the atmosphere or an abrasive brush can cause this condition. Extreme light spring pressure (below 1.5 psi) can also cause this condition. Proper brush applications and filtering the air on force ventilated motors can reduce the commutator wear.



Heavy Serrated Surface (S5)

As (4) above, but problem is more severe or has been allowed to continue longer.



Copper Particles (SII)

Copper pick-up from commutator surface can result from copper drag problems or heavy peak loads. Can cause further commutator wear.



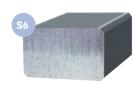
Streaking (P5)

Of only the film is not detrimental to the commutator. Brush and commutator life are not at risk in this condition. If metal transfer develops, this condition will progress into threading. This type of filming can be dependent on current density or brush grade.



Copper Drag (PII)

Occurs when high energy transfers copper in a molten state. These particles become coated by contaminants from the surrounding environment and do not oxidize properly to form the film on the commutator surface. These particles accumulate at the edge of the bar, eventually shorting across the insulating mica. This condition needs to be addressed immediately when discovered or serious damage may occur.



Ghost Marked Surface (S6)

This may be associated with difficult commutation and can arise from incorrect neutral position, interpole problems or other causes of poor commutation.



Chipped Edges (S12)

Normally occurs on the leading (entering) edge of the brush. breakage can result from poor commutator profile, high micas and severe brush instability.



Bright Spots (P6)

Bright spots in the film suggest poor contact or overloading.

The resultant under-brush sparking tends to destroy the patina and will eventually erode the commutator.

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Chart of common difficulties on rotating electrical machines

Note: Collector means slip ring or commutator

	SYMPTOM																			SYMPTOM
М	Serration and grooving of collector																			Wear of slip ring on one polarity
L	Excessive collector wear-surface blackened																			Copper picking in brush face
K	Copper dragging																			Brush chatter
J	Excessive collector wear or slip ring wear-bright surface																			Collector surface streaky
1	Unequal brush wear																			Collector has unsymmetrical burn marks
Н	Rapid brush wear- while commutation good																			Collector has symmetrical burn marks
G	Flexible burnt out or discoloured																			Collector has wavy pattern
F	Brushes and brush holders too hot																			Ghost marks on steel slip rings
E	Collector-slip ring-too hot																			Glazed contact surface of brush
D	Sparking vicious and trailing around collector																			Pitted contact surface of brush
С	Green in sparks																			Chipping of brush edges or brush breakage
В	Sparking at entering edge																			Failure to develop a protective skin
Α	Sparking at leaving edg																			Insufficient voltage on self exciting machines
	Probable Cause Of Trouble	_		D	E F	G	+ 1	JK	L M	N	0	P Q	R	S T	U	V	N X	Y	Z	Remedy
1	Interpole field too strong		x x								X			X			x			Weaken interpole by divert or by increase gap
2	Interpole field too weak	х	х			ш		х			×			x						Strengthen interpole fields by reducing air gap
3	Interpole air gap too small		х х			Ш					×			×			×			Enlarge air gap to decrease effective interpole flux
4	Interpole air gap too large	х	х			ш		x			x		ш	x						Reduce air gap to increase effective interpole gap
5	Air gaps uneven (bearings worn?)	х	×				×				×			×			×			Renew bearings and realign machine
6	Overload machine	х)	x x	х	x	x			×			x			x			Reduce and limit load on machine
7	Vibration from external causes, i.e. Prime mover: Nearby forge hammer etc	х					x x	x	x	x	×	x		x x	×	x	x	×	x	Locate and remove cause of vibration or mount machine on shock absorbers
8	Vibration from internal causes, i.e. out of balance, poor alignment etc	х					x x	x	х	х	×			x x	×	х		×	х	Balance armature and check for bearing wear
9	Quasi electrolytic wear of slip ring									x					×					Reverse the polarity of rings periodically
10	Oil and dirt on collector						x x		×			×	×					x	x	Clean collector
11	Resistance between brushes and brush arms not uniform				х		x x							x			x		×	Clean and tighten the connections
12	Grains of abrasive in brush contact face						×	Y	x									Y		Re-bed and clean the brush face
13		х		v			^	^	^				х	v			v	^	х	
	Faults in armature winding or equaliser connections				^								_	^						Locate and cure fault or consult manufacturer
14	Mica proud	х	х	×					X		X	x	х				x x	X		Recess mica, or use more abrasive brush
15	Collector eccentric	х					x		х х	X	x	x	х	х					х	Turn or re grind preferably at near rated speed
16	Collector riser connections open circuited	х	х х	X										X					х	Re-solder connections
17	High or low collector segments	х	x						х			x	x				×			Tighten collector, turn, or re-grind
18	Collector loose	х	x	×					х		x	x x	×	х			х			Tighten collector, re-mica if necessary,turn or re-grind
19	Flats on collector	х	x x						х		x	x					x x			Locate and remove cause of flattening, turn or re-grind
20	Spring pressure too low	х)	x x	х	x x	x x	х х	х	x	x x	×	x		x	×	х	х	Adjust spring pressure to that recommended for brush grade
21	Spring pressure too high)	x x		×	x x	x									×		Adjust spring pressure to that recommended for brush grade
22	Spring pressure unequal	х			×	х	х	х			×	x x	x	х			x	x		Adjust spring pressure uniformly to that recommended for brush grade
23	Brush grade unsuitable for machine duty	х		x x	х х		×	х х	x x	х		x		×		х	x x	x		Select one of our alternative grades or ask for our recommendation
24	Brush arc of contact excessive	х	x x								×			x			x			Reduce the effective thickness of brush, preferably consult manufacturer
25	Brush arc of contact insufficient	х	х х					х			x			x						Apply suitable circumferential stagger, preferably consult manufacturer
26	Brush flexible connection faulty					x	x												x	Fit a new brush with a sound flexible connection
27	Brush flexible too short or too stiff	х			x	x	×							x					x	Use brushes with flexible of correct length & flexibility
28	Imperfect brush bedding in	x	×		x		x					×						×	х	Bed brushes by our recommended method
29	Radial brush holders mounted at small reaction angle	x	×		x x		x	x	x	x		x	x	Y		x	Y		x	Adjust holders to a radial position, & correct distance from comm
30	Reaction type holder mounted trailing	x			x x		x	x	×	×		×		×		x			x	Reverse holders or direction of rotation
	Brush sticking or sluggish in brush holder				× ×			^	^	^		^ _				^	_ ^	^	X	
31		х	^		^	х	x x		*		^	^	х	X					^	Check that brush size is correct, clean brushes and holders, remove any burrs Replace holders, or order brushes of correct dimension
32	Brushes too loose in brush holder(holders worn?)				х		х					x		х		х	Х	x		·
33	Terminal connections loose or dirty			,	x x	Х	х					x	Ш						Х	Clean terminals and terminal block. Tighten screws
34	Brush holder mounted too far from collector						х		х	x		x x	х			х		×		Adjust holder to be 3mm from collector
35	Incorrect brush position		х х			Ш			x		×		Ш	×	×		×		х	Adjust holders to correct position
36	Unequal brush holder spacing or alignment	х	х х	×		х	х				×		ш	x			×			Correct spacing and alignment of holders
37	Humidity of atmosphere low						×		х			×					x	×		Humidify the cooling air or draw air from normal humidity source
38	Humidity of atmosphere excessive								х			×	x		×					Enclose machine or draw cooling air from normal humidity source
39	Dusty atmosphere						×	×	x									×		Remove cause if possible or install filter
	Gas or acid fumes in atmosphere					х	x		x			×	×		×		x	×	х	Arrange clean air cooling
40																				

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