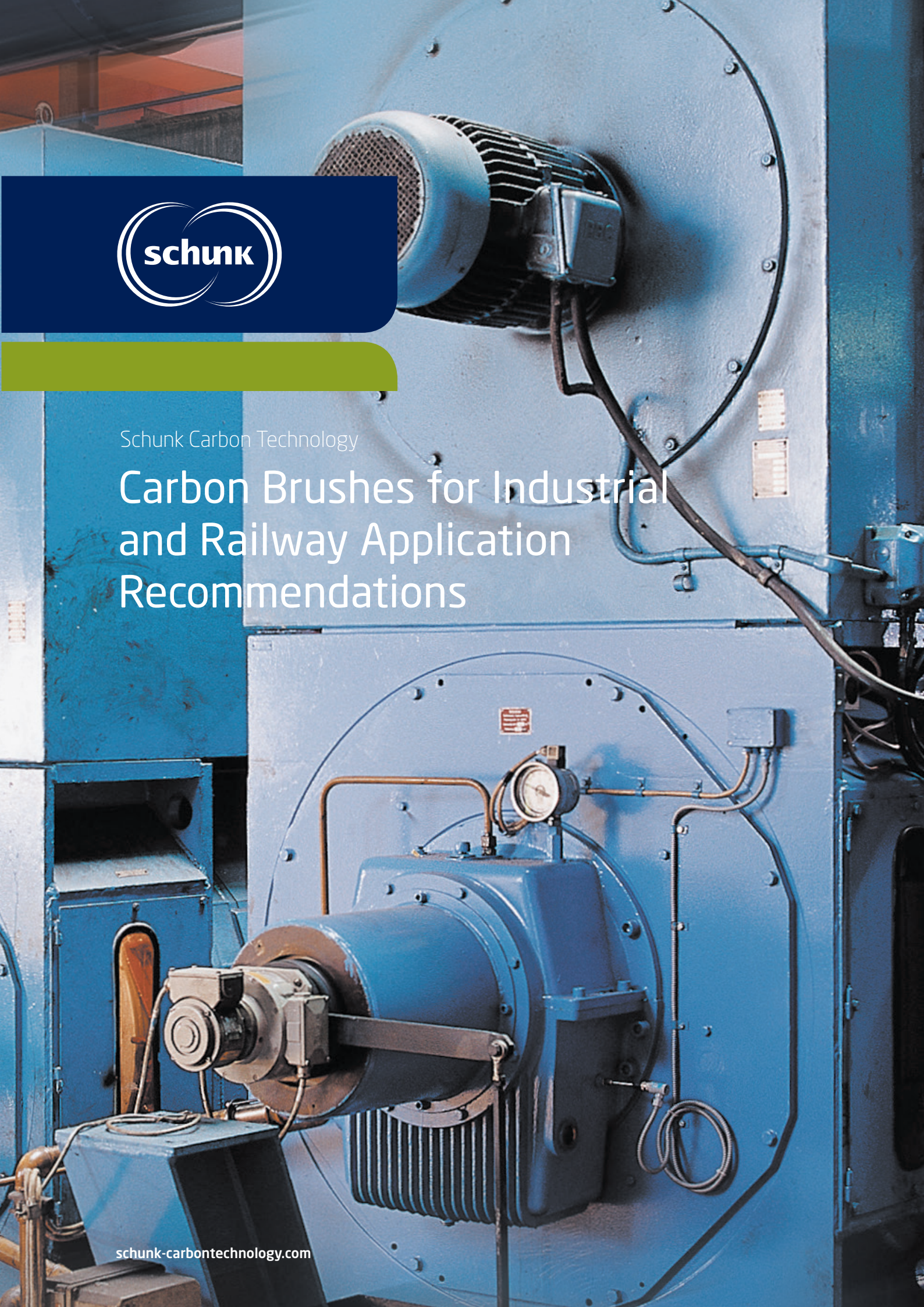

Schunk Carbon Technology

Carbon Brushes for Industrial and Railway Application Recommendations

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The following application recommendations for our standard grades are based on practical experience and measurements carried out in our laboratories. A variety of machines is listed in the following pages together with a list of brush grades that have performed well on such applications. Generally we have listed our basic grades but we can also use additional treatments such as X, Z and F to meet special requirements.

It is not possible, however, to take account of all the operating conditions which may occur, or different machine characteristics, in our application recommendations. A different grade of carbon brush may therefore be required in some cases.

Special requirements are imposed on the sliding contact of the carbon brushes, for example, by short-term overloads, rapid rates of rise or fall of current, prolonged no-load running, low-load operation, chemically corrosive gases and vapours, high or low ambient temperatures, oil fumes and high dust and ash contents in the surroundings. Attention should also be paid to the humidity level of the air.

The values shown in the recommendations for current density (calculated from the current running along the length of the brush), peripheral speed and brush pressure have been based on experience with machines in practical use.

The data are guideline values, in which the particular application has been taken into account and do not have to be strictly adhered to. Carbon brushes can be loaded with higher current densities, provided there is an adequate temperature reserve or good cooling and appropriately dimensioned fittings.

The limit is determined by the practical application. On commutators, the limit of overload capacity or the maximum permissible continuous current density depends, not only on the material characteristics of the carbon brushes and on the cooling, but also on the commutation.

Depending on the brush grade a prolonged low electrical loading can result in the formation of grooves or in chattering. In most cases low brush current density gives more problems than overloading.

With very good concentricity of commutators and slip rings plus satisfactory commutation the stated peripheral speed may be exceeded, provided the current distribution between the individual brushes permits this (aerodynamic effects). The brush pressure depends on the machine requirements and its operating conditions. The stated guideline values may therefore have to be corrected in use. With metallised graphite brushes it may be necessary to increase the brush pressure because of their greater mass.

APPLICATION RECOMMENDATIONS INDUSTRIAL APPLICATIONS

Application	Problems	Grade	Guide-line values for			Remarks
			Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
Blower, ventilators	Unbalance by V-Belt, low load	-F61-	1-8	200	30	Low load resistant, max. 4 brushes per pole
		-E49X-	4-16	250	40	For difficult commutation
Cement	Dust, high starting currents (rotary kilns)	-E101-	4-16	250	40	Rotary kiln, resistant against variable loads
		-E46X-	5-14	250	40	For extreme starting loads
		-C40Z3-	12-20	250	30	Open machines, standard grade at high ring temperature
		-K14Z3-	12-20	250	30	Closed machines
		-C80X-	12-22	250	30	Standard grade
		-C80Z2-	12-22	250	30	At low humidity
Cranes, hoist motors	Long idle phases, vibrations, difficult commutation, salt water	-E101-	4-16	250	40	Standard grade, at extreme vibration brush pressure up to 350 cN/cm²
		-E108-	4-16	250	40	For salt influence
Data transfer, measuring currents	Low current	-S20-	-	400	20	Standard grade
		-S30-	-	400	30	Standard grade
		-E43-	-	400	30	For carbon slip rings
		-S60-	-	400	30	For applications in vacuum or protecting gas
		-SI10-	-	400	30	Special grade
		-SI20-	-	400	30	Special grade, film regulating
Electric car	Extreme starting and braking current, vibrations	-E105-	5-20	250	40	Excellent commutation
Electroplating	High current, ambient conditions	-C20-	15-30	250	30	Standard grade, lead free
		-C20F14-	15-30	250	30	Special protection against corrosion
		-C60-	15-30	250	30	At heavy acid influence
		-C40Z3-	10-25	250	30	For lower load
		-B25-	15-30	250	30	For high current
Elevators	Low load, high load at starting and braking	-E49-	5-12	250	30	Standard grade
		-E101-	4-16	250	30	Good commutation

APPLICATION RECOMMENDATIONS INDUSTRIAL APPLICATIONS

Application	Problems	Grade	Guide-line values for			Remarks
			Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
Extruder	Low load, chemical influences	-F49 -	2-8	250	30	Film regulating, max. 4 brushes per pole
		-F61-	1-8	250	30	With less ambient influences
		-E101-	4-16	250	30	Good commutation
		-E108-	4-6	250	30	Film regulating
Hydro Power Stations		-E46F3-	5-14	200	30	Standard grade for slip rings
		-E468-	5-14	200	30	Optimised brush wear, at low humidity
		-E55-	3-12	250	30	Commutators
		-HG2634, HG6634-	3-10	160	60	Slip rings
Low voltage motors	Mechanical shocks, high starting and braking current, difficult commutation	-C70-	12-20	350	30	U ≤ 24 V
		-C80-	10-18	350	30	U ≤ 24 V
		-F17-	4-14	350	30	U ≤ 24 V
		-C72-	8-16	350	30	U 24 - 48 V
		-A41-	8-16	350	30	U 24 - 48 V
		-C16-	10-18	350	30	U ≤ 48 V
		-L300-	5-14	300	40	U ≤ 72 V
		-L310-	5-14	300	40	U ≤ 72 V, e.g. cold storage
		-E43-	5-14	350	40	U ≥ 48 V
		-E105-	5-20	350	40	U ≥ 72 V , good commutation
		-E160-	5-20	350	40	U ≥ 72 V
Mining	Peak load during acceleration and brasking, low load	-E46-	5-12	250	50	Good current sharing, good film formation
		-E79X-	5-12	250	50	Optimised commutation
		-E220-	5-12	250	50	Drag lines, motors
		-E105Z2-	4-16	250	50	Drag lines, motors & generators
		-C40Z3-	10-25	250	30	Conveyor belts

APPLICATION RECOMMENDATIONS INDUSTRIAL APPLICATIONS

Application	Problems	Grade	Guide-line values for			Remarks
			Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
Paper industry	Low load, high humidity, difficult ambient conditions	-E101-	4-16	250	40	Main drives, wet zone
		-E101M-	4-16	250	30	Better commutation, film regulating
		-E108-	4-16	250	40	At difficult ambient conditions
		-E468-	4-14	250	40	Good film formation
		-E55-	2-12	250	40	For low load. dry area
		-F61-	1-10	250	30	For pumps, low load resistant, max. 4 brushes per pole
Power plants (Thermal)	High peripheral speed	-E46F3-	5-12	160	Max. 60	Non-grooved rings
		-E104-	5-14	130	80	Grooved and non-grooved rings
		-HG2634-	3-10	130	95	Grooved rings
		-HG6634-	3-10	130	95	Grooved rings
Press drives	Vibrations, shocks, oil influence	-E101-	4-16	350	40	Good commutation
		-E108-	16	350	40	For heavy oil influence
Printing	Low load, silicone influence	-F61-	1-8	250	30	Good current sharing at low load, max. 4 brushes per pole
		-F49-	1-8	250	30	In case of silicone influence
		-E49-	5-12	250	30	Good commutation, possibly sandwich design
		-E108-	16	250	30	Film regulating properties, in case of silicone influence
Pumps	Long idle phases, peak current, high humidity	-E55-	3-12	250	30	Low load resistant
		-E101-	4-16	250	40	Standard grade
		-F61-	1-10	250	30	Low load resistant, max. 4 brushes per pole
Rolling mill, Main drives	Shocks, vibrations, reversing operation, oil influence	-E46-	5-14	200	40	Standard grade, excellent current sharing
		-E46X-	5-14	250	40	Optimised mechanical strength
		-E468-	5-14	200	40	Film regulating
		-E46F3-	4-16	250	40	Slip rings of synchronous motors
		-E55-	3-12	250	30	Low load resistant, specially for cold mills only for load commutation demand
		-E101-	4-16	250	40	For difficult commutation, for variable loads
		-E49X-	5-12	250	40	Standard grade

APPLICATION RECOMMENDATIONS INDUSTRIAL APPLICATIONS

Application	Problems	Grade	Guide-line values for			Remarks
			Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
Rolling mill, Auxiliary drives	Shocks, peak load, long idle phases	-E46X-	5-14	250	40	Standard grade, excellent current sharing
		-E46XM-	5-14	250	40	Specially for shear drives
		-E55-	3-12	250	30	For cold rolling mills, good performance with influence of emulsions
		-E101-	4-16	250	40	For difficult commutation
		-F61-	1-8	250	30	Low load resistant
Ropeways, ski lifts	Low load, low humidity	-E101X-	4-16	250	40	Adjusted for low humidity
Shaft grounding	Oil influence, shocks	-S13/F19-	-	250	30	Sandwich design
		-C40Z3-	-	250	30	Film regulating
		-S15-	-	250	30	Shaft grounding for ships (80% metal content)
		-S11-	-	250	30	Shaft grounding for ships (95% metal content)
Ship drives	Salt water, oil	-E46X-	5-14	250	40	Good film formation, at low temperatures
		-E49X-	5-12	250	40	Standard grade
		-F49-	2-8	250	30	Good performance with oil influence
Slip rings	Dust, low humidity	-C70-	12-20	250	30	Open machines (steel & bronze rings)
		-K14Z3-	12-20	250	30	Closed machines (steel rings)
		-C40Z3-	10-25	250	30	At higher ring temperature (steel & bronze rings)
		-C80X-	10-22	250	30	Universal grade
		-C20-	15-30	250	30	For high current, lead free
		-C60-	15-30	250	30	Film regulating
		-E43- -E43Z3-	5-12	200	40	Low load resistant, bronze rings
		-E46F3-	4-16	200	60	Low load resistant, steel rings
		-E468-	4-16	200	60	Film regulating
		-E200-	3-12	200	50	Low load resisitant, steel rings
		-SI20-	5-14	200	50	Special grade
		-C80X-	8-18	250	30	Slip rings of Schrage motors
Storehouses	High starting and braking current, low load	-F61-	1-8	250	30	For driving motor, excellent current sharing at low load
		-E105-	4-16	250	30	For lift motor, excellent performance at peak load
Tacho generators		-S13-	-	250	30	Standard grade
		-E43-	-	250	30	For silver tracks

APPLICATION RECOMMENDATIONS INDUSTRIAL APPLICATIONS

Application	Problems	Grade	Guide-line values for			Remarks
			Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
Three phase AC motors, Schrage motors	High transversal current	-F63-	1-10	250	30	Standard grade
Wind Turbines	Long idle phases, extreme temperatures	-A41X-	8-18	250	30	Standard grade
		-C72-	8-15	250	30	For low current density
		-C80X-	10-22	250	30	Universal grade
		-C80Y3-	10-22	250	30	For high humidity
		-C80Z2-	10-22	250	30	For low humidity
		-S13/F19-	-	250	30	Shaft grounding
		-SI20-	-	250	30	Shaft grounding, for modern converter generations
		-K14Z3-	-	250	30	Lightning protection
		-E43-	-	250	30	Lightning protection, off shore
		-E46X-	5-14	250	30	DC pitch motors
		-E106-	5-16	250	30	DC pitch motors, difficult commutation
Wire annealing	High current, difficult ambient conditions	-C40Z3-	10-25	250	30	Adjusted for low humidity
		-B25-	15-30	250	30	For high loads, lead free
Wire industry, bunchers	High demands, difficult ambient conditions	-E43-	5-14	250	30	Power rings
		-E438-	5-14	250	30	Power rings, film regulating
		-SI10-	-	250	30	Data transfer
		-SI20-	-	250	30	Data transfer, film regulating

APPLICATION RECOMMENDATIONS TRACTION

Application	Grade	Guide-line values for			Remarks
		Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
AC Commutator-Motors	-E64Z4-	5-12	300	50	Standard grade, excellent film formation
Single phase serious wound motors 16 2/3 Hz, 50Hz	-E79Z1-	5-12	250	50	Good commutation, commutator saving
	-E84S-	5-12	300	50	For extreme mechanical stress
	-E151-	5-12	250	50	Improved commutator life
Auxiliary drives	-E29Z4-	12	350	30	Starter in diesel electric locos
Converter, fan, compressor, generator	-E49X-	12	350	40	Standard grade, motor-alternator sets
	-E55-	12	350	30	Low load resistant, improved commutator life
	-F40-	2-8	350	30	Motor alternator sets
	-F51-	2-8	350	50	Suitable for low load
DC Traction Motors	-E64Z4-	5-12	300	50	For extreme climatic conditions
Overhead powered	-E79Z1-	5-12	250	50	For extreme climatic conditions
	-E84S-	5-12	300	50	For difficult mechanical conditions
	-E160-	5-12	350	50	Good film formation high wear resistance
	-E220-	5-12	350	50	Commutator saving, good commutation
DC Traction motors	-E49X-	5-12	350	50	High eslasticity
Diesel-electric locomotives, motors	-E88X-	5-12	350	50	Standard grade, high strength
	-E84S-	5-12	350	50	Standard grade
	-E141-	5-12	350	50	Wear resistant
DC Traction motors	-E49X-	5-12	300	40	For difficult commutation
Diesel-electric locomotives, Generators	-E55-	3-12	300	40	Wear resistant
DC Traction motors	-E46X-	5-14	300	50	For difficult ambient conditions (salt influence)
Local traffic	-E50X-	5-12	350	30	Trams and underground with chopper control, commutator saving
	-E151-	5-12	350	50	Improved brush wear
	-E141-	5-12	350	50	Trams, wear resistant
	-E160-	5-12	350	50	Good film formation

APPLICATION RECOMMENDATIONS TRACTION

Application	Grade	Guide-line values for			Remarks
		Permanent current density A/cm²	Brush pressure hPa	Speed m/s	
Grounding contacts	-A16-	15-25	400	-	Good film formation on steel and bronze discs
	-A20X-	10-20	400	-	Low friction coefficient, low noise level
	-C40Z3-	10-25	400	-	Standard grade
	-C60-	15-30	400	-	For high loads, improved signal transfer
	-E43-	12	400	-	Carbon grade -FE85- as counter material, extremely wear resistant
Mining locos	-E29Z4-	12	400	40	Standard grade, for battery and overhead-wire supply
	-E101-	16	400	40	For difficult commutation
Trolley buses	-E50X-	12	350	50	For chopper control, commutator saving
	-E151-	12	350	50	Optimised wear resistance
	-E141-	12	300	50	Wear resistant

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