



Perfect Power Transmission for Fractional Horse Power Motors – Carbon Brushes and Brush Cards by Schunk

90 Years of Experience – Innovations for the Future



Universal motors place the highest demands on smoothness during running and on the operating life

Success on Which You Can Rely

For more than 90 years Schunk has successfully developed and produced top products for power transmission. The Small Motor Technology Division contributed decisively to this global success. Competent technological consultation as well as the implementation of customer-specific requirements have made the Small Motor Technology Division the market leader in many fields. We want to expand this excellent position on the market further in the future.

By means of the continuous improvement of our materials and systems we actively support the development of more and more efficient and reliable motors.

Cooperation on the Basis of Partnership – Product Optimisation

Renowned manufacturers of power tools and household appliances as well as of mini- and micro-motors have relied on Schunk products for decades. In this context customers appreciate in particular our materials knowledge, our detailed knowledge regarding the interaction between the motor components as well as our analyses and recommendations.



Washing machine carbon brush. Schunk Market Share: almost 100%

Schunk cooperates closely with many motor developers all over the world. We test and optimise the latest product developments in our highly-efficient development departments, such as our chemistry and physics laboratories, the radio interference measurement room as well as the application-technology test-benches.

Competitive Advantages for Our Customers

The aim of such close cooperation is to safeguard concrete competitive advantages for our customers. These can be achieved by means of developments in the following fields:

- Increased functional reliability
- Longer operating life
- Lower radio interference levels
- Lower noise levels
- Increased efficiency
- More efficient production

as well as many other innovations.

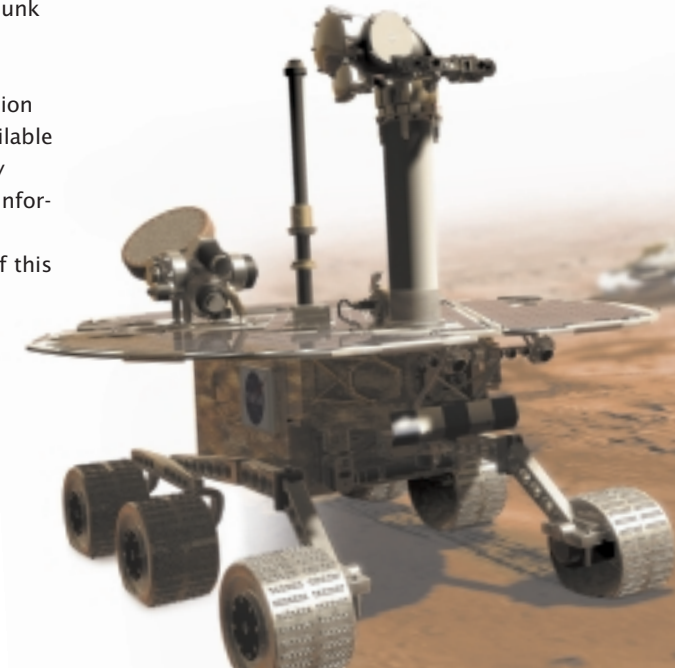
Part of an International Technology Group

The Small Motor Technology Division forms part of Schunk Group, which is an international technology group with a broad range of services in the field of materials engineering and systems technology. Schunk is active in 25 countries with more than 80 subsidiaries and employs a staff of 7,300 people worldwide.

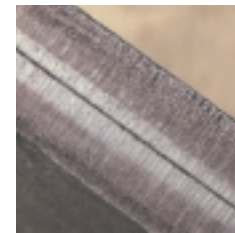
As a customer of the Small Motor Technology Division you will automatically benefit from the innovations developed in the course of the research and development projects of Schunk Group.

The materials capability, application technology and consultation available from the Small Motor Technology Division is available worldwide. Information on the contacts for your region is provided on the back of this brochure.

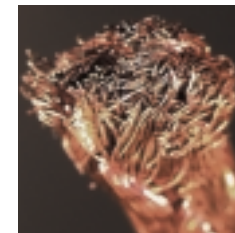
Exploration of Mars in 2004. High-tech electric motors with Schunk carbon brushes



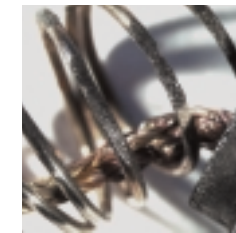
Materials Know-how



Contact face of a laminated carbon brush after washing



Fracture of a flexible wire. The analysis of the fracture provides constructive ideas for lower vibration brush systems



Damage to a spring resulting from fault currents. An clear error analysis forms the basis for product optimisation



Microscopic examinations of the commutator surface provides information concerning the operational behaviour of the carbon brushes as well as regarding commutation

Best Materials for Power Tools



Schunk patent. Carbon brush with signalling wire. With switch-off device and current transmission within the smallest possible space (a = 10 mm)

Modern Carbon Brushes – Integral Components of the Motor Systems

Carbon brushes with a signalling wire and a switch-off device form one example of the innovative power of Schunk. Schunk was the first company to implement this double function in one a single carbon brush within the smallest possible space.

8 to 10 operating hours prior to the end of the wearing stage the signalling wire issues the signal for exchange of the brush itself. This means that the professional tool user knows that his tool will be in full working order for another working day and he is thus able to plan the exchange of the brush accordingly. On the part of the motor manufacturers this creates the possibility of determining the service intervals with the help of the carbon brush.

When the wear and tear threshold level is reached, an automatic switch-off device lifts the brush off the commutator, cuts off the flow of the current and prevents commutator damage. With the help of new ideas and new developments in this field carbon brushes and associated systems can be increasingly used as integral components of the motor system.

Tailor-Made Materials for Use under the Toughest Conditions Possible

Professional appliances and power tools place the highest demands on electric motors. Schunk carbon brushes and systems have shown excellent performance in this field. In addition to research and development it is mainly the right materials choice combined with the superior process technology in our mixing plant in conjunction with our modern production technology which ensures the high quality of our products.

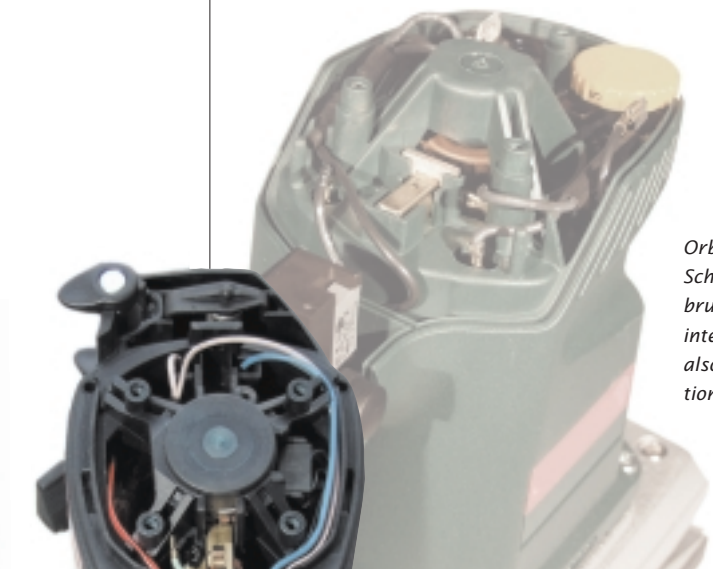
Schunk materials and modules for power tools are tailor-made specifically for use under difficult conditions such as:

- High current densities
- Vibration
- Dust formation
- High rotational speeds
- Exposure to weather conditions etc.

In this context the expectations comprise a long operating life with the possibility to refit new components as well as a high operational reliability.



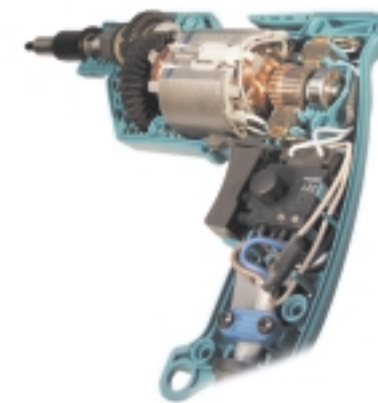
Circular saw. Schunk carbon brushes also guarantee a long operating life at high rotational speeds



Orbital sander with Schunk carbon brushes. Low radio interferences levels also during functional vibrations



Permanent vibrations and adverse environmental conditions. Hedge clippers require the best-possible commutation



Drills and compact rotary hammers. Long service life of the carbon brushes as well as easy servicing are required

In case of extreme loads. Carbon brushes with special protection of the commutator

System Technology



Carbon brush with helical spring, flexible wire and terminal



Carbon brush for orbital sanders. Brush holder with special insulation



Carbon brushes and brush holders with constant pressure spring

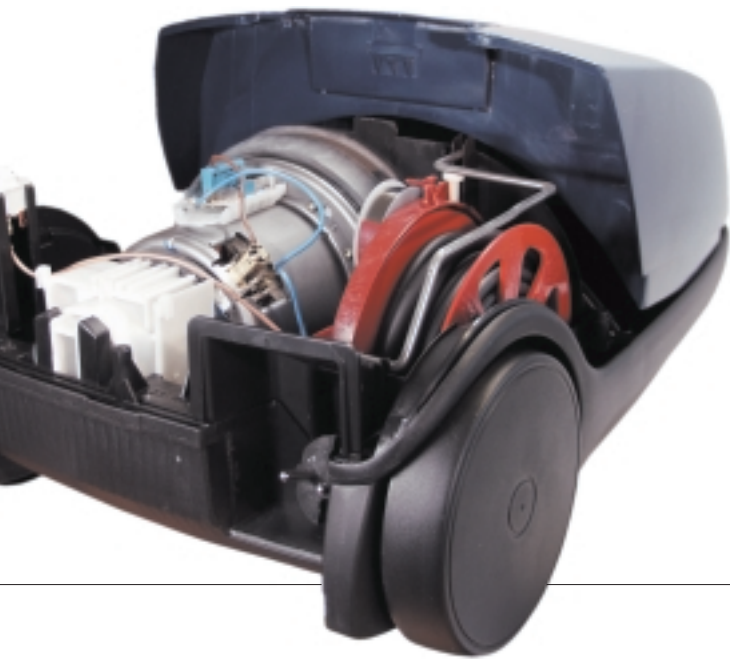


Solution for professional hedge trimmers. The brass holders optimise heat dissipation resulting in the system staying cooler



High degree of dimensional accuracy and narrow tolerances. Brush card for high-quality compact rotary hammers

Best Performance for Household Appliances



High requirements are needed to vacuum cleaner carbon brushes: up to 60,000 rpm and long operating life

Special Requirements for Material and Design

Carbon brushes and brush holder assemblies used in household appliances demand special requirements of both material and design. Today's motors are designed to be smaller and lighter, whilst simultaneously increasing rotational speeds. The Small Motor Technology Division reacted to this trend in development trend many years ago. In this context special value is placed on the continuous improvement of the commutation behaviour as well as a steady increase of efficiency.

Carbon Graphite Materials – Versatile Materials

At Schunk carbon graphite materials are primarily used in universal motors destined for household appliances and hand-operated power tools. They are versatile to use and are suitable for very diverse solutions to difficult problems. They offer the following advantages:

- Wide range of resistivity
- High materials strengths
- Stability against electrical burn-off
- Good cleaning effect with sufficient
- Mechanical damping

Carbon graphite carbon brushes can be produced with very high specific resistances in ranges from 35 to 3,000 $\mu \Omega$ m. In order to improve running behavior additional impregnations are recommended in principle.

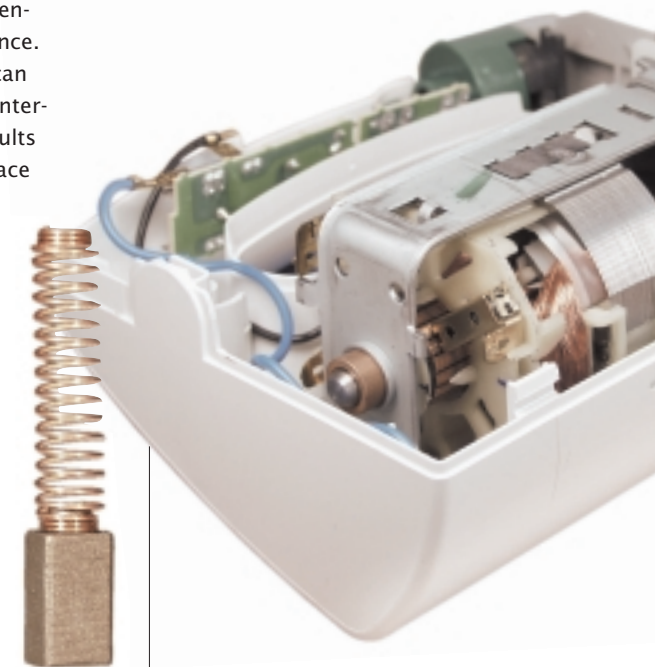
Resin-bonded Graphite

Carbon brushes made of resin-bonded graphite lead to low to medium abrasiveness during the operation of the brushes so that stains developing on the surface of the commutator can be ground off. The materials have excellent damping and sliding properties and can also be used at relatively low current loads as well as at extremely high peripheral speeds.

Electrographite, a material, which is very pure and has excellent sliding properties, is particularly suitable for applications with high current densities and a low operational voltage.

The Schunk Advantage – Possibility to Save Radio Interference Suppression Coils

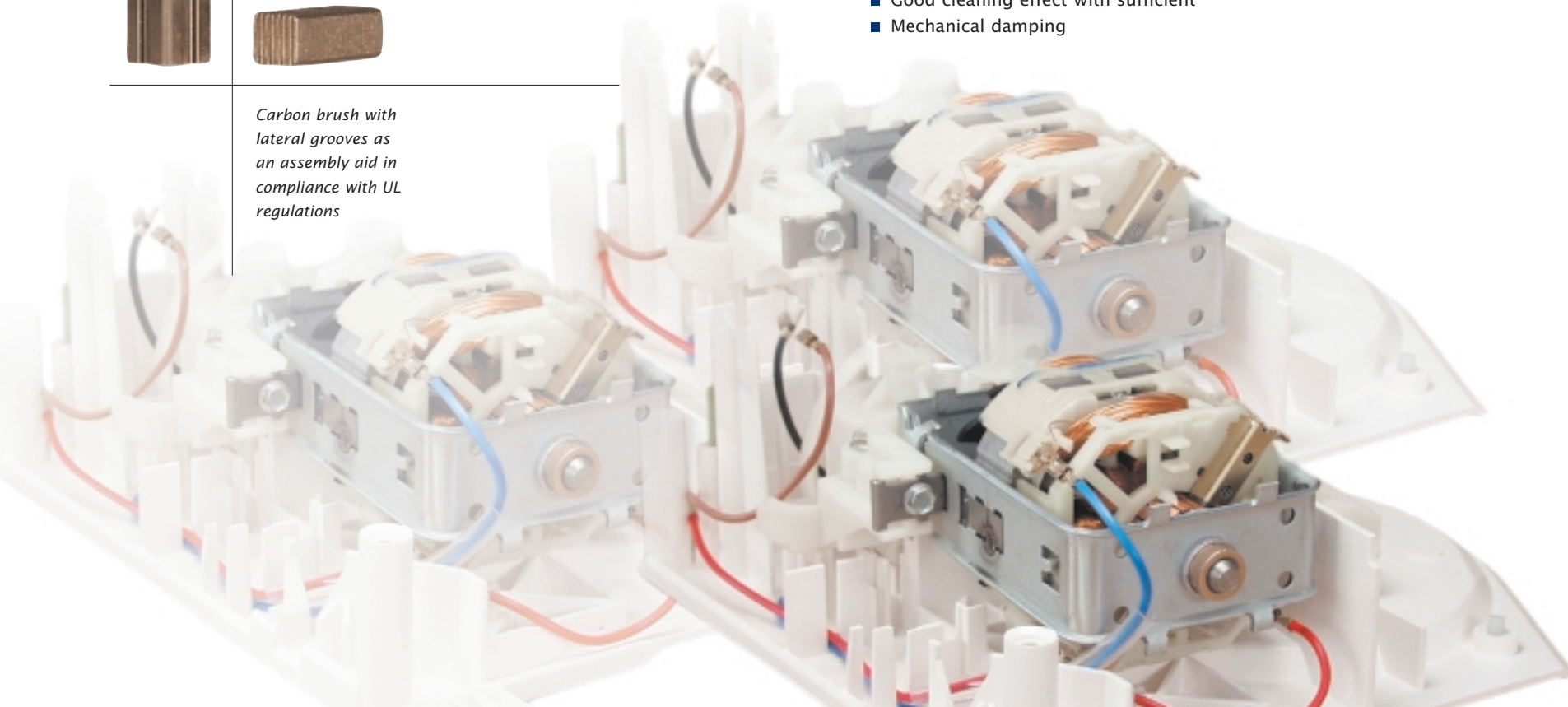
Generally, Schunk carbon brushes ensure a low levels of radio interference. In many cases, motor developers can do so even entirely without radio interference suppression coils. This results in cost reduction as well as the space savings.



Carbon brush with a copper-cased steel spring for use in slicing machines. The transmission of power is possible to up to 5.5 A without flexible wire



Carbon brush with lateral grooves as an assembly aid in compliance with UL regulations



Perfect Commutation



Carbon brushes and holders for washing machine motors. Optimum commutation with direct current and alternating current supply



Special development by Schunk. This laminated carbon brush which consists of two parts glued together with a central insulating layer ensures a decisive reduction of commutating currents

Precision Technology for Mini- and Micro-Motors



The Biggest Possible Success – Even with the Smallest of Motors

One field of special knowledge which the Small Motor Technology Division commands is the development and production of micro-carbon brushes, small, finished-moulded precision parts for small and miniature motors. Micro-carbon brushes are used in mini-motors with both mains supply and battery supply, for example:

- Small motors for electric razors
- Miniature motors for the office sector
- High-quality motors for use in toys
- Mini-motors for medical applications
- Audio and video devices

The aim of precision motors with very small dimensions is to ensure a relatively high output combined simultaneously with smooth and silent operation.

Metal-graphite Materials – Special Mixtures for the Best Properties

Schunk primarily uses materials made of resin-bonded copper- or silver-graphite and pitch bonded copper-graphite for low-voltage and micro-motors as well as for toy motors.

As in the case of materials used for longer carbon brushes, physical material properties for mini- and micro-motors are primarily defined by means of

- Coefficient of friction
- Specific electrical resistance
- Rockwell hardness
- Bending strength
- Density
- Metal content
- Admissible peripheral speed
- And constant current density

and designed accordingly.

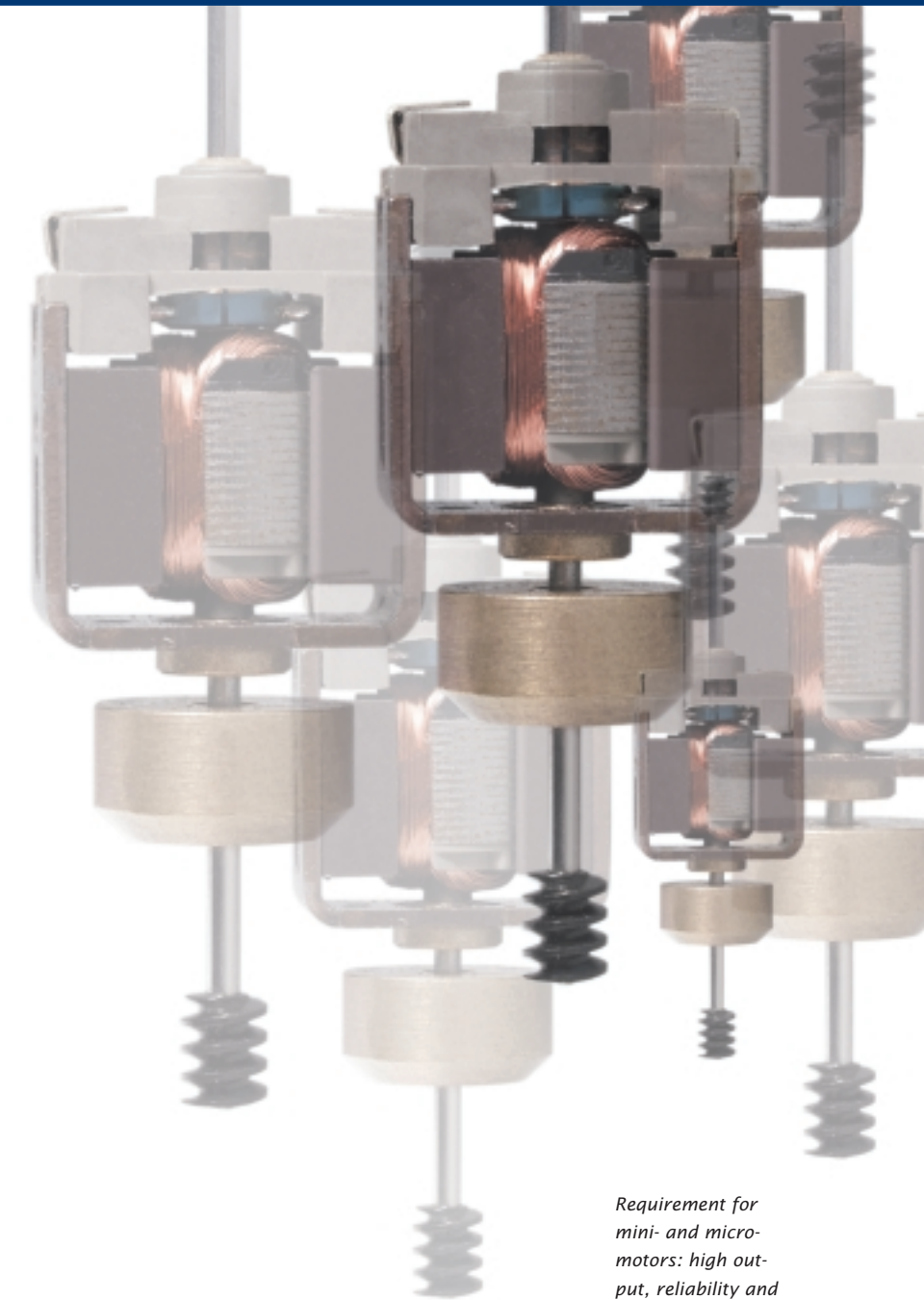
The secret to success in this case is to find the right balance of these properties. Schunk can help you to do just that with its many years of experience as well as with comprehensive testing.

Micro-carbon Brushes – Standard Materials and Special Developments

In this sector too, the Small Motor Technology Division offers both finished materials, which have shown excellent performance in other applications, and support for customer-specific systems solutions.

The development and production of special materials and the specialized tool ensure top quality as well as implementation in accordance with customer requirements.

As with bigger carbon brushes, micro-carbon brushes are tested in our own laboratory specifically to optimise the operating life and to reduce noise, etc. and, moreover, the development of these brushes is continued there.



Requirement for mini- and micro-motors: high output, reliability and low noise levels

Schunk Precision



Carbon brush with Cu head



Precision moulding technology on the highest level. Carbon brush, size < 6 mm



Carbon brushes for micro-motors with a complex geometry



Development: Carbon brush with laser-welded leaf spring



Micro-motor for high-value model railways. With carbon brushes, mounted into the adequate holders



Production and Quality Assurance

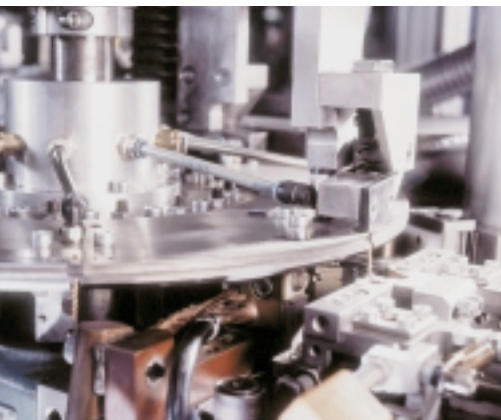
On Site for You as a Global Player

Since we have various production sites all over the world, we are one of the global players in carbon brushes and carbon brush holders manufacture as well as of entire modules for small motors and for miniature motors.

We are prepared to place production and logistics as close as possible to our customers' sites and we manufacture with manual, semi-automatic and with fully automated systems.



Production hall with modular automatic round table machines



Fully automatic processing of carbon brushes on automatic round table machines ensures a continuously high quality

"Made by Schunk" Means Top Quality

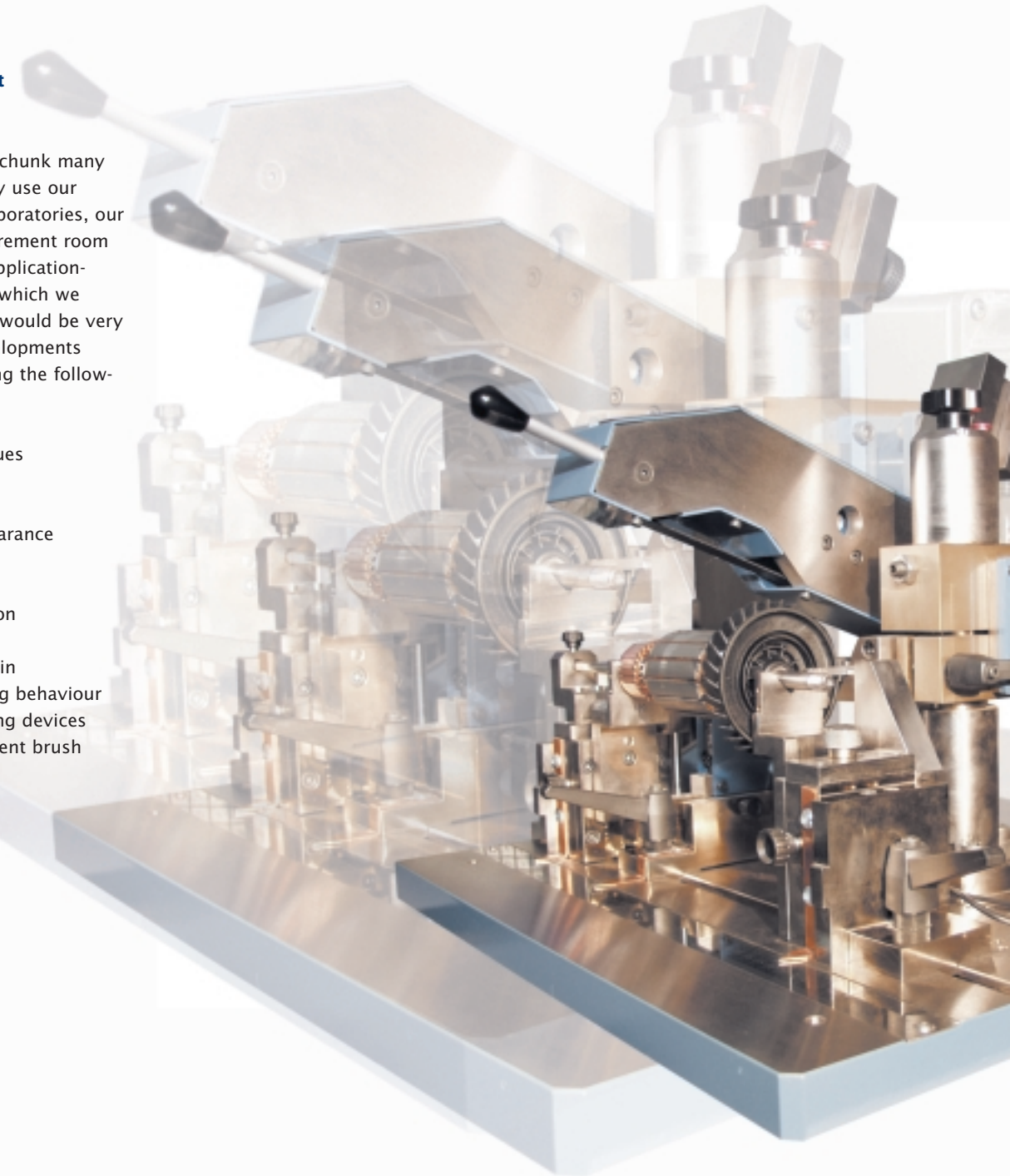
We have a clearly defined commitment to quality as well as a firmly established quality management throughout the entire small-power motor technology division. The individual enterprises within our group are certified according to ISO 9001, in some cases they are even certified according to QS 9000.

In the context of an established project management for new parts, all known quality planning and clearance processes are covered. These comprise: production quality forward planning and potential Failure Mode and Effects Analysis (FMEA) as well as a number of further quality assurance measures.

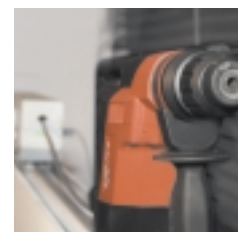
Intensive Development Consultation

In the cooperation with Schunk many motor developers actively use our chemistry and physics laboratories, our radio interference measurement room as well as the different application-technology test-benches which we have at our disposal. We would be very pleased to test your developments and advise you concerning the following subjects:

- Materials: physical values and properties
- Brush design
- Brush guide, brush clearance and brush pressure
- RFI – Radio Frequency Interference suppression
- Impregnations
- Carbon brush running-in
- Carbon brush operating behaviour
- Switch-off and signalling devices
- Mounting of two different brush materials in one motor



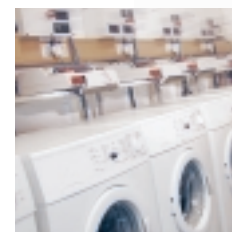
Quality Assurance



Radio interference measurements of electrically operated household appliances and power tools



Documentation and processing of radio interference measurement data obtained



Washing machines submitted to long-term testing in order to achieve optimum service life for carbon brushes



Endurance testing with professional tools



Circular saw. Testing of the carbon brush operating life under various load conditions



Long-term testing of permanent magnet motors

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