



**Schunk Group –  
Shaping the Future Together**

## From Local Tradition to Global Innovation



In 1913, the successful history of Schunk began in the city of Fulda. It was in that year that Ludwig Schunk and Karl Ebe launched their company for the production of carbon brushes. The company, which had started out as a small shop floor, soon proved its capabilities and corporate vision. In 1918 the company had already 60 employees and relocated to Heuchelheim near Giessen, where the production area increased.

These commencements developed into a global corporation. By now the Schunk Group is represented in 26 countries with a total of 60 companies, due to its broad range of services in the field of materials technology and systems technology. The number of employees has increased to well over 7,000. The carbon brush production is still a vital integral part, but the overall range of products and technologies has been significantly expanded. And again and again innovations tap new domains.

To imagine a life without Schunk today is not easy. After all, Schunk is a major contributor that we can have the things that we take for granted in our everyday life: cars, stereos, household appliances, power tools, high-speed trains, buses and railroads, airplanes, power plants, microchips or satellites. Because components or systems “made by Schunk” perform well in millions of devices, engines or industrial facilities across the world. They provide reliable drive, inspected safety and high comfort.

These components are sometimes tiny, in other instances they have an impressive size. Usually they operate unnoticed. And they always exhibit the quality and the cutting-edge intellect that only a future-oriented corporation like Schunk can offer – this is its tradition.

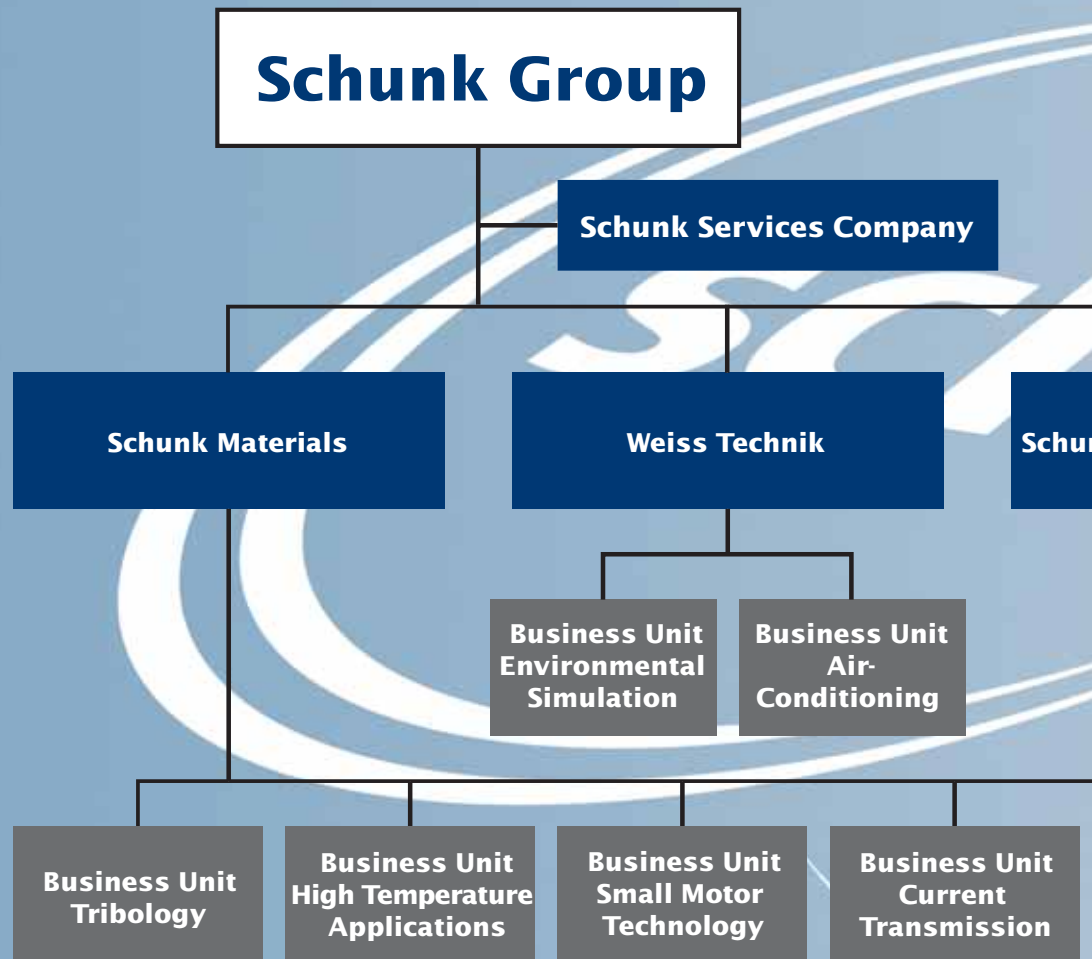


The importance of securing the future of our company is part of this tradition. For this reason, long-term vision and sustainability always affected the actions of Schunk. Both in regards to our services and therefore our customers, as well as in regards to our employees. Reliability has become the cornerstone of the Schunk corporate philosophy. Customers can rely on the promises and on the quality of the products coming from Schunk, because the company in turn can rely on the skills and motivation of its employees. Their identification with the company is the key to the satisfaction of all our customers.

Ludwig Schunk established the basis for this solidarity. He proved himself in many regards as an impressive visionary during the foundation and progression of his company.

This was also the case when he left his entire estate in 1947 to the "Support Organization for Employees". Today the Ludwig-Schunk-Trust holds the assets of the corporation in trust and ensures that the duties specified in the will are adhered to. For the benefit of all employees and for the future of the entire company.

# From Today's Brand to the Possibilities of Tomorrow

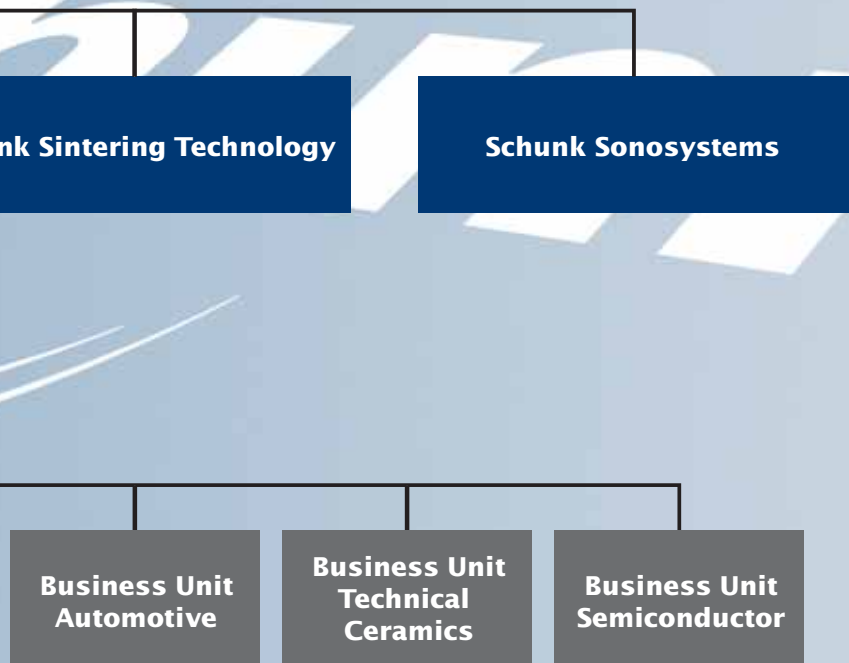


Schunk is not only associated with high-quality materials and components, stable quality, safety and perfection with tradition. Schunk represents much more. The will to tackle problems differently and to strike new paths as well as the passion for finding new solutions are the driving forces. Our motto for the future is innovation.

In regards of competence and top quality we always prove ourselves to be a reliable partner. For the future, we will show even more intensely how extensive the imagination is that turns our components into indispensable elements of countless efficient technologies, machines and devices.

The drive for innovation has led to an ever-increasing expansion of our business activities. This way we have been able to develop new, related fields of technology time and time again. However, this will for innovation has never been and is also not now an end in itself. The requests and goals of our customers are always our top priority. To fulfill them individually is one of those driving forces that lead to joint and economical solutions.

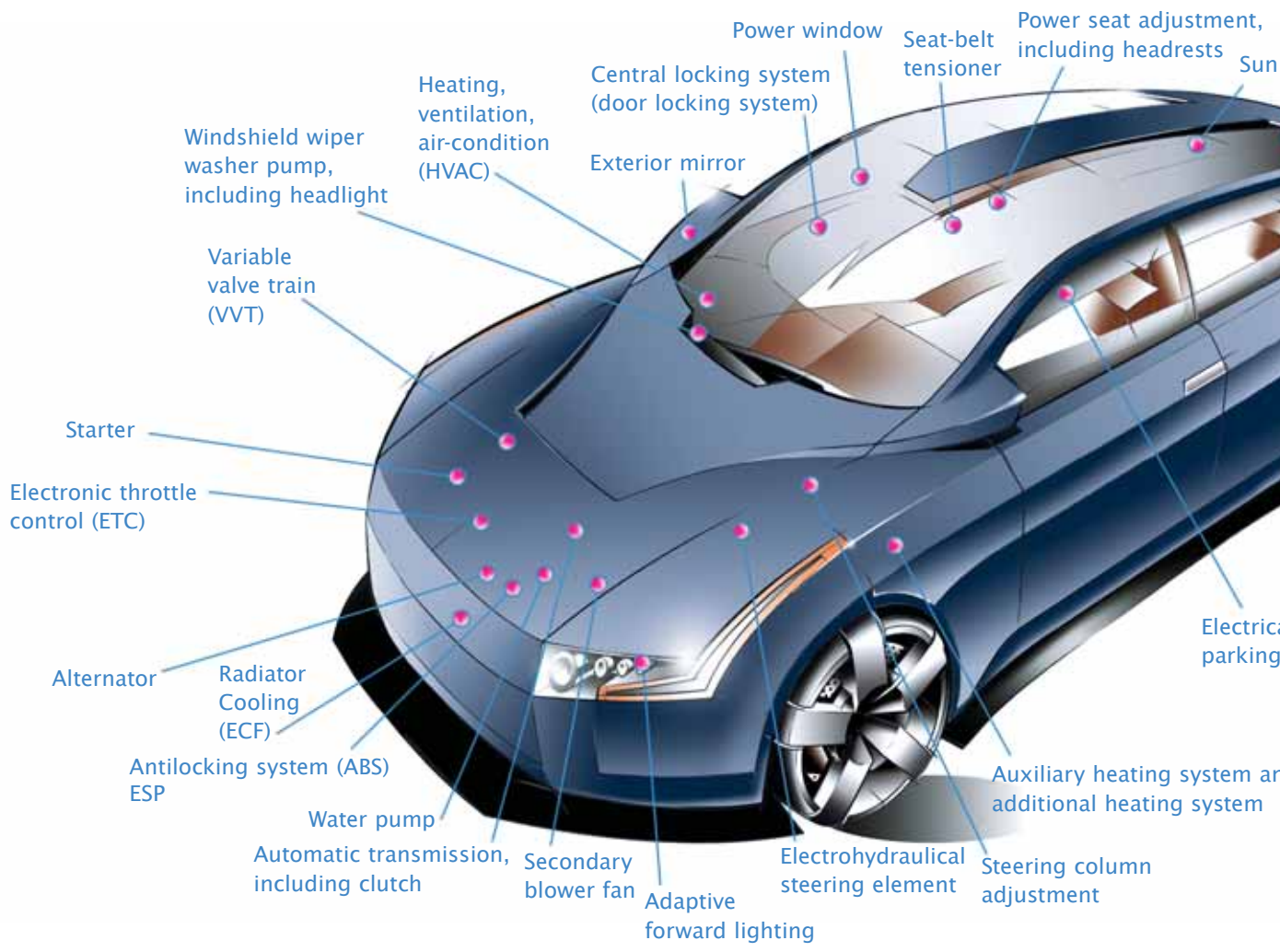
The companies of the Schunk Group are organized in divisions. They operate independently in their markets; however, in addition they constitute a tight network of strategic alliances and co-operations. Connections to the leading research institutes of the world are used effectively. All of this means: The know-how and the insight from the most diverse business divisions is used for new innovative solutions in projects – as a competitive advantage for our customers.



The Schunk Group is divided into the following technology branches:

- Schunk Materials
- Weiss Technology
- Sintered Metal Technology
- Sonosystems

We would like to give you an impression of the unlimited possibilities and innovative potentials hidden behind these short names. Please join us for this journey.





### Fractional Horsepower Motor Technology

Carbon brushes made by Schunk are the “driving forces” in countless fractional horsepower motors of appliances, toys and power tools for handymen and professionals worldwide. Dozens of Schunk components are in everybody’s household, from washers to blenders and to hair dryers.

Schunk Materials delivers the core elements of any electric motor: Carbon brushes, entire brush holder systems and brush yokes for the transmission of the electric power. We also ensure continued operation even after intensive use: Our products are subjected to continuous durability testing in our own laboratories.

### Industrial and Railroad Technology

Schunk Materials designs and manufactures components and subassemblies for safe current transmission, ranging from measurement current to high current. This includes carbon brushes and brush holders, brush yokes, pantographs, collector shoes, grounding contacts and switching contacts.

roof



Rear window wiper

Fuel pump

al  
brake

nd

Thousands of railway vehicles worldwide rely on power transmission systems by Schunk: from the European ICE to the IORE, the most powerful electric locomotive in the world, which pulls more than 8,000 tons of ore with its 10,800 kW through the icy vastness of the polar circle.

Schunk Materials guarantees safety not only on railroads. Furthermore there are flexible power connections and holder systems for the manufacturers of switchgears, industrial furnaces, welding robots and transformer substations.

Brush yokes and carbon brushes by Schunk are used very effectively in applications ranging from forklift trucks to golf carts. Equally sophisticated components are produced for medical technology. Schunk components are used in the field of renewable energies as well, especially in the fields of wind energy and fuel cells.

### Automotive

Modern cars contain over 100 electric motors. Schunk components provide exemplary service in these motors. ABS, starters, fans (for ventilation and air-conditioning), power windows, seat-belt tensioners, fuel pumps, sun roofs, power seat adjusters or windshield wipers – they are all equipped with carbon brushes and brush systems made by Schunk.

For that purpose, we deliver annually over 500 million brushes and brush systems to the automotive industry, often carbon brush holders or ready-to-install modules as well. Our systematic automotive technology ensures increased driving safety, for example with ABS, as well as modern engine management, for example in fuel pumps, and a decrease of CO<sub>2</sub> in the stop-and-go-starter. Our partners in the automotive industry know that they can rely on our quality.

# Between Safety on Railroads and Reliability on Roads



Perfect power transmission worldwide: whether in a high-speed train going 400 km/h or in the vacuum cleaner in the living room. And equally reliable and efficient with the various technologies of power generation



More driving safety in the smallest dimensions: components for electric engines in the car, ranging from the electrical power steering pump to the ABS-system

High dimensional accuracy and narrow tolerances. Brush yoke for a high quality hammer drill

Grounding contact, also for the most powerful electric locomotive in the world: IORE



## Between Innovative Traction Force and Compact Propulsive Force – Schunk Materials

Materials need to be even more lightweight, more robust, and more resistant to temperature and wear, so that they make the machines and products of tomorrow already possible today. The Business Units of Schunk Materials push the limits for materials with concentrated innovative force.

You will meet these materials on the roads of the world, in countless households, at sea, on land and in the air. And, in their own way, components made by Schunk even conquer space: almost unnoticed by the public, but of immense importance for functioning and success. Where other materials fail, components made by Schunk pass with flying colors.

Schunk Materials has production facilities in 33 locations worldwide. Components are manufactured from carbon, graphite, carbon-composites, silicon carbide, aluminum oxide and silica for the most various lines of industry.

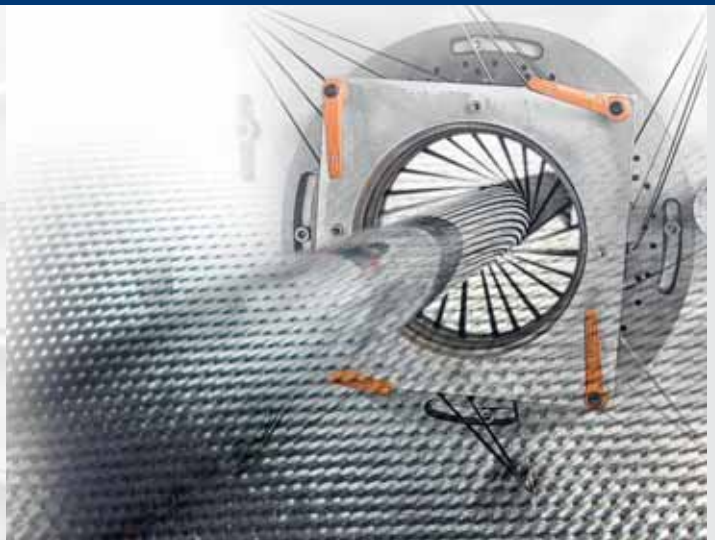
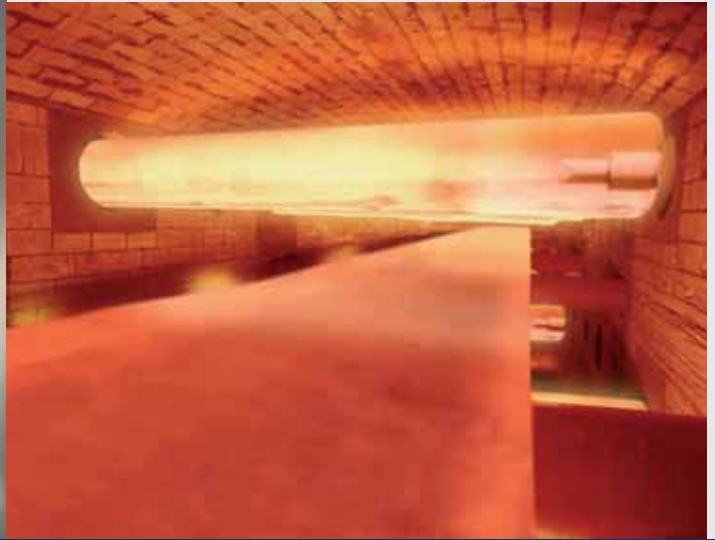


Every year, several billion pieces are produced. Their dimensions range from microscopically small up to several meters. From standardized mass-production with high quantities to unique high-tech pieces. This includes carbon brushes for the Mars Rover or the coating of the combustion chambers of the Ariane rocket.

Schunk Materials combines passion for innovation with enthusiasm for action. Here, the fascination for speed meets the demands for comfort in all aspects of everyday life. And above all that is the demand for safety.

Whether with engineering ceramics, the production of silicon wafers for the semiconductor industry or the development of carbon fiber reinforced plastics (CFRP) – for us, the future has already started. And again and again, highest future requirements are our standards today.

## Between Highly Sensitive Materials and Insensitive Components



Top left: Tribology in perfection - friction materials for various types of pumps, seal rings and compressors  
Top right: SiSiC Radiant Tubes (continuous annealing line)  
Bottom: Winding machine for the production of high performance fiber composite materials

CFRP winding components for highest rotation loads, for example in high vacuum pumps

### Tribology

“Nothing less than perfection in tribology” – this is our standard. Our highly wear-resistant bearing rings and seal rings made of carbon, graphite and silicon carbide are developed for applications with highest requirements. They perform outstandingly in the plants and machines of the chemical and petrochemical industry, as well as in automotive, HVAC and power plant engineering and the pharmaceutical and food industry.

### High temperature applications

There are materials for very high temperatures – and then there are the customized materials and components made by Schunk. They are designed to withstand even the most extreme temperatures. Based on these requirements, graphite components for industrial furnaces or silicon production are manufactured.

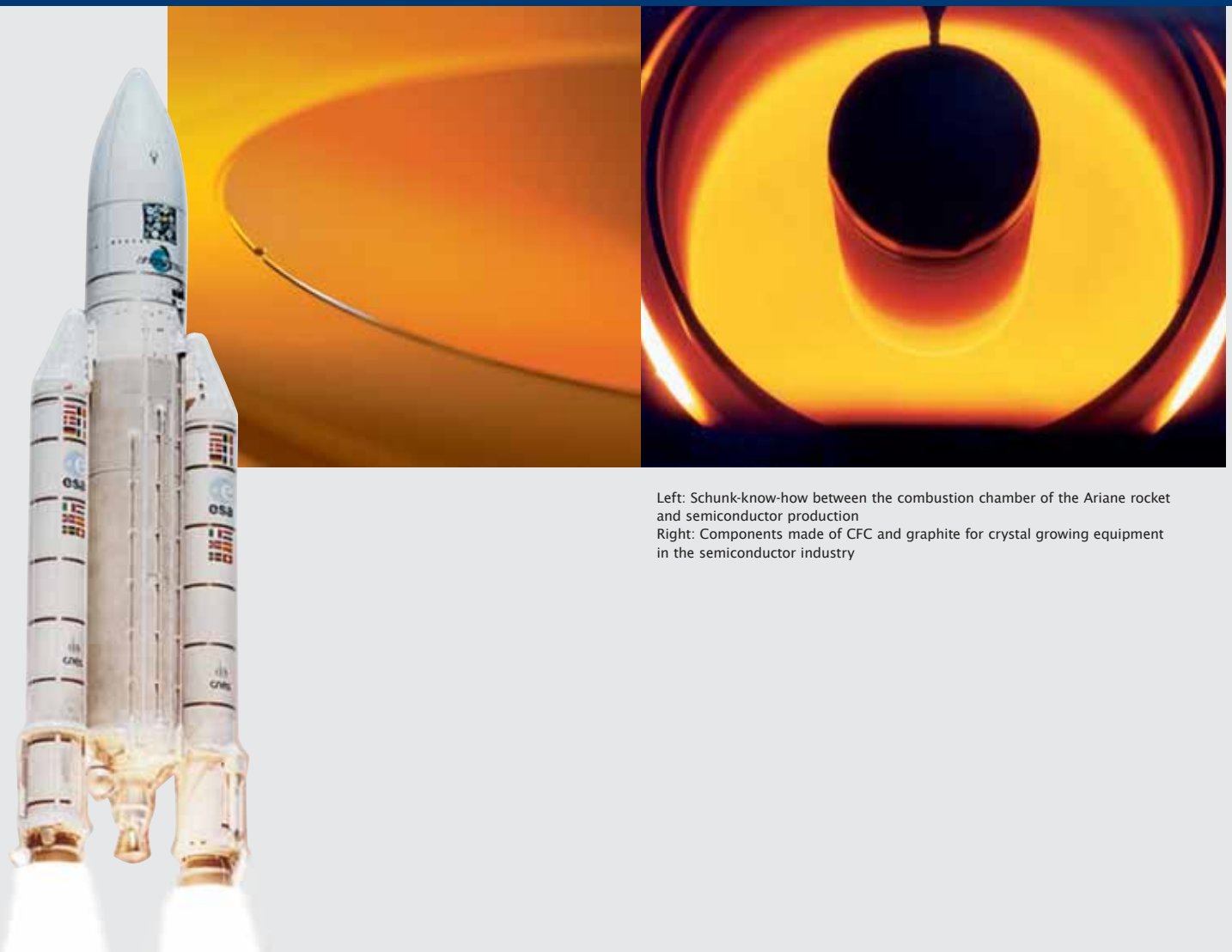
With carbon fiber reinforced carbon (CFC) it is possible to achieve tremendous stability. Our highly oriented silicon carbide coatings are used in aerospace for space mirrors and mirror carrier structures. And last but not least, we are global market leader as the supplier of graphite components for one of the most precise procedures in trace analysis, atomic absorption spectroscopy (AAS).

### Engineering Ceramics

Schunk Engineering Ceramics enables technical implementations in applications where they would be impossible with other materials. This is made possible by their chemical resistance and their high temperature resistance. Thus ceramic radiant tubes and flame tubes, as well as recuperator burners made of siliconized silicon carbide (SiSiC) are produced – for the heat processing technology. We produce components for furnace and plant engineering as well as for process engineering, for example ceramic kiln furniture for the production of china and sanitary ceramics. Every single one of these solutions is developed in close collaboration between our engineers and developers and our customers.

### Semiconductor

Schunk products are used in many significant process steps of the semiconductor production: in graphite crucibles for crystal growing, in CVD-coated ceramic susceptors or in silica wafer boats for the treatment of wafers. Besides crucibles, electrodes, cutting bars, heaters and tubes we also produce custom components of highest purity or with an additional coating of pyrocarbon (PC) or siliconcarbide.



Left: Schunk-know-how between the combustion chamber of the Ariane rocket and semiconductor production  
Right: Components made of CFC and graphite for crystal growing equipment in the semiconductor industry





### **Weiss Environmental Simulation**

The climate is one of the main topics of conversation of our time. People are worried about impending climate changes. But even the everyday climate already exhibits extremes, which demands highest performances of materials. Environmental simulation is becoming more important from these perspectives – for many years it has been the specialty of Weiss Environmental Simulation.

Our mission is: The cutting edge technology of tomorrow needs the best possible testing systems already today. Against this background we design and build environmental simulation systems for all imaginable and many unimaginable test requirements. We have become the most important manufacturer in this field worldwide.

One core expertise includes testing equipment that recreates extremely high thermal requirements, i.e. that can change the temperature of components from  $-80^{\circ}\text{C}$  to up to  $+220^{\circ}\text{C}$  within a few seconds. Our equipment simulates the conditions of cold weather, heat and humidity of various seasons or the extremes of various climate zones of the world. Through our efforts it is possible to calculate the impact of the environment on products.



A substantial portion of our products is used by the automotive industry. For many years, our know-how has been an inherent part of the quality management system of numerous renowned manufacturers. We design the most versatile test systems for them: from salt spraying test chambers (corrosion tests) to testing technologies for everything on and in the car up to road simulation and combined testing procedures – as real as reality.

Whether exhaust emissions or the reliability of the airbag, we contribute crucially to the fact that only examined quality is mass-produced and reaches the streets and roads worldwide.

Our stability testing systems are an indispensable guarantor for the safety and the consistently high quality and durability of medical and pharmaceutical products. The product range extends from stability testing cabinets to walk-in climate chambers and customized systems of any size, manufactured according to customer specifications. Our product range is of course based on the guidelines according to GMP, FDA and ICH.

## Between Ice Cold Temperatures and Hot Test Stages – Weiss Environmental Simulation



Top: An example of the Weiss product range: Vötsch Hephaistos, revolutionary microwave technology for the heat technology



Walk-in temperature and climate chamber WT/WK



## Between Extreme Exposure and Optimum Conditions – Environmental Simulation by Weiss

Weiss Group has been an inherent part of Schunk Group for many decades. Several companies are active under the umbrella brand “Weiss Technik”.

Weiss Environmental Simulation has been dedicated to the production of testing devices and testing systems for environmental simulation for more than 50 years.

Test procedures can be performed in a reproducible manner on most diverse products according to standards or special customer requests with these systems- this is an important contribution for the production of reliable products in research, development, quality assurance and production. Environmental factors such as temperature, moisture, air pressure, light, dust, rain, salt mist, corrosive gas and numerous other factors impact the test specimen individually or in combination.

Weiss Environmental Simulation is one of the most important manufacturers of environmental simulation systems worldwide.



# Between Comfortable Office Space and Sterile Clean Rooms – Weiss Air Conditioning

## Weiss Air Conditioning

In air condition technology, the name Weiss has represented for decades future oriented developments and high quality worldwide. Wherever optimum climate framework conditions are required for production processes and procedures for man and machine, Weiss air condition devices, systems and Weiss process technology prove their reliability.

A lot of heat is created when many computer capacities are utilized. Modern Weiss air condition systems provide the best possible climate conditions in rooms with a high thermal load, such as computer centers and relay stations. Thus they not only help to avoid computer and server crashes by means of constant temperatures and a precisely set humidity. In addition, innovative Weiss climate solutions remove excessive dissipated heat intelligently and facilitate a particularly energy-saving operation of the entire system.

Whether a comfortable climate in small commercial buildings or comprehensive climate concepts in large building complexes, the solutions provided by Weiss Air Conditioning ensure ideal conditions everywhere.

We also create optimum conditions wherever clean room system solutions and know-how are required. From food industry to pharmaceuticals, genetic engineering, bioengineering, microelectronics and the field of automotive industries and up to nanotechnology-systems from Weiss Air Conditioning have proven themselves in the most divergent specialties.

The most demanding challenges include all functional areas of a hospital. With MEDICLEAN® we offer an entire product range which includes hygienic air condition solutions for operating rooms, sterile chambers, laboratories/hospital pharmacies, sterilization, intensive care units, sterile laundry and diagnosis facilities.

Whether hygienic climate or air-conditioning of clean rooms, computer centers and office buildings: Weiss Air Conditioning delivers individual solutions. We are one of the few companies worldwide that provide customized solutions from one source – from system consultation to development, design, production, assembly and start-up and extending to maintenance and service.



Energy and space saving air-condition solutions for rooms, offices and conference centers with a high thermal load

Intelligent solutions for diverse clean room requirements



Hygienic air condition solutions for all functional areas of the hospital



DELTA CLIMA® – energy and space saving air conditioners for rooms with a high thermal load



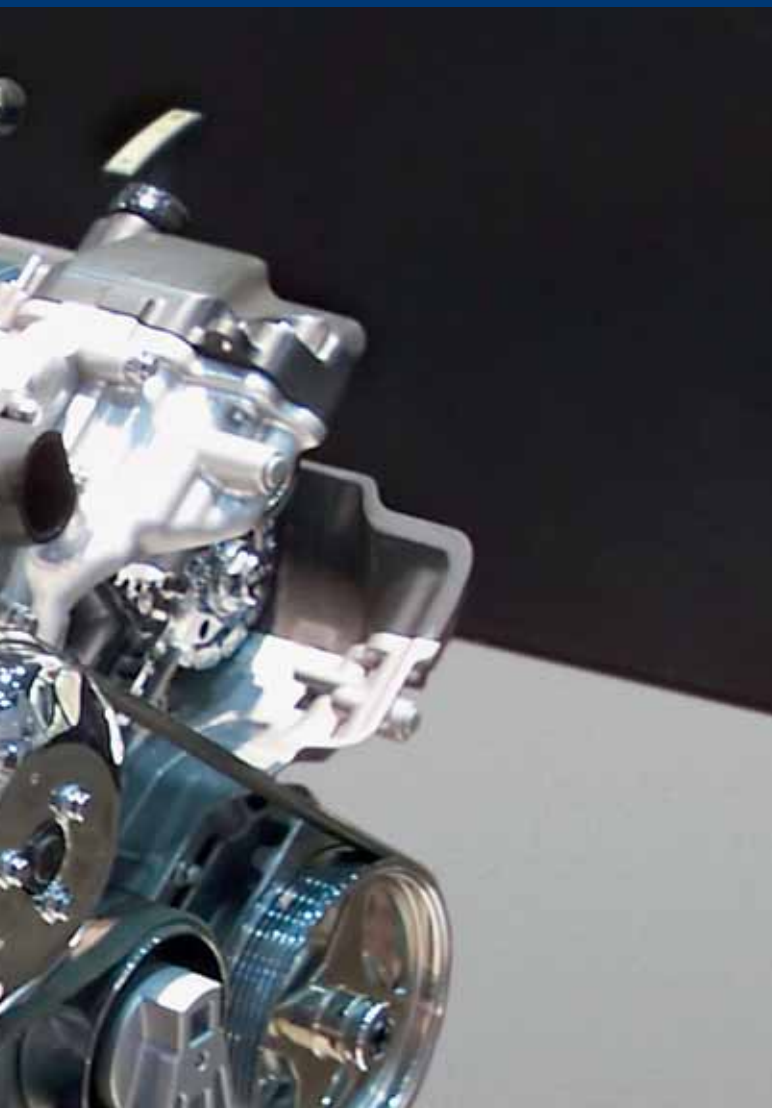


### **Schunk Sintered Metal Technology**

Sintering includes the steps of molding of metal powder, its subsequent hardening through tempering and the finishing of the sintered parts. The skill that signifies the huge experience head start of Schunk is the continuous further improvement of product and process development.

Our partners come in particular from the automotive and automotive supplier industry but also from electrical engineering and the entertainment industry, from the field of household appliances and electric power tools, from mechanical engineering and medical technology.

Schunk produces components such as gears, safety equipment, joint parts and injection molded parts, impregnated precision friction bearings – ranging from tenths of grams up to complex machined parts of several kilograms – from many thousand tons of metal powder annually. What distinguishes these components is the guarantee that sintered parts made by Schunk provide the ideal solution for sophisticated components and systems within many different industries.

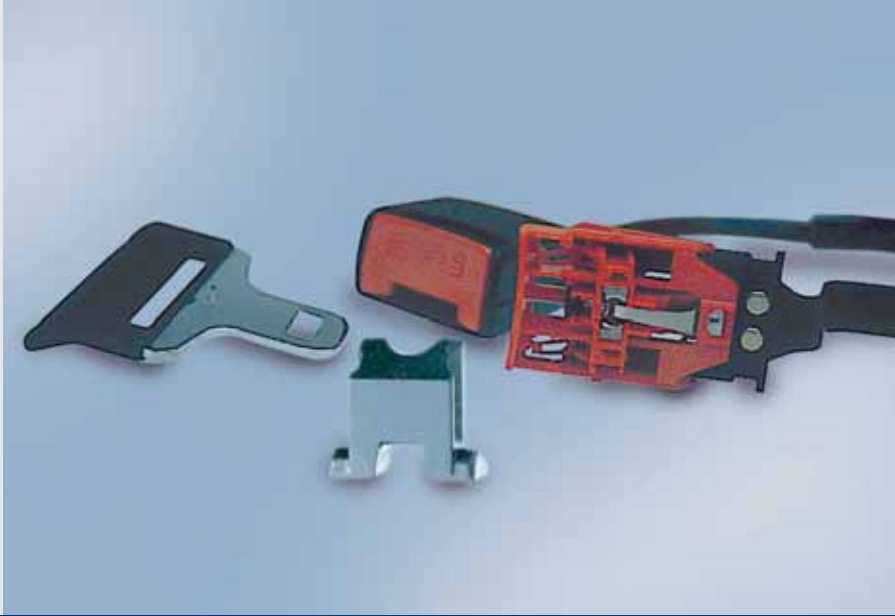


The advantages of the powder metallurgic products produced by Schunk are the highest dimensional accuracy even with complex geometries, the precise reproducibility in mass-production and the customized material properties specified together with the customer.

“Together” is a key term, which is reflected throughout our entire process organization. Every single one of these sintered parts is developed in close collaboration with the customer. We regard the customer’s wishes at every level: from consulting to development to production and delivery of our components.

In our production process we use a procedure, which is one of the most progressive in the world: MIM, Metal Injection Molding. It offers unimagined combination possibilities for the design of mechanical components. For more than ten years Schunk has been the market leader in Europe in this field.

Anybody who uses Schunk sintering technology can count on innovative ambition and know-how, which is offered by hardly anyone else in the world. This is found throughout all stages of the production chain – from consulting to the cost-effectiveness of our production program up to the technical implementation of very specific environmental aspects.



One "click" for more safety in millions of cars worldwide – the latch cam for seat belts



Left: Cam socket, manufactured with MIM  
Right: Camshaft sprocket for diesel engines in the common rail technology



Left: Camshaft adjuster  
Right: Three-piece joined assembly with helical gear pinion for electrical seat adjustment, ES<sup>®</sup> annealed



## Between Red-Hot Metal and Reliable Engines – Schunk Sintered Metal Technology

The technology of sintering is one of the oldest and at the same time one of the most innovative branches of metallurgy. And regardless of how unimpressive many of our sintered parts might appear to the outsider, they still have a tremendous innovative potential.

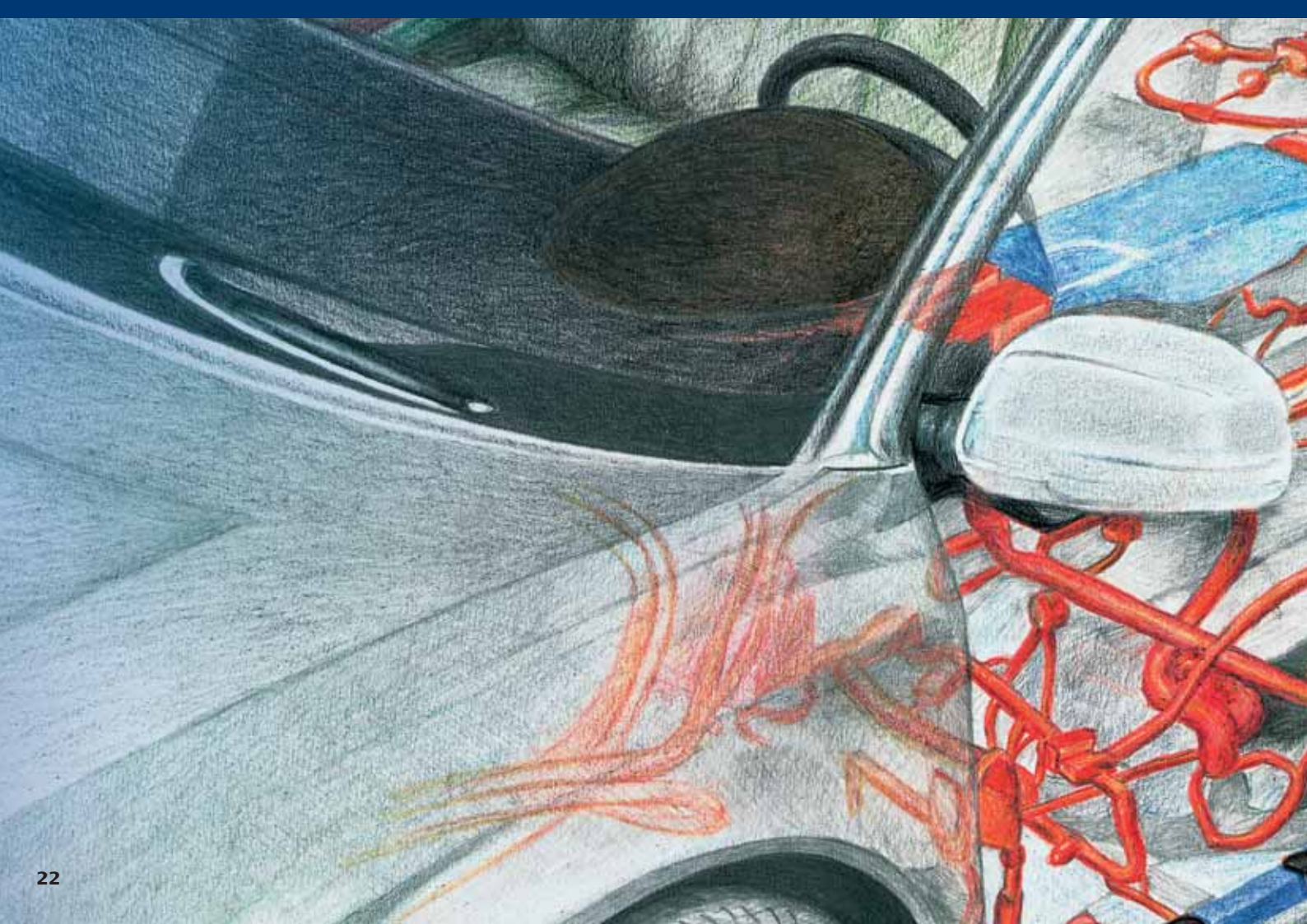
The most significant application area of sintered metal components made by Schunk is the automotive industry. Here they bring speed and safety at the same time onto the roads of the world. Without sintered parts in its engine and transmission, a car does not move. Up to 50 components made by Schunk can be found in vehicles produced by European manufacturers. And whenever the seat belt ensures with a characteristic “click” a safe driving experience, a sintered part is used here as well – a sintered latch cam made by Schunk is used in more than 100 million cars worldwide.

Sintered machined parts and bearings stand for safety and reliability. Our components are reliable, because our zero-defect philosophy determines all our actions. Users of seat belts, car seats and many other safety-relevant applications rely on us. Many customers call it “Schunk inside” and for many years they have trusted our innovations and us.



Schunk Group







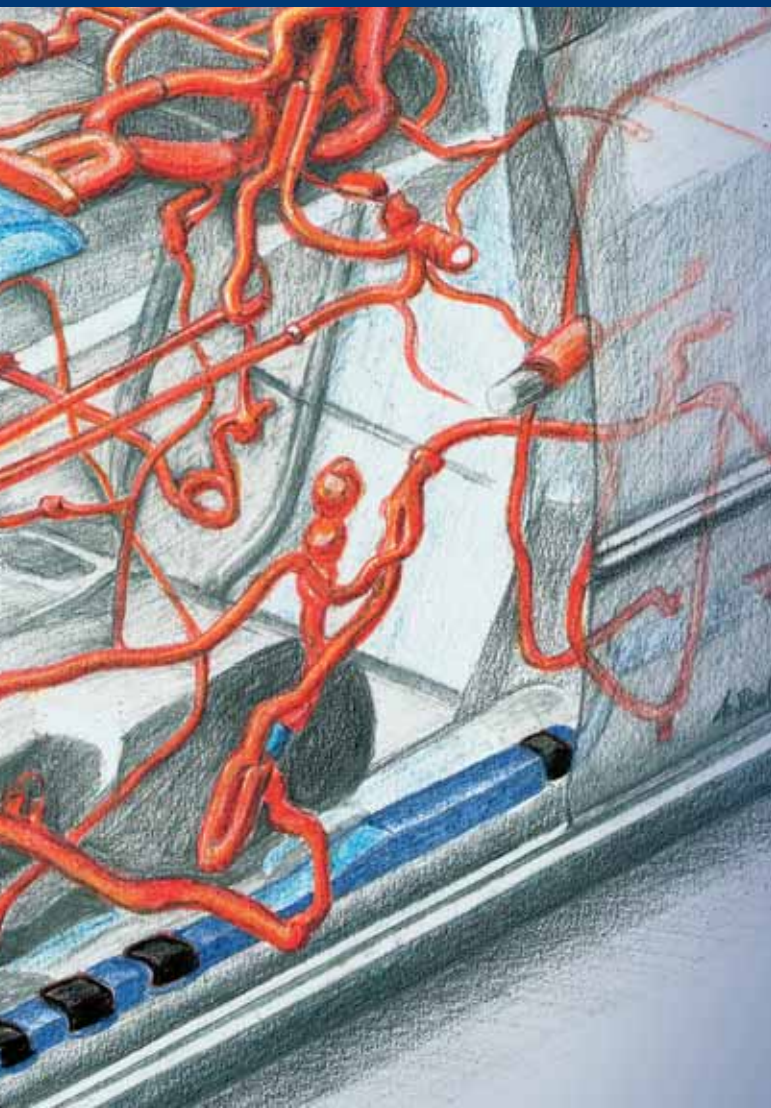
### **Schunk Sonosystems**

Within the field of ultrasonic metal welding, Schunk has become a specialist that is accepted worldwide. Through intensive fundamental research and numerous innovations we acquired a huge head start in technology.

Again, the automotive industry is a main user in this challenging field. Schunk Sonosystems provides perfect connections, millions of times, worldwide in the electrical “nervous system” of the car, the wire harness.

The products that leave the production facility under the name of Schunk Sonosystems, are complete systems solutions from one source. In addition to the standard machine program, Schunk offers a modular system concept. This concept makes the integration of ultrasonic systems into complex assembly lines possible.

The range of products includes welding systems for the wiring harness industry, ultrasonic rod welding tongs for the gas-tight sealing of cooling systems and complex customized systems for the solar and electronics industry.



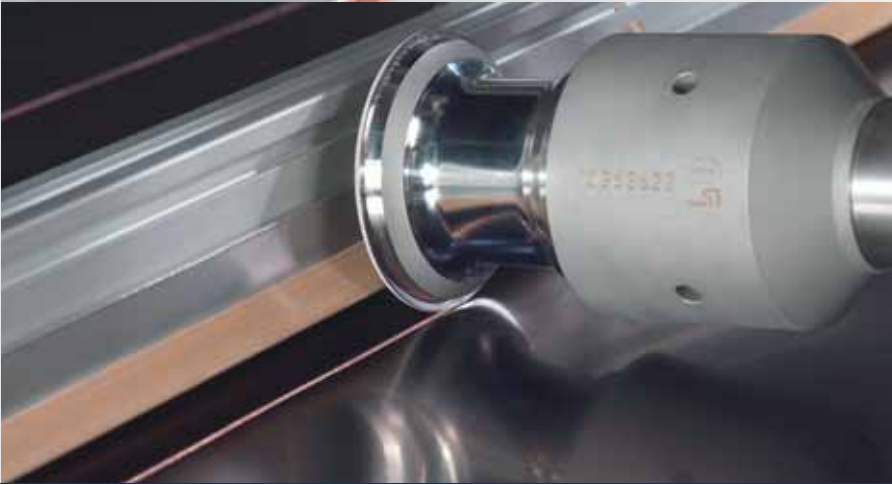
All systems are characterized by their flexible use, the simple connection, low operating costs and comprehensive process control.

The comprehensive global service for all Schunk system solutions is an additional crucial advantage. Part of this global service are our training centers for the effective handling of the equipment or the Schunk-Online service – for example for the optimization of welding parameters.

Today's high standard means also that the development is pushed towards the future. Networking of welding systems with PPC systems is one of the projects into which we invest innovative potential. For new trend setting, customized solutions.



Tube welding system  
for the cooling unit industry



Special welding system for  
solar large surface absorbers



Perfect connections in the wire harness,  
the electrical "nervous system" of the car



Ultrasonic strand welding machine  
for the wire harness industry



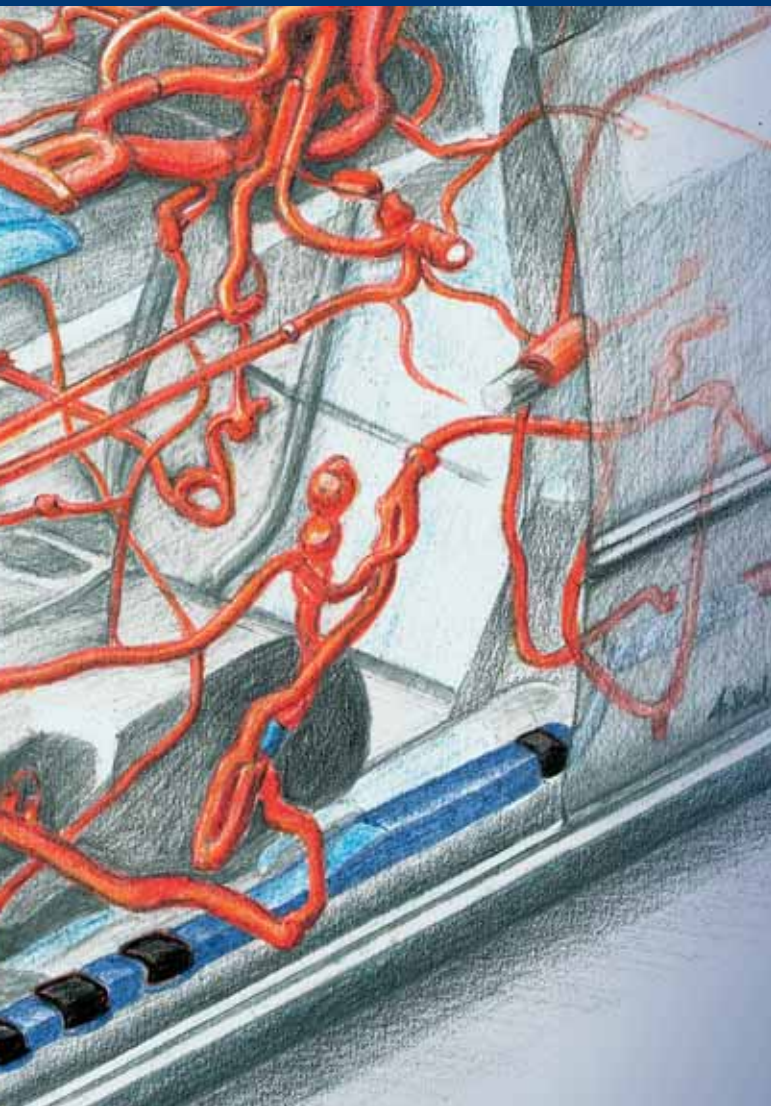
## Between Solid Connections and Complex Solutions – Schunk Sonosystems

When hearing the keyword welding, the images of red hot metal, glistening streams of sparks, essential safety glasses and solid, but rough, connections inevitably come to mind. The ultrasonic welding technology, which Schunk developed and matured during the seventies, is in many ways the exact opposite.

Ultrasonic welding is a future-oriented procedure, which is basically only because of the stability of its connections reminiscent of conventional welding. And even here the quality reaches a different level.

This special welding procedure joins metals by means of ultrasound. In this process, the materials to be welded are overlapped and then moved against each other at low pressure and with high-frequency mechanical vibrations.

Thus a stable, solid and metallurgical pure connection is created within a split second, without placing a thermal load on the components. This connection has excellent physical properties.



All of this ensures a qualitative and economically superior alternative, without the need for a filler metal.

Schunk Group





## From Sprouting Concepts to Full-Blown Innovations – Outlooks for Schunk

For Schunk, the future basically started in 1913. Exactly at the moment when Ludwig Schunk focused his energy and his corporate vision and launched his own company. He took an additional trend-setting step, when he elevated the trust, which he placed into his own employees, to a pillar of the Schunk company philosophy.

The employees of our company confirm this trust time and time again through their commitment and their strong solidarity with the company. They contribute on a daily basis to our increased sustainability. For our future, as well as for the future of our customers.

Products “made by Schunk” are absolute quality products. This consistently high level of quality is the result of many quality assurance measures. All employees are responsible for the implementation of these measures. Through this joint commitment and quality awareness we have advanced to global technology leader status, and not only in numerous of our specialties. We have also been able to set standards in terms of innovative energy, customer orientation and flexibility time and time again all over the world.

One of the big potentials – and the basis for this comprehensive motivation – is personal responsibility. This responsibility extends into the detail of each product bearing the name Schunk.

However, our worldwide employees are not only challenged – they are also directly supported. Within the industry, training and professional development at Schunk is considered exemplary. Through the Ludwig-Schunk-Trust, the employees of Schunk have a holding in the profits of the corporation. And every single employee is proud of his position within the company. Because everyone in the big global Schunk team senses: My ideas matter!

It is one of the most important concerns for Schunk to inspire and focus all the innovative energies within the company. This allows all employees to actively participate in the joint future.

How do our customers benefit from this? They benefit directly from the synergies of an innovative global technology corporation – for their own competitive advantage, And not only today, but particularly also in the future.



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