Morgan
Advanced Materials

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:

SALES/CUSTOMER SERVICE:
021-64343350 Ext 691
chinasales@morganplc.com

DISTRIBUTOR POLICY:
021-64343350 Ext 260
ecchina.channel@morganplc.com

ANTI-COUNTERFEITING ISSUES:
ecchina.antifake@morganplc.com

OTHER SUGGESTIONS:
ecchina.suggestions@morganplc.com

OFFICIAL WECHAT ACCOUNT:
Morgan1856

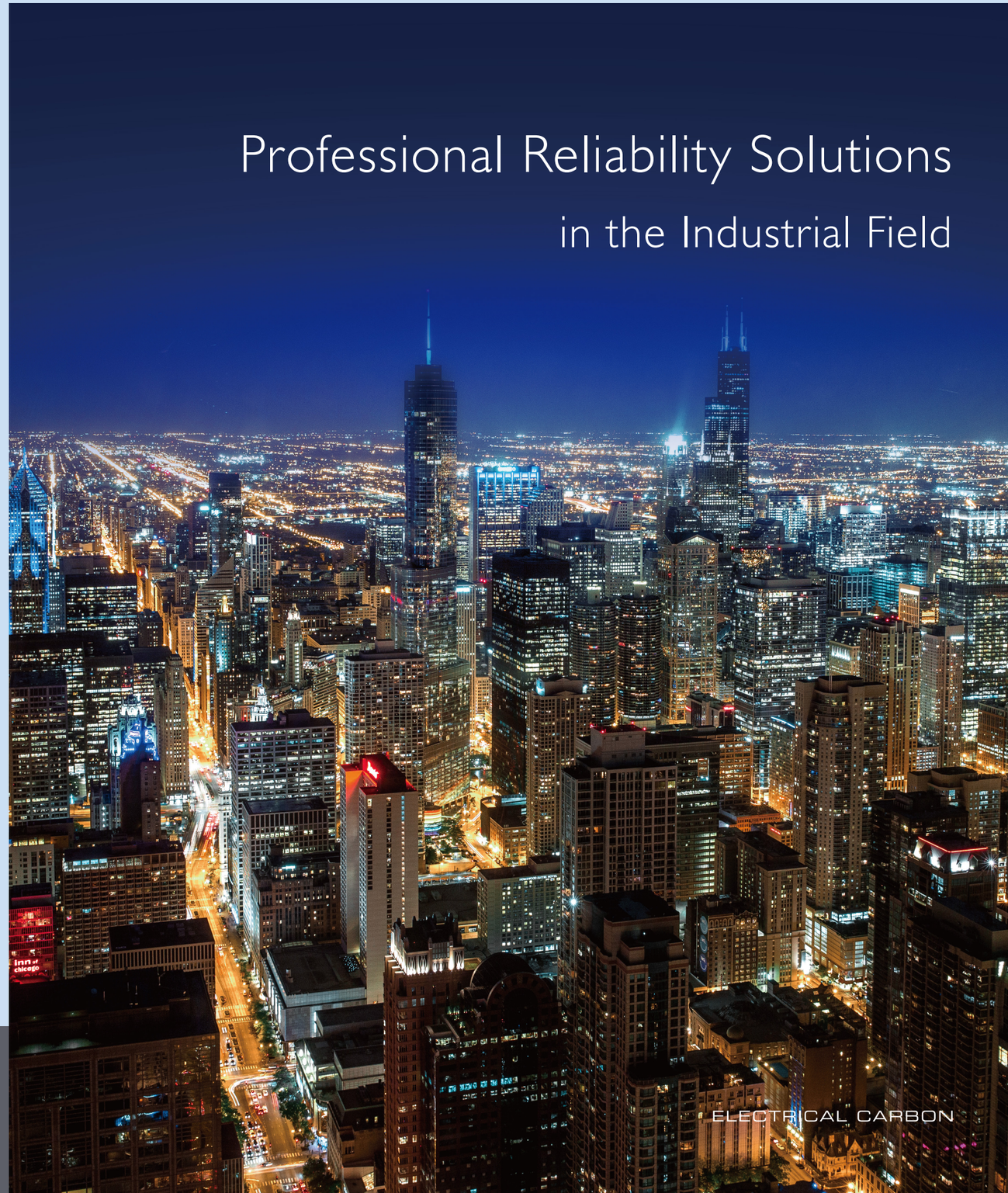
ONLINE FLAGSHIP STORE:
https://morgancarbon.1688.com

Morgan AM&T(Shanghai) Co., Ltd.
No. 4250, Longwu Road, Minhang District, Shanghai, China

www.morganelectricalmaterials.com
www.morganadvancedmaterials.com

Morgan
Advanced Materials

Professional Reliability Solutions in the Industrial Field



Morgan
Advanced Materials

Professional reliability solutions
Achieve better operation performance
Adapt to all kinds
of harsh working conditions

Contents

More Professional Solutions

Morgan is committed to provide professional and reliable solutions by understanding the specific needs of all sectors in the industry, this will improve motor running time and reduce maintenance costs. Our foundation is built on 160 years of experience in material science and application engineering with professional teams and service system covering the whole world. We supply customers with various products (including special application carbon brushes, brush holders and assembly) which cater for different working condition and environment based on the application experience of actual operation of motors.

More reliable operation performance

It is most important to choose a type of material formula which can form a stable oxide film between the carbon brush and commutator under specific working conditions. Because this layer of oxide film can extend the service life of the carbon brush, protect the commutator surface and reduce its wear. Carbon brush grades of Morgan are customized and developed in accordance with various complex environments, which can achieve more reliable operation performance under different load conditions. With unique materials and processes, our carbon brushes achieve better technical performance and become industry models. Hereinto, NCC634® and T900 are regarded as global gold standards by power plants and mining industry.

Morgan's professional engineering services and production bases are all over the world

Carbon brush products and solutions can be customized in accordance with your needs

No matter where you are, we promise to deliver on time

Application of carbon brushes in industry/power industry

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. Morgan can provide customized solutions to cater for different industrial characteristics and application conditions.

Choosing the right carbon brush material based on your application conditions can reduce the wear of commutator and extend the service life of carbon brush, which is also the decisive factor of the generator operation performance. Our application engineers can help you choose the correct carbon brush grade and make special design based on your needs. You can also select materials that meet your specific needs for different application conditions with reference to our selection chart.

Product features:

- Reliable performance through unique formula
- With stable patina forming ability, low friction can be achieved
- With stronger spark suppression ability, minimal carbon brush wear can be achieved
- With smaller wear differential between carbon brushes, more stable performance can be achieved

Main advantages:

- Over a century of professional experience in manufacture and application of carbon brushes
- Advanced R&D and design capabilities
- Independent and complete overall production process
- Technical and application support of a global expert team
- Different carbon brush grade to cater for various complex working conditions
- Can be customized according to the specific needs of customers

Benefits to customers:

- A better overall solution
- Less commutator wear
- Less motor repair

Morgan
Advanced Materials

Industrial Carbon Brush Grade Recommended by Morgan

Grade	Resistivity μΩm	Bending strength MPa	Coefficient of Friction	Rated current density A/cm2	Allowable circumferential speed m/s	Product features:
NCC634	17.8	7.5	L	10	81	It is suitable for high power turbine generator and includes advantages of high current distribution uniformity during high-speed running and extremely low impurity content. There won't be abnormal heating of brushes and slip rings due to overloaded individual brushes. This guarantees low brush wear.
D	12.7	29.0	L	12.4	50	It is suitable for slip rings of hydroelectric generator. Low coefficient of friction can be obtained by using electrographite base material with special treatment, excellent wear performance can be obtained under variable rotating speed conditions, and short-time current impact when starting and stopping can also be withstood.
N48	71.0	22.0	L	15.5	51	It is suitable for traction motor and steel rolling motor of cement rotary kiln. It has excellent ability to suppress sparks, special formula and treatment to obtain a lower coefficient of friction. It has excellent rideability, especially suitable for motors with commutation difficulty and short-term overload.
T573	65.0	21.4	L	12.5	35	It is suitable for traction motor and steel rolling motor. The special treatment method enable the material to have higher resistivity and relatively higher flexural strength, and the excellent mechanical performance makes it more suitable for the working conditions with large vibration and impact of the motor.
T900	51.0	31.0	M	12.5	40	It is suitable for DC traction motor of mining. The formula is specially designed for applications with large variable load span and large working environment change. With special after-treatment, it can obtain stable carbon brush performance, ultra-long service life and anti-pollution ability, especially suitable for mining machinery and other applications with complex and changeable load and environment.

Definition of coefficient of friction		
H	High	Above 0.4
M	Medium	0.22 - 0.4
L	Low	Below 0.22

Beware of imitations

Counterfeit and shoddy products will not only cause direct economic losses to you and the company, but also immeasurable damage and safety hazards to machinery and equipment!
Therefore, we remind you to identify Morgan's trademarks and products and choose proper channels.
Please be wary of products with "too low" prices, beware of similar trademarks or grades, scan the code on the goods upon arrival, and beware of imitations!

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.

Disclaimer

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.

Recommendation of Carbon Brush Grade for Application Industry

	Grade	Resistivity μΩm	Flexural strength MPa	Coefficient of Friction	Rated current density A/cm2	Allowable circumferential speed m/s	Main application
Hydropower generation	**D**	12.7	29.0	L	12.4	50	Slip rings of hydroelectric generator
	CH17	14.0	14.0	L	12	50	Slip rings of small hydroelectric generator
Steam turbine generation	**NCC634**	17.8	7.5	L	10	81	It is suitable for slip rings of turbine generators with high power
	S27	21.0	13.5	M	10	70	It is suitable for slip rings of steam turbine generators with low power
Steel	**N48**	71.0	22.0	L	15.5	51	Traction motor and steel rolling motor, as well as motor with commutation difficulty
	T573	65.0	21.4	L	12.5	35	Traction motor and steel rolling motor
	SA40	64.0	15.0	L	15	41	Steel rolling motor with good performance of commutation
	N19	60.5	26.5	L	12.4	41	Low current density traction motor and steel rolling motor
	D374N	62.0	18.0	L	12	50	General traction motor and steel rolling motor
Cement	**N48**	71.0	22.0	L	15.5	51	Rotary kiln motor, which is suitable for motor with commutation difficulty
	T573	65.0	21.4	L	12.5	35	Rotary kiln motor
	D374N	62.0	18.0	L	12	50	Rotary kiln motor with good performance of commutation
	D374B	61.0	18.0	M	12	50	Rotary kiln motor
Mining	**N6000**	60.0	13.8	L	15.5	41	DC traction motor, which is suitable for application environment with large load span or large humidity range
	T500	76.0	13.8	L	12.4	41	Heavy duty loader motor
	T583	55.0	28.2	L	12.4	30	Cooling air blower motor
	T825	63.5	29.0	L	12.4	51	DC traction motor
	T900	51.0	31.0	M	12.5	40	DC traction motor
	CH17	14.0	14.0	L	12	50	General DC motor, generator

* Please consult Morgan sales team for any grade or customized development

Definition of coefficient of friction

H	High	Above 0.4
M	Medium	0.22 - 0.4
L	Low	Below 0.22



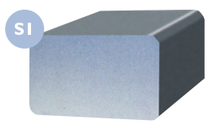

Morgan Advanced Materials

Recommendation of More Industrial Carbon Brush Grades

Grade	Resistivity μΩm	Flexural strength MPa	Coefficient of Friction	Rated current density A/cm2	Allowable circumferential speed m/s	Main application
TA45	66.0	11.7	L	12.4	51	Low current density DC motor
T900	51.0	31.0	M	12.5	40	DC traction motor
T825	63.5	29.0	L	12.4	51	DC traction motor
T573	65.0	21.4	L	12.5	35	Traction motor and steel rolling motor
SA40	64.0	15.0	L	15	41	Steel rolling motor with good performance of commutation
N6000	60.0	13.8	L	15.5	41	DC traction motor, which is suitable for application environment with large load span or large humidity change
N48	71.0	22.0	L	15.5	51	Traction motor, steel rolling motor and rotary kiln motor, which is suitable for motor with difficult commutation
NI9	60.5	26.5	L	12.4	41	Low current density DC motor
D376N	64.0	17.0	L	12	50	General locomotive traction motor, main generator, steel rolling motor, general AC motor and DC motor
D374N	62.0	18.0	L	12	50	General locomotive traction motor, main generator, general AC motor and DC motor
D374B	61.0	18.0	M	12	50	General locomotive traction motor, main generator, general AC motor and DC motor
D308	46.0	26.0	M	10	40	120 - 440V DC motor
D252	18.0	27.0	M	12	45	Slip rings of 110V DC motor and AC motor
D214	28.0	27.0	M	10	40	General DC motor
DI72	13.0	14.0	L	12	50	Slip rings of steam turbine generator and small-medium DC motor
D104	10.0	12.0	L	12	40	Slip rings of 80 - 120V DC motor and AC motor, and DC welding machine
CH36N	64.0	17.0	L	12	50	General locomotive traction motor, main generator, steel rolling motor, general AC motor and DC motor
CH33N	62.0	18.0	L	12	50	General locomotive traction motor, main generator, general AC motor and DC motor
CH33	61.0	18.0	M	12	50	General locomotive traction motor, main generator, general AC motor and DC motor
CH21	29.0	31.0	M	10	40	General DC motor
CH25	18.0	27.0	M	12	45	Slip rings of 110V DC motor and AC motor
CHI7	14.0	14.0	L	12	50	Slip rings of steam turbine generator and small-medium DC motor
CHI0	10.0	12.0	L	12	40	Slip rings of 80 - 120V DC motor and AC motor, and DC welding machine
CE50	57.0	25.0	L	12	41	DC traction motor
CE23	58.0	21.0	L	12	41	Steel rolling motor with good performance of commutation
CE20	57.0	25.0	L	12	41	Traction motors for electric locomotives, which is suitable for applications with high vibration
MG750	0.14	67.0	M	22	35	Slip rings of low voltage DC motor and variable speed motor, and collecting electrons
MG70	0.62	42.0	L	22	20	Slip rings of low voltage DC motor and variable speed motor, and collecting electrons
MG65	1.00	40.0	M	20	25	Slip rings of DC motor and AC motor, and collecting electrons
MG50	4.00	37.0	L	18	35	Slip rings of DC motor and AC motor
MG30	4.44	24.0	M	15	35	Slip rings of DC motor and AC motor
J204	0.62	42.0	L	22	20	Slip rings of DC motor and AC motor
J201	2.80	30.0	M	18	35	Slip rings of DC motor and AC motor
C412	0.21	95.0	L	25	15	Grounding brush and high current transfer and linear current collector
CM9T	0.50	40.0	L	18	35	Slip rings of DC motor and AC motor
CMIS	0.14	67.0	L	22	35	Grounding carbon brush and collecting electrons
SM3	1.40	17.2	M	15	20	Silver graphite carbon brush, which is suitable for tachometer motors and micro motors
MA70	0.27	40.0	M	15	20	Silver graphite carbon brush, which is suitable for AC tachometer motor and AC/DC micro motor
MA90I	0.09	60.0	M	20	15	Silver graphite carbon brush, which is suitable for sliding contact point of signal transmission

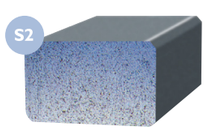
* Please consult Morgan sales team for any grade or customized development

Surface condition of carbon brush



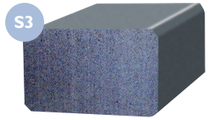
Smooth polished surface (S1)

It shows that the performance of carbon brush is relatively good. However, if the surface smoothness is similar to that of a mirror (glazing), high frequency chattering may be caused by the low current. It should check the side of the carbon brush for signs of vibration.



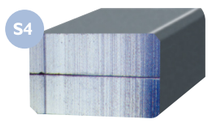
Porous surface (S2)

It shows that the performance of carbon brush is satisfactory. The actual appearance will depend on the grade of carbon brush.



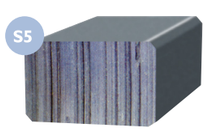
Fine grain surface (S3)

It shows that the performance of carbon brush is relatively good. However, if the surface smoothness is similar to that of a mirror (glazing), high frequency chattering may be caused by the low current. It should check the side of the carbon brush for signs of vibration.



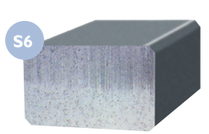
Fine serrated surface (S4)

Compared with (S3), the situation is slightly more serious. The common reasons are the presence of pollutants in the atmospheric environment or insufficient load current.



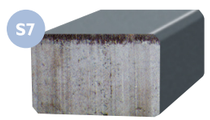
Deep serrated surface (S5)

Same as above (S4), but more severe or longer.



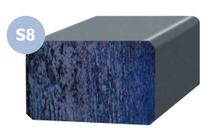
Ghost surface (S6)

It may be related to the difficulty of commutation, which may be caused by incorrect neutral wire position in neutral gear, commutating pole problem or other bad commutation reasons.



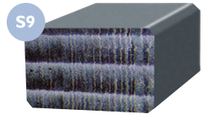
Burned edge (S7)

It usually appears at the edge of carbon brush, which is caused by bad commutation and large spark.



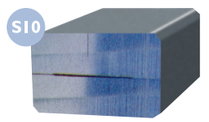
Dent surface (S8)

It shows that there is a large spark on the surface of carbon brush, which may be caused by excessive current or unstable operation of the carbon brush.



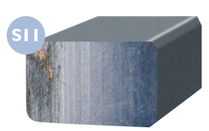
Laminated surface (S9)

It is caused by poor commutation arising from armature winding failure.



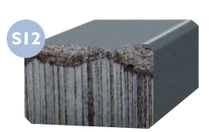
Double bedded surface (S10)

It usually occurs in the motor with bi-directional rotation requirements, that is, the carbon brush will re-run in every time when the rotation direction changes. As such, this issue will not raise concern.



Copper precipitates (S11)

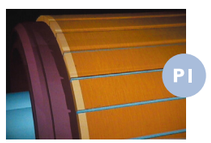
Copper adhesion on the surface of carbon brush may be caused by copper drag or super peak load, which may increase commutator wear.



Broken edge (S12)

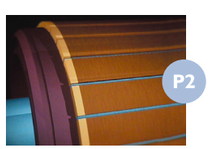
It usually appears on the edge of the carbon brush. The edge damage is caused by the bad condition of the commutator, mica protrusion/large inter-slice bounce or severe vibration of carbon brush.

Patina of commutator



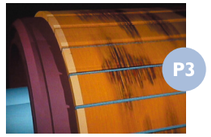
Glossy patina (P1)

It is located on the surface of whole commutator, which is one of the common normal conditions of a well-running machine. The color of the patina depends on the grade of carbon brush and current density.



Darken patina (P2)

In good shape. The color of the patina changes from light to dark, but it is still uniform. In general, the patina layer with good performance looks slightly glossy.

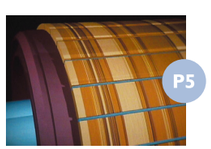


Spotted patina layer (P3)

It is the most common phenomenon that the patina layer looks uneven. There may be some accumulated deviations in various parts of the motor, such as commutator roundness, carbon brush contact pressure, uneven magnetic field and chemical vapor, which will cause this phenomenon over time.

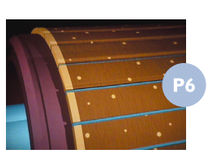
Deep and shallow striped patina layer (P4)

Light and dark patina appear at intervals, which is related to the number of armature coils in each slot. This configuration depends on the design or manufacture of the motor and is usually independent of the function of carbon brush.



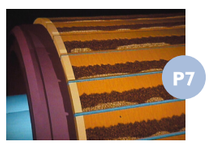
Stripe (P5)

This type of patina layer is harmless to the commutator, and the service life of carbon brush and commutator will not be reduced. If metal contact transfer occurs, it will gradually develop into the thread shape. This kind of patina will be affected by current density or carbon brush grade.



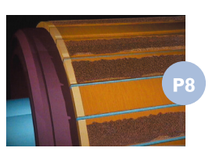
Bright spots (P6)

Bright spots on the patina indicate poor contact between the carbon brush and commutator or overload of the motor. This will cause sparks under the carbon brush, thus damaging the glossy patina layer and eventually corroding the commutator.



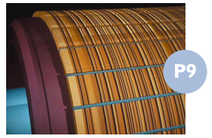
Burning mark of commutator segment(P7)

The sliding edge of the commutator segment is damaged. Failure of motor components, improper adjustment of electrical symmetry of windings, or poor commutation ability of carbon brush will cause burn marks on the commutator segments.



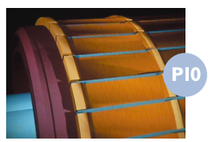
Burning mark of commutator segment(P8)

Each second, third or fourth commutator segment is corroded according to the design of armature winding. Improper carbon brush materials, incorrect carbon brush matching or improper electrical design can lead to this situation, which will seriously damage the commutator and reduce the service life of carbon brush.



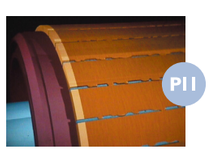
Threading patina(P9)

The width and color of threading patina without commutator wear may be different. This can be caused by atmospheric conditions (humidity, oil vapor or other gases) or insufficient load.



Groove(P10)

The uniform annular wear on the commutator is equivalent to the width of the carbon brush. Excessive dust in the environment or carbon brushes containing abrasive formulations can cause this case. The extremely small spring pressure (below 1.5psi) is also the cause of this case. The wear of commutator can be reduced by using carbon brush correctly and improving ventilation design in motor.



Copper drag(P11)

This happens when the high energy sparks make the copper melt. Once the molten copper particles are covered by other substances in the surrounding environment, it is difficult to fully oxidize and form a good epithelium on the surface of the commutator. These copper particles usually accumulate at the edge of the commutator segment and eventually lead to short circuit between the commutator segments. This phenomenon should be solved immediately, otherwise it may cause serious damage.

Chart of Frequently Asked Questions for Rotating Motors

Note: collector refers to slip ring or commutator

Sign		Sign	
M	The commutator or slip ring is jagged or grooved	Unipolar wear caused by slip ring	N
L	Excessive wear of commutator - black surface	Copper fragments on the surface of carbon brush	O
K	Copper drag	Carbon brush chatter	P
J	Excessive wear of commutator or wear of slip ring - bright surface	The surface of the commutator or slip ring is striped	Q
I	Uneven wear of carbon brushes	Uneven burn marks on the commutator or slip ring of collector	R
H	The carbon brushes wear rapidly - while the commutation is good	Symmetrical burn marks on commutator or slip ring	S
G	Burn or discoloration of brush braid	Raised grains on commutator or slip ring	T
F	The temperature of carbon brush and brush holder is too high	Moss spots on steel slip ring	U
E	Overheating of commutator or slip ring	Glazing occurs on the contact surface of carbon brush	V
D	Serious spark around commutator	Pitting on the contact surface of carbon brush	W
C	Green needle spark	The edge of the carbon brush has a gap or the carbon brush is damaged	X
B	Sparks on the slip in edge of carbon brush	Poor formation of oxide film	Y
A	Sparks on the slip off edge of carbon brush	Insufficient self-excited electrode voltage	Z

	Possible cause of failure	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Remedy scheme	
1	Excessive strong magnetic field of commutating pole		x	x												x				x				x				The commutating pole magnetic field can be reduced by splitting or increasing the air gap	1
2	Excessive weak magnetic field of commutating pole	x		x								x				x				x								The magnetic field of the commutating pole is enhanced by reducing the air gap	2
3	The air gap of that commutating pole is too small		x	x												x				x				x				Increase the air gap to reduce effective flux of commutating pole	3
4	The air gap of that commutating pole is too large	x		x								x				x				x								Reduce the air gap to increase effective flux of commutating pole	4
5	Uneven air gap (due to bearing wear, etc.)	x	x							x						x				x				x				Replace the bearing	5
6	Motor overload	x				x	x	x		x	x					x					x			x				Reduce and limit motor load	6
7	Vibration caused by external factors, such as motor close to forging machinery and other strong vibration environment	x							x	x		x		x	x	x	x			x	x	x	x		x	x	x	Find out the cause of chatter and solve it or install the motor on the shock absorber	7
8	Vibration caused by internal reasons, such as imbalance, poor centering, etc.	x							x	x		x		x	x	x				x	x	x	x			x	x	Adjust the armature dynamic balance and check the bearing for wear	8
9	Electrolytic wear of slip ring														x							x						Regularly change the polarity of slip ring	9
10	Oil or dust on the commutator or slip ring surface							x	x				x					x	x							x	x	Clean commutator or slip ring	10
11	Uneven resistance between carbon brush and carbon brush handle					x		x	x											x				x			x	Clean and fasten connector	11
12	There are friction powder particles on the contact surface of carbon brush								x	x				x												x		Reinstall and clean the surface of carbon brush	12
13	Link failure of armature winding or equalizer	x			x		x												x	x				x			x	Find and solve the failure or consult the manufacturer	13
14	Mica protrusion	x		x	x								x			x	x		x					x	x	x	x	Undercut mica or use a more abrasive carbon brush	14
15	Decentration of commutator or slip ring	x							x				x	x	x	x		x	x		x						x	Turning or rounding close to the rated speed	15
16	The commutator elevator is connected to an open circuit	x	x	x	x															x							x	Re-weld the connector	16
17	The commutator blade is raised or recessed	x		x									x				x		x					x				Fasten commutator, turning or regrind	17
18	Loose commutator	x		x	x								x			x	x	x	x		x				x			Fasten the commutator, if necessary, undercut mica, turning or regrind	18
19	Flat commutator or slip ring	x	x	x									x			x	x							x	x			Find out the cause of flat and solve it, turning or regrind	19
20	Spring pressure is too low	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	Adjust the spring pressure to meet the requirements of carbon brush grade	20
21	Spring pressure is too high					x	x		x		x	x		x												x		Adjust the spring pressure to meet the requirements of carbon brush grade	21
22	Uneven spring pressure	x					x	x		x		x				x	x	x	x		x			x		x		The spring pressure is adjusted evenly and meets the requirements of carbon brush grade	22
23	The carbon brush grade does not match the motor load	x			x	x	x		x		x	x	x	x	x		x			x			x	x	x	x		Reselect carbon brush	23
24	Oversize contact arc of carbon brush	x	x	x												x				x				x				Reduce the effective thickness of carbon brush, and it is best to consult the manufacturer	24
25	Undersize contact arc of carbon brush	x	x	x								x				x				x								Use the appropriate circumferential staggered arrangement, and it is best to consult the manufacturer	25
26	Brush braid connection failure							x		x																	x	Replace a new carbon brush, and pay attention to reliable connection	26
27	The brush braid is too short or too stiff	x				x		x		x										x							x	Replace a new carbon brush, and pay attention to the length and the flexibility of the wire	27
28	Improper installation of carbon brush implantation	x	x			x				x									x							x	x	Install the carbon brush in the recommended way	28
29	Small inclination occurs when the radial brush holder is installed	x		x		x	x			x		x		x	x		x		x	x			x		x	x	x	Adjust the radial position of the brush holder and make it at the correct distance from the commutator	29
30	The forward tilting brush holder is installed as a backward tilting type	x	x	x		x	x			x		x		x	x		x		x	x			x		x	x	x	Turn over the direction of the brush holder or change the direction of motor rotation	30
31	The carbon brush is too tight in the brush holder	x	x			x		x	x	x			x			x		x	x		x			x			x	Check whether the carbon brush size is correct, clean the carbon brush and brush holder, and remove burrs	31
32	The carbon brush is too loose in the brush holder (maybe the brush holder is worn)						x			x							x			x			x		x	x		Replace the brush holder or adjust the correct size of the carbon brush	32
33	Loose or dirty terminal connection					x	x	x		x							x										x	Clean terminals and terminal blocks. Fastening screws	33
34	Brush holder is too far away from commutator or slip ring									x				x		x		x	x	x			x		x	x		Adjust the distance between brush holder and commutator or slip ring	34
35	Incorrect position of carbon brush	x	x	x									x				x				x		x		x			x	Adjust the brush holder to correct position	35
36	The arrangement of brush holder and the spacing of the brush carrier are not equal	x	x	x	x			x		x							x				x				x			Correct the spacing and arrangement of brush holders	36
37	Low atmospheric humidity								x					x				x								x	x		Take measures to regulate humidity	37
38	High atmospheric humidity													x					x	x			x						Adopt enclosed motor structure or provide normal humidity working environment	38
39	Dust in the atmosphere								x		x			x													x		Remove dust source or install filter	39
40	The air contains flue gas or acid vapor							x	x					x					x	x			x		x		x	x	Introduce clean cold air	40
41	Long-term operation under low load	x			x	x	x					x		x		x	x							x		x	x	x	Change the grade of carbon brush and seek suggestions to adjust the grade of carbon brush	41