

Morgan AM&T is a leading global supplier to the Railway Industry, providing products, services and solutions for electric motors and current collector systems.

Morgan AM&T spans the world, supplying not only carbon pantograph strips but also carbon brushes, brush holder assemblies, third rail shoes, earthing units and expertise.

By combining our product range and technical expertise we can assist in optimising system performance. Morgan AM&T has highly trained Technical Sales Engineers for local support, backed up by a team of Traction Experts and together they provide technical solutions for all our customers.

## Morgan AM&T work with all major global OEM's, Railways and Urban Transport Systems.

#### Morgan can offer:-

- Local sales engineering support
- Application engineering technical support team to investigate problems and offer solutions.
- Design improvements for better performance and reliability.
- Over a 100 years of traction experience.
- Material technology & development facilities
- Machine Test Centre to simulate field conditions
- Technical training courses either held at the customer's site, a Morgan regional business unit or in our technical centre of excellence.



#### **Typical design Features**

Pressure systems employing clock springs for robust performance. Constant force Springs for compact designs. Copper based alloys have become established as optimum for the holder bodies.

Brush pockets are broached to give the required tolerances, IEC136 being widely accepted as the industry standard. Surface finishes, such as electroplating or painting can be applied when required.

#### **End Mounted assemblies**

End mounted holder assemblies complete with supports and terminal plates. Typical of designs supplied for use on battery locos, light rail and metro applications. Either clock springs or constant force springs may be specified.

#### **Earth Return Current Units**

Employing novel materials and design, Morgan has developed units for a variety of applications including Locomotive, EMU and Light Rail solutions.

#### Pins, Pillar & Insulators

Double ended mounting pins, pillars and stand off insulators. Moulded in either high strength GRP with excellent electrical and mechanical properties or mica glass for special high temperature requirements.

#### **Spring Clips**

In addition to offering a wide range of class leading carbon brush materials, we are able to offer brush holders and their components such as replacement springs clips.

#### **Engineering Innovation**

Our design team will take your current product and reengineer it to optimise performance and improve reliability

#### Morgan New Improved Re-design

- Design review
- Individual brush pockets to improve commutation and contact.
- Adopt semi-captive C/F.
- Springs can be replaced in situ.
- Include spring hold off facility.
- Weight reduction.









DC traction systems have inherent differences to their industrial counterparts having to cope with increased levels of vibration and thermal shock as a result of rapidly changing load currents. The advent of fast switching thyristor control and regenerative braking have added to the harsh conditions already experienced by the carbon brush which is a vital part of the current carrying chain, so it is imperative that the correct grade of brush is chosen to optimise the performance and reliability of the equipment.

Morgan AM&T the World's number one traction brush supplier offers a wide range of materials and design expertise to minimise the effects of harsh running conditions.

Morgan is an established, experienced high performance brush manufacturer with over 100 years experience in serving the traction industry. Optimum brush grades are developed in the global centres of excellence, using our own testing facilities for in house development and customer support. Sharing knowledge and experience, Morgan will give local technical support backed up by a global team of application engineers.

By specifying a Morgan brush holder and brush our customers are safe in the knowledge that they are optimising the reliability and operation of their equipment and they have added advantage of the ease of access to Morgan's world wide technical support.



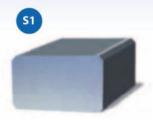
### Morgan AM&T Traction Grade

#### **Traction Grade suggestions**

		GRADE	C12	CMIS	DE3	DE7	DE7000	DE8	DE9000	EG105	EG105S	EG114	EG116	EG14D/EG118S	EG238S	EG259	EG260	EG268	_	EG3	EG6749N	H100	IM9101/IM26	ME393/ME373/ME353	917	N2000	N4	248	N6000/ME377	PMS0P	TA35R
		DC				0	0		0		0			0		0		0	0					0							
	Freight	Rectified AC				0	0		0					0				0	0					0							
	- Congress	Thyristor				0	0		0		0		0	_				0	0												
	7	Chopper				0	0		0		0		0	0				0	0					0							
		DC				0	0		0	0	0					0	_		0							0			0	$\overline{}$	
	Passenger loco (high speed)	Rectified AC				0	0		0	0						0	_		0							0			0	$\overline{}$	
10	and the second	Thyristor				0	0		0		0					0	_	_	0							0			0	_	_
8		Chopper				0	0		0	0	0					0		_	0							0			0	_	
DC Traction motors	The second second second	DC				0							0			0	_	_	0		0					0			0	_	
6	Suburban EMU (passenger)	Rectified AC				0							0	_		0			0		0					0			0	_	
8	Constitution of the Consti	Thyristor				0							0	0					0							0			0	$\overline{}$	
E		Chopper				0							0						0		0					0			0		
O		DC			0								0	0		0			0					0	0	0					
	Metro/rapid transit	Rectified AC			0								0	0					0					0	0	0	0				
	меногары папан	Thyristor			0								0	0					0					0	0	0					
		Chopper			0								0						0					0	0						
		DC			0		0						0						0					0	0						_
	Trolley bus/tram	Rectified AC			0		0						0						0					0	0						
	Troney bustain	Thyristor			0		0						0						0					0	0		0				
		Chopper			0		0						0						0					0	0	0					
AC Traction	AC commutator dr	rive																	0								0	0			0
10	Generators/exciters							0				0			0		0						0					0			
8	Compressors		0																0				0							0	
#	Blowers/vent fans													0								0	0							0	
9	Pumps														0															-	
-	MA sets																		0				0								
Earthing				0																											

#### **Smooth Polished Surface**

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**

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



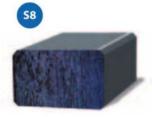
#### **Open Textured Surface**

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



#### **Pitted Surface**

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



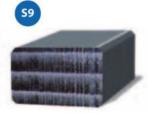
#### **Finely Lined Surface**

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**

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



#### **Finely Serrated Surface**

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



#### **Double-Bedded Surface**

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.



#### **Heavy Serrated Surface**

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



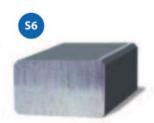
#### **Copper Particles**

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



#### **Ghost Marked Surface**

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



#### **Chipped Edges**

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



# MorganAM&T

#### **Light Film**

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.



#### **Patina Dark**

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.



P2

**P3** 

#### **Slot Bar Burning**

damage or a flashover.

**Bar Burning** 

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.

is the erosion of the trailing edge of the

maladjusted electrical symmetry of the

commutator bar. Failed machine components,

machine or a poor commutating brush can

result in bar burning. If not corrected, this

condition can cause severe commutator



P8



## **Blotchy Film**

this nonuniform 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 with Collector Wear

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.



repeating light and dark filming



## **Pitch Bar Burning**

results in commutator bars being eroded in a pattern related to 1/2 the number of brush arms, progressing into a pattern equal to the number of brush arms. This condition is caused by a cyclic mechanical or electrical disturbance such as an unbalanced armature, misaligned shafts, bent shaft, bad bearings, weak foundation, failed equalizers or a poor riser connection. If not corrected this condition will result in a flashover.



#### **Slot Bar 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

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 iltering the air on force ventilated motors can reduce the commutator wear.



#### Streaking

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

occurs when high energy transfers copper in a molten state. These particles become coated by contaminants from the surrounding environment or the brush treatment 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. Chamfering the commutator bar edges is necessary to stop the progression of this condition.





#### **Bright Spots**

Bright spots in the film suggest poor contact or overloading, the resultant under-brush sparkling tends to destroy the patina and will eventually erode the commutator.

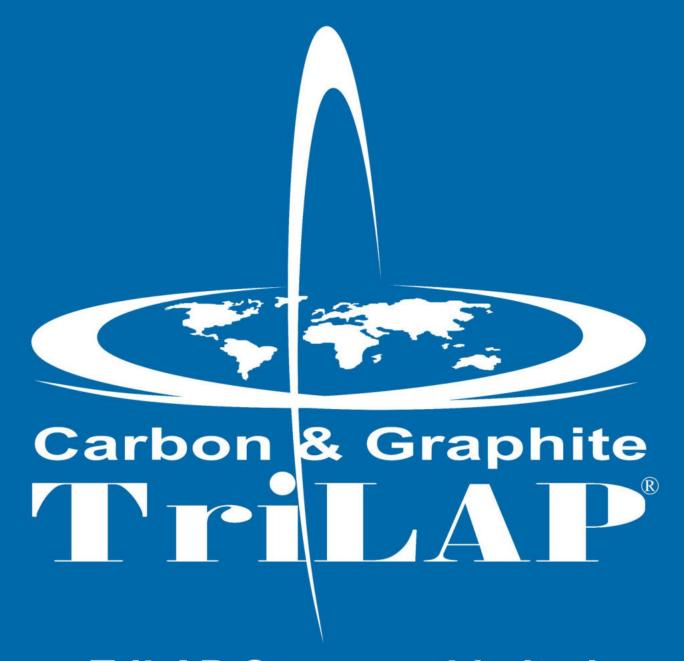








					olimbrania.	
M Serration and proposing of committator or slin ring					Wear of slin ring on one polarity	2
Excessive commitator wear	STATE				Conner nicking in brush face	0
K Copper dragging		f			Brush chatter	<u>a</u>
J Excessive commutator wear or slip ring wear-bright surface					Commutator surface streaky	O
Ilnanual brish wear					Commitator has unsymmetrical hurn marks	00
H Rapid brush wear					Commutator has symmetrical burn marks	S
G Flexible burnt out or discoloured					Commutator has wavy pattern	<b>—</b>
F Brushes and brush holders too hot					Ghost marks on steel slip rings	n
E Commutator-slip ring-too hot					Glazed contact surface of brush	>
D parking vicious and trailing around commutator					Pitted contact surface of brush	>
					Chipping of brush edges or brush breakage	×
B Sparking at entering edge					Failure to develop a protective skin	> 1
A Sparking at leaving edge PROBABLE CAUSE DE TRAIBLE	ARCHE	N M	0 0 0 0	A X M X	Insufficient voltage on self exciting machines	7
I Interpole Field too strong			×	×	Weaken interpole by divert or by incre	-
2 Onterpole field too weak	×	×	×		Strengthen interpole fields by reducing air gap	2
3 Interpole air gap too small	×		×	×	Enlarge air gap to decrease effective interpole flux	က
4 Interpole air gap too large	×	×	×		Reduce air gap to increase effective interpole gap	4
5 Air gaps uneven (?bearings worn)	×		×	×	Renew bearings and realign machine	5
6 Overload machine	××××	×	×	×	Reduce and limit load on machine	9
7 Vibration from external causes, i.e. Prime mover:nearby forge hammer etc.	×	×	×	×		7
8 Vibration from internal causes, i.e. out of balance, poor alignment etc	×		×	×	x Balance armature and check for bearing wear	00
9 Quasi electrolytic wear of slip ring		×		×		m
10 Oil and dirt on commutator or slip ring	×	×	×	×		10
11 Resistance between brushes and brush arms not uniform	×		×	×		= :
12 Grains of abrasive in brush contact face	×	×		×		71
13 Faults in armature winding or equaliser connections	100					20 5
4 Wilca proug	×	×	×	×		<b>t</b> L
15 Commutator or slip ring eccentric		×	×			2 2
ייין בייין וואפן רחווופרייים או בייין הייין הייי	<			*	T T T T T T T T T T T T T T T T T T T	2 .
19 Committee Local	100	× >	×	×	Trabition commutator, turn, or re-grind	101
10 Communication to object of the ripe		< >	× × × ×	,	Ingities and communication, 18-111100 in the communication of floatening forms of any or or an arising	0 0
20 Series around the four first	, , , , , , , , , , , , , , , , , , ,	× 3	× 3	× ×		500
20 Spring pressure too low	× ;	×	××××	×	x Adjust spring pressure to that recommended for brush grade	07
21 Spring pressure too nign	×	×	,	× :	Adjust spring pressure to that recommended for brush grade	17
22 Print pressure unequal	× >	> > > > > > > > > > > > > > > > > > >	× × ×	× >	Colors and of our alternative grades or set for our recommendation	22
24 Druck are of content according any		<	< >	< >	Doduce the effective thickness of truck preferable popular manufactures	VC
24 brush are of contact excessive	× > × >	>	× >	×	Apply enitable circumferential change preferably consult manufacturer	25
26 Britsh flexible connection faulty	c	<	<	>	Fit a new hrish with a sound flexible connection	36
27 brush flexible too short or too stiff	× ×		×	×		27
28 imperfect brush bedding in	×		×	×		28
29 Radial brush holders mounted at small reaction angle	×	×	×	×××		29
30 Reaction type holder mounted trailing	×	×	×	×		30
31 Brush sticking or sluggish in brush holder	XXXX	×	×××	×		31
32 Brushes too loose in brush holder(?holders worn)	×		×	×	Replace holders , or order brushes of correct dimension	32
33 Terminal connections loose or dirty	×		×	×	Clean terminals and terminal block. Tighten screws	33
34 Brush holder mounted too far from commutator or slip ring	×	×	×××	×	Adjust holder to be 2mm from commutator	34
35 Incorrect brush position	×××	×	×	×	x Adjust holders to correct position	32
36 Unequal brush holder spacing or alignment	X X X X X X		×	×	Correct spacing and alignment of holders	36
37 Humidity of atmosphere low	×	×	×	×	Humidify the cooling air or draw air from normal humidity source	37
38 Humidity of atmosphere excessive		× :	×	×	Enclose machine or draw cooling air from normal humidity source	88
An Case or soid fumos in atmosphere	× >	< >	3	3		200
40 das of acid fulles ill autilospitele	>	< >	× >	× >		7 5
41 Long periods of low of steady loads.	×××	×	××	YYYY	x) change brush grade, ask for recommendation	+



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