

K»MOBIL

THE KIRCHHOFF GROUP MAGAZINE



Strengthening the global economy and acting together

A strong European Union means great economic and social benefits for its Member States, for its trading partners and for businesses. Read more about current developments from page 4. »

Contents



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K>MOBIL
the KIRCHHOFF Group magazine

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KIRCHHOFF Group

- 004 Editorial: Act Together and Promote Innovation
- 008 Is Lightweight Construction Essential in Times of E-mobility?
- 010 Networking Science and Business

KIRCHHOFF Automotive

- 014 New products on the Road
- 020 Mobile—but how?
- 024 Electro first—on the Auto Shanghai
- 030 KIRCHHOFF Automotive Opens New Plant in Romania
- 034 BMW Supplier Diversity Conference 2019
- 036 New Ideas for Light-weight Construction
- 038 The Future is Autonomous—Even in Manufacturing
- 040 It's All About Aluminium
- 042 Rustless

KIRCHHOFF ECOTEC

- 076 Drive Zero
- 080 Technical innovations take unusual paths
- 082 Trucks Insight
- 084 Please refill oil
- 086 Flying high
- 087 Built for the toughest jobs
- 090 100 PERCENT CLEAN
- 092 Powerfull partner
- 094 Brewing and Malting
- 096 On Track
- 098 Something is spinning
- 100 Number 178 has outdated
- 102 Trendy sweepers in Austria
- 104 Sunny bins
- 106 Seine-Sational

- 044 Have you ever driven electric?
- 050 A Cultural Program Conquers Europe
- 054 First Colleague, Then Boss
- 056 Employee Development—Always In View
- 057 Quality First

KIRCHHOFF Mobility

- 060 Many Applications by NIVO Rear Cut-Out
- 063 NIVO, Turny and Co. for People in their Prime

WITTE TOOLS

- 066 MAXX Plus on tour—A sporty "Hello" from the Salzburg Region
- 070 A Success Story: 20 Years of WITTE Tools Screwdrivers for MATCO Tools
- 072 On TV: WITTE Tools

Act Together and Promote Innovation

Dear Customers and Friends of our Group of Companies,
Dear Employees,



The first six months of 2019 were marked by an economic and political situation that required a great deal of attention: in respect to politics, companies and society. As a committed group of companies, we are actively contributing our voices to Berlin and Brussels, reacting to the economic and political situation and adopting a clear position. We are critical of global trade conflicts, and we advocate that the parties involved reach an agreement quickly in order to strengthen the major markets in North America and Asia, and to position Europe well in international competition. There is an urgent need to strengthen both the rule-based international trade order and the European competition order. The uncertain outcome of Brexit and its delay until autumn 2019, are creating uncertainty in the markets, especially in regards to exports to the UK. A customs agreement with Great Britain is absolutely necessary in order to continue to serve the market well and in every sense. The currency risk must also be hedged in order to prevent further losses for suppliers from the euro zone due to the continuing threat of a fall in the value of the pound against the euro. »

Dr. Johannes F. Kirchhoff, Managing Partner of the KIRCHHOFF Group

European Elections 2019

European Parliament elections in May 2019 were accompanied by nationalist and protectionist developments in the EU Member States. The results clearly show that right-wing parties as well as parties that primarily promote environmental policy and climate protection performed well. Meanwhile, Christian Democrat and Socialist parties have lost popularity and credibility. This gives the European Union many tasks for the future, as even more political, economic and social actors should communicate the benefits of the European Union and support strategies that guarantee security, environmental protection, democracy and open markets.

Economic Freedom in the Social Market Economy

Global industrial and trade policy challenges of foreign trade, arise from the focus of some nations on government strategies to promote and protect certain industries. These nations are also currently undermining the liberal world economic order. The result is a nationalist economic policy coupled with political uncertainty. In Germany, there arises a dispute between the "Industrial Strategy 2030" economic programme and medium sized companies, which form the backbone of the German economy. In our free and social market economy, our aim is to continue supporting private-sector action and not a more controlled economy.

Conserving Resources and Driving Change

Growth in the automotive sector is expected to slow worldwide in 2019. This affects North America as well as the European market and the BRICS states, with the exception of Brazil. In the KIRCHHOFF Ecotec environmental division, we have also been serving the Australian market since mid-2018 with the largest manufacturer there, Superior Pak. The entire KIRCHHOFF Group was able to record growth in the first half of 2019 compared to 2018 and sees a continued positive development for 2019. There is great potential in the markets of Central and Eastern Europe and Asia in particular, as well as from the marketing of our new technologies, the development of which we continue to attach great importance to.



Research & Development

500 employees in the KIRCHHOFF Group are active in research & development and work on the continuous further development of existing products as well as numerous new developments. Digitalization, networking of processes, products in use, and numerous future projects and services, which are digitally controlled as required, are a priority with the company.

For alternative drives, we not only rely on battery electric drive technology, but also on fuel cell technology (seen in use with the BLUEPOWER from FAUN or in the CLEAN DRIVE from ZOELLER). As the KIRCHHOFF Group, we stand behind the opinion that fossil energy cannot be replaced by battery-powered vehicles alone, especially if the electricity used for this does not consist exclusively of regenerative resources. Our incentive is to find the right mix of alternative drives, especially in the current time of change from a scientific, technological and market point of view, and convert it into products for our customers.

The KIRCHHOFF Group is looking forward to exciting projects, to the further development and new development of products, as well as to shaping the future in our industries.

Each individual can contribute his or her part to this cause. Let us work together on the changes and tackle them with gusto!

We wish you and your families a pleasant summer with sincere greetings.

Yours,

Dr. Johannes F. Kirchhoff

Environmental protection and resource conservation are integrated into our corporate goals. Our steady growing environmental awareness is particularly noticeable in the automotive and transport sectors. To this end, we are developing sustainable solutions and new products for our industry. In the area of **KIRCHHOFF Automotive**, topics such as vehicle safety for electro mobility in conjunction with lightweight construction technology, are on the agenda. For example, with our hybrid battery housing, high-voltage battery modules can be safely contained in electric cars, and the innovative lightweight construction concept also saves energy. The environmental division **KIRCHHOFF Ecotec**, is working at full speed on further hydrogen-based alternative drives for waste collection vehicles, road sweepers and lift systems. As well as development on the use of digitization for more economical use of municipal vehicles, among other things through a forward-looking service.

WITTE Tools recorded results above the industry average despite the economic downturn in Germany and abroad. The new customers acquired in the last two years also contribute to the continued growth of the tool business. **KIRCHHOFF Mobility** as a leading supplier to individual automotive conversions, was able to achieve great success in the first part of 2019 with the product innovation of the rear entry modification NIVO for the new Opel Combo Life, Peugeot Rifter and Citroën Berlingo from the PSA Group.

Does this also apply to the future in which the automotive industry faces the greatest changes in its history? This is a question to Professor Christoph Wagener, Vice President Research and Product Development at KIRCHHOFF Automotive.

The future trends of tomorrow's mobility are shared mobility, autonomous driving and e-mobility. What influence do these have on the body of a vehicle?

Prof. Christoph Wagener: Shared mobility is based on the assumption that more and more people, especially in cities, no longer own a car themselves, but rent a vehicle. This will become particularly relevant in large cities, most likely first in China, where more than 750 million people already live. In addition to economic attractiveness, other functionalities to think about, are at the forefront for these vehicles. Such as the networking of the vehicles and the requirements to be able to clean the vehicles as efficiently as possible—to enable the interior to be renewed several times over its useful life. However, this will not change the requirements for crash safety and body weight.

But what about autonomous cars when they no longer cause accidents?

Prof. Christoph Wagener: Here, for example, the interior will change fundamentally. Since a driver is no longer required, the pedal system and steering wheel will become obsolete. But does this autonomous driving according to Level 5, also mean that we will drive accident-free? At the very least, these vehicles will eliminate man-made accidents. These account for over 90 percent of accidents. If we have both drivers and networked/autonomous vehicles driving on the roads, there will continue to be accidents. How long this will continue for, cannot be predicted at the moment. But in the transition period to get to full driving autonomy, the drivers and occupants want and need to continue relying on being protected by the bodywork of a vehicle.

Let's move on to lightweight construction. Media and press for the industry, is discussing the question of whether lightweight construction still makes any sense at all, since for electric vehicles it doesn't matter how heavy the body is.

Prof. Christoph Wagener: It is true that the mass of electrically powered vehicles has a significantly lower influence on energy consumption and thus on CO₂ emissions in the service life than that of conventionally powered cars. If the weight of three comparable vehicles with different drive systems is reduced by 100 kg each, the consumption of a petrol engine is reduced by up to 0.2 litres, which corresponds to 1.8 kWh, and that of a diesel engine by approx. 0.15 litres, or 1.5 kWh. In an electrically powered vehicle, only 0.4 to 0.5 kWh of energy is saved per 100 kilometers. The effect of reducing the mass of a diesel vehicle is thus 3 times greater, and that of a petrol car even more than 3.5 times greater.

Then we can save on lightweight construction in the future?

Prof. Christoph Wagener: A clear no. On the one hand, less use of materials will continue to mean savings in resources. Basically a larger mass (a heavy vehicle), requires more energy for locomotion, i.e. for acceleration and deceleration. Driving performance, driving behaviour and comfort, are considerably influenced by the mass. A low mass means better braking performance, less wheel and axle loads and so on. A particularly important point in this context is again, road safety. The greater the vehicle mass, the more energy must be dissipated in a crash. Therefore, lightweight construction will remain a very important aspect in the development of new vehicle bodies in the future.

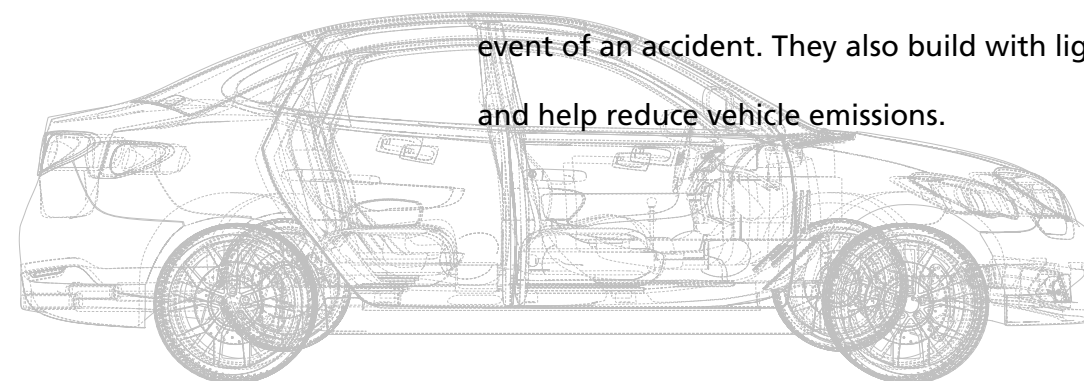
The interview was carried out by Andreas Heine, Global Executive Vice President Communication & Marketing



Interview with Prof. Christoph Wagener, Vice President Research and Product Development of KIRCHHOFF Automotive.

Is Lightweight Construction Essential in Times of E-mobility?

— If one were to describe the core competencies at KIRCHHOFF Automotive in a few words, it would be about safety and economical lightweight construction for vehicles. The body products from the automotive supplier of South Westphalia, Germany, ensure that people are safe and protected first, in the event of an accident. They also build with lightweight in mind, to save resources and help reduce vehicle emissions.



Networking Science and Business



Three graduates of the University of Applied Sciences South Westphalia received the Dr. Kirchhoff Prize worth 3,000 euros for their outstanding theses. The final theses of the three prize winners were prepared in close cooperation with industry—a win-win situation for all participants.

"As a member of the jury, I am always delighted to be able to evaluate these outstanding works, which are of benefit to all involved. They also show the good networking of the University of Applied Sciences South Westphalia with the industry," emphasized J. Wolfgang Kirchhoff, Managing Partner of the KIRCHHOFF Group. He along with Vice Rector Prof. Dr. Andreas Nevoigt, took over the award ceremony together at the annual reception for the University of Applied Sciences in Meschede, Germany.

One of the theses was written by **Marius Brinkmann**, a graduate of the Electrical Engineering Bachelor's program in Meschede. In cooperation with Rohde & Schwarz GmbH & Co. KG in Munich, he has developed software for the characterization of automotive radar sensors. "I am delighted about the special appreciation of my work, which confirms that I dealt with a current topic in my bachelor thesis," says the prizewinner. "In the automotive sector in particular, more and more radar sensors are being used, the evaluation of which has so far proved difficult because it was

necessary to intervene in the radar sensor to evaluate it. My goal was to significantly simplify the evaluation of radar sensors. The new software makes it possible to characterize the radar sensors in terms of quality and accuracy and to compare them with other radar sensors," explains Marius Brinkmann. Personally, he hopes that the software will continue to be used and developed at Rohde & Schwartz in the future.

Jan Moritz Schäfer, a graduate of the Bachelor of Electrical Engineering, analyzed, evaluated and optimized steering sensors in his thesis in cooperation with HELLA GmbH & KGaA from Lippstadt. "I chose this topic because it enabled me to continue my education in areas that were not directly part of my studies. I also find the topic very interesting," he explains. An increasing number of hybrid and electric vehicles on our roads require more and more electrical components and the emission of electromagnetic fields. The sensors used for this must measure reliably and precisely. Based on investigations of a steering angle sensor and a steering torque sensor, Jan Moritz



Left: J. Wolfgang Kirchhoff, Managing Partner of the KIRCHHOFF Group, congratulates Jan Moritz Schäfer on his successful thesis. **Right:** Three graduates of the University of Applied Sciences Südwestfalen were awarded the Dr. Kirchhoff Prize for their outstanding theses. From left to right: Rector Prof. Dr. Claus Schuster, prizewinners Jan Moritz Schäfer and Sebastian Mau, J. Wolfgang Kirchhoff and Prorector Prof. Dr. Andreas Nevoigt.

Schäfer developed various optimization measures. In doing so, he took into account findings regarding effectiveness and cost-benefit ratio in current developments. The results of his work have already been used in day-to-day business. "The Dr. Kirchhoff Prize confirms to me once again that the effort and time were worth it and that I chose the right course," says Jan Moritz Schäfer, who is currently writing his master's thesis in the Systems Engineering & Engineering Management course in Soest.

In his Bachelor's thesis in the Mechanical Engineering and Automation Technology degree program, prizewinner **Sebastian Mau** designed and developed a novel medium-frequency high-voltage generator in modular design. The cooperation partner was Munk GmbH in Hamm. "The choice of this topic gave me the opportunity to develop a new, ultra-modern system," says Sebastian Mau. Process reliability and reproducibility play a major role in aerospace technology. With conventional grid-guided technology however, the process

window for highly efficient turbines cannot be reduced to the required extent. The system developed by Sebastian Mau enables higher outputs with identical modules. "I am pleased that my work in the context of the Dr. Kirchhoff Prize is appreciated and actually applied by highly qualified specialists from industry."

J. Wolfgang Kirchhoff congratulated the prizewinners on their outstanding final theses with the encouraging words, **"This opens up a good path for your professional future."**

Author: Eva Rademacher



014



024



030



050

- 014 New products on the Road
- 020 Mobile—but how?
- 024 Electro first—on the Auto Shanghai
- 030 KIRCHHOFF Automotive Opens New Plant in Romania
- 034 BMW Supplier Diversity Conference 2019
- 036 New Ideas for Light-weight Construction
- 038 The Future is Autonomous—Even in Manufacturing
- 040 It's All About Aluminium
- 042 Rustless
- 044 Have you ever driven electric?
- 050 A Cultural Program Conquers Europe
- 054 First Colleague, Then Boss
- 056 Employee Development —Always In View
- 057 Quality First



012 - 057

KIRCHHOFF
AUTOMOTIVE

WE.MOVE.FUTURE.

New products on the Road

Authors: Nadine Bartzik, Vanessa Wilkniß

— KIRCHHOFF Automotive is represented in the latest vehicle models with a range of crash-relevant structural parts. Our lightweight construction products also convince up-and-coming manufacturers with their development and manufacturing competence.



BMW Z4 and Toyota Supra Frontend

Technologies:

Forming, MIG-welding, riveting, heat treatment, e-coating

Production plants:

Mielec, Gliwice/Poland

Capacity/Year:

40,190 vehicles

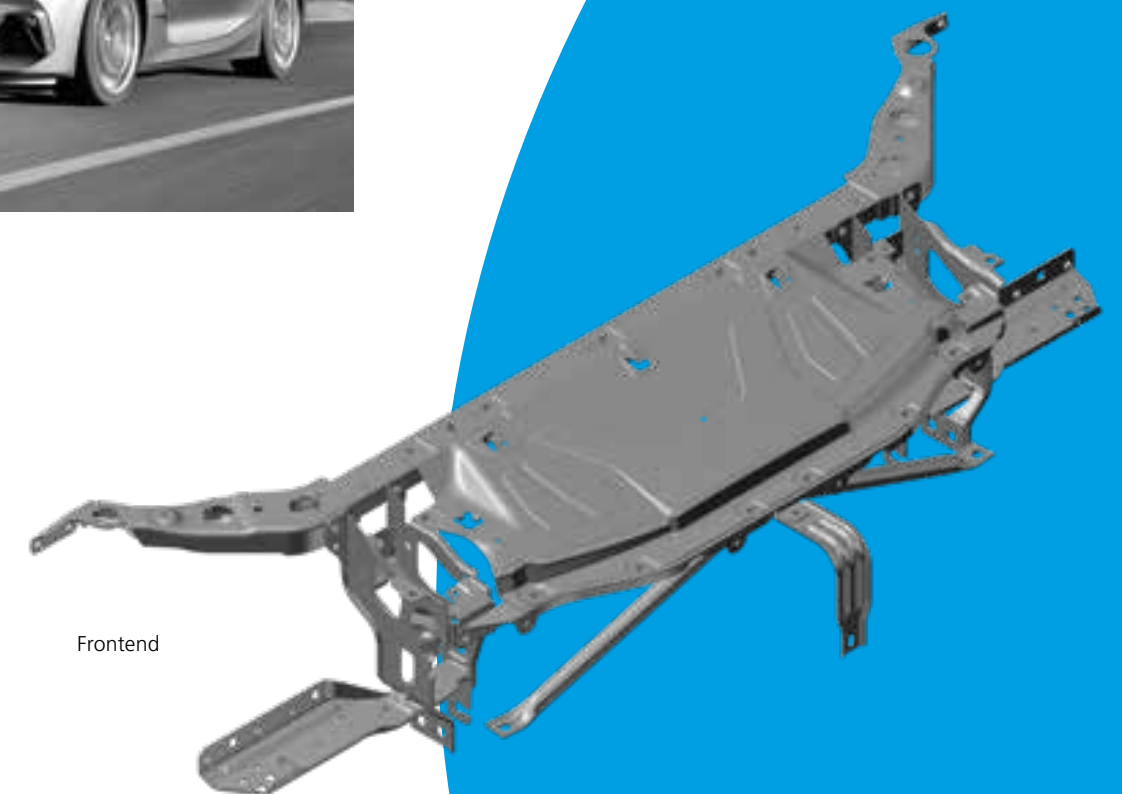
Customers/Models:

BMW Z4 Roadster, Toyota Supra



Frontend for BMW Z4 and Toyota Supra

The frontend was developed for the BMW Z4 Roadster in Germany and is now installed in this BMW sports car as well as in the Toyota Supra. The front wall is the supporting structure for the front of the car and largely contributes to the vehicle's lightweight construction. This design is guaranteed by a sophisticated all-aluminum solution in profile and shell construction with the highest tolerance requirements. The optimum geometric design of the components also achieves high rigidity for the driving dynamics of the sports cars.



Frontend



Mercedes-Benz CLA A-pillar, B-pillar, roof frame

Technologies:

Hot forming, forming, laser cutting, spot welding, gluing

Production plants:

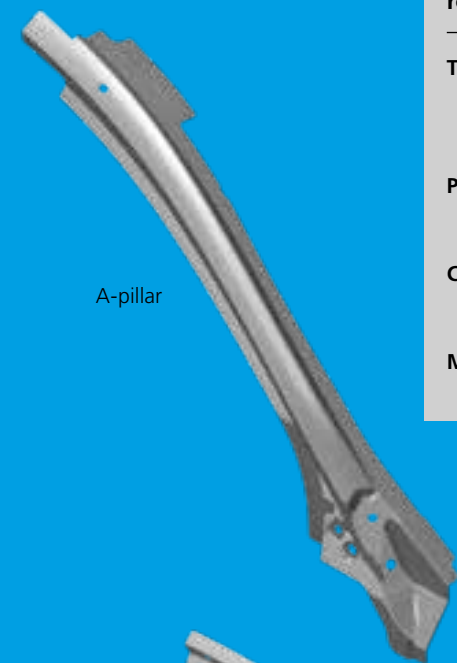
Esztergom/Hungary

Capacity/Year:

78,000 vehicles

Model/Customer:

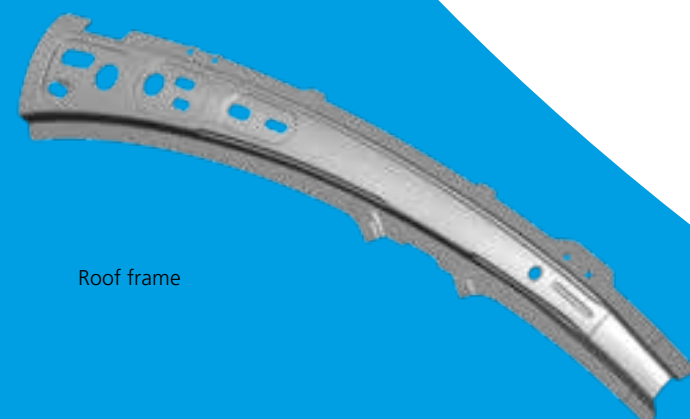
Mercedes-Benz CLA



A-pillar



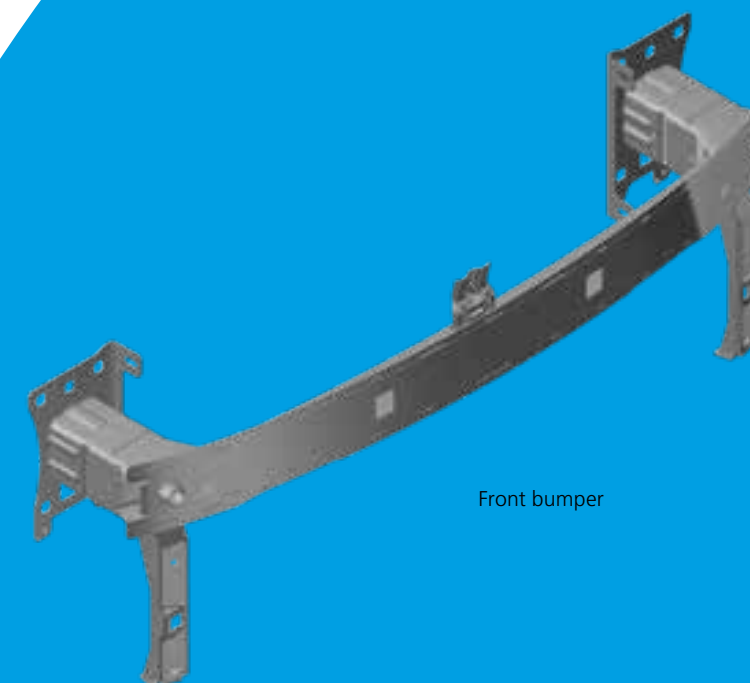
B-pillar



Roof frame

Structure for the Body of the Mercedes-Benz CLA

With the A- and B-pillars, as well as the roof frame, we supply the Mercedes-Benz CLA with products that contribute significantly to the stiffness of the body. The components form a unit with which the roof and the doors are fixed. They are therefore also of great importance in the event of a crash. High-strength steels are used to ensure the high rigidity of the products. The B-pillar consists of a mixture of high-strength and normal-strength components, which are joined together by means of adhesives and welding points.



Front bumper



Škoda Scala Front bumper carrier

Technologies:

Forming, hot forming, MAG- and projection welding, e-coating

Production plant:

Gliwice/Poland

Capacity/Year:

75,000 vehicles

Customer/Model:

Škoda Scala

Relevant Safety Component for the Škoda Scala

With the front bumper, the Polish plant in Gliwice provides safety for the Rapid successor, Škoda Scala. The Scala is based on the VW Group's MQB A0 platform such as the VW Polo and, despite its compact dimensions, offers more space than the Rapid. The crash management system is already being installed in the third Škoda model.



BMW 3 Series Frontend and SO-frame

- Technologies:**
Forming, resistance welding, MIG- & MAG-welding, e-coating
- Production plants:**
Mielec, Gliwice/Poland, Querétaro/Mexico, Shenyang/China
- Capacity/Year:**
677,000 vehicles
- Model/Customer:**
BMW 3 Series



Worldwide Delivery for the BMW 3 Series

The front wall for the new BMW 3 Series was developed with an optimal material combination (steel-aluminium) by KIRCHHOFF Automotive in Germany. The result is a lightweight design with the best possible performance. The multi-material mix represents a competitive solution that our KIRCHHOFF Automotive locations worldwide supply to BMW.



Frontend and SO-frame



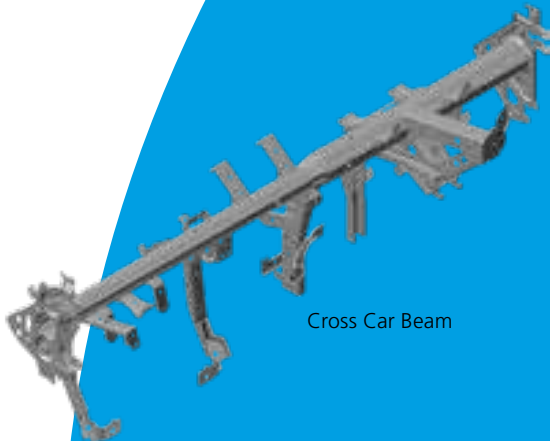
Nissan Maxima Cross Car Beam

- Technologies:**
Forming, MIG-welding, projection welding
- Production plant:**
Manchester, Tennessee/USA
- Capacity/Year:**
46,000 vehicles
- Customer/Model:**
Nissan Maxima



Stabilizing Structural Part for Nissan Maxima

Supplying the Cross Car Beam (CCB) for Nissan's middle class sedan the Maxima, KIRCHHOFF Automotive contributes to the safety and stability of the vehicle overall. The metal structure supports the instrument panel, steering column as well as the glove box. In addition to that, it serves as a stabilizing element to the front end of the vehicle.



Cross Car Beam



Lynk 01, 02, 03 Cross Car Beam

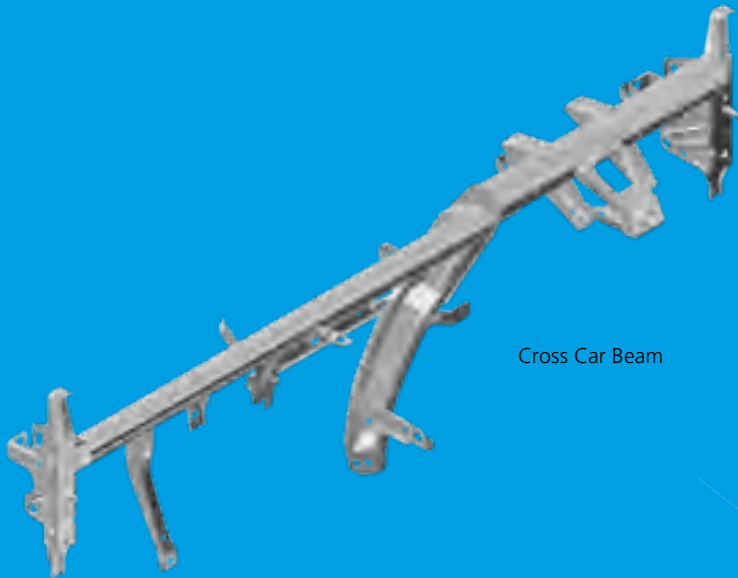
- Technologies:**
Forming, CMT-MAG-welding, stud/nut projection welding
- Production plant:**
Suzhou/China
- Capacity/Year:**
400,000 vehicles
- Customer/Model:**
Lynk 01, 02, 03



D-pillar

Cross Car Beam for new Chinese models

A lifestyle brand with a car—this is how Lynk & Co. describes itself. As a brand of the Chinese car manufacturer Geely, Lynk & Co. offers holistic, individual mobility concepts. A car for a day, a week, a month or even a whole year, fitting itself to the lifestyle of the customer. KIRCHHOFF Automotive also contributes to the safety of the vehicles with the production of the modular Cross Car Beam for various models of the brand. The eight variants for the Geely Volvo CMA platform are characterized by a cost-optimized steel structure in lightweight design. In order to guarantee a high welding quality for the CCB, and for the thin-walled components, the plant in Suzhou uses CMT-welding (cold metal transfer). At Auto Shanghai in April 2019, KIRCHHOFF Automotive presented the product to the public for the first time. Read more about this on page 24.



Cross Car Beam

Mobile— but how?

— To be able to move faster and faster over greater distances, and also transport large, heavy loads, has always been a human need and important for survival. Galileo Galilei once stated, "Nothing is older in nature than movement." But what will our mobility of tomorrow look like? An observation by Prof. Christoph Wagener, responsible for research and development at KIRCHHOFF Automotive.

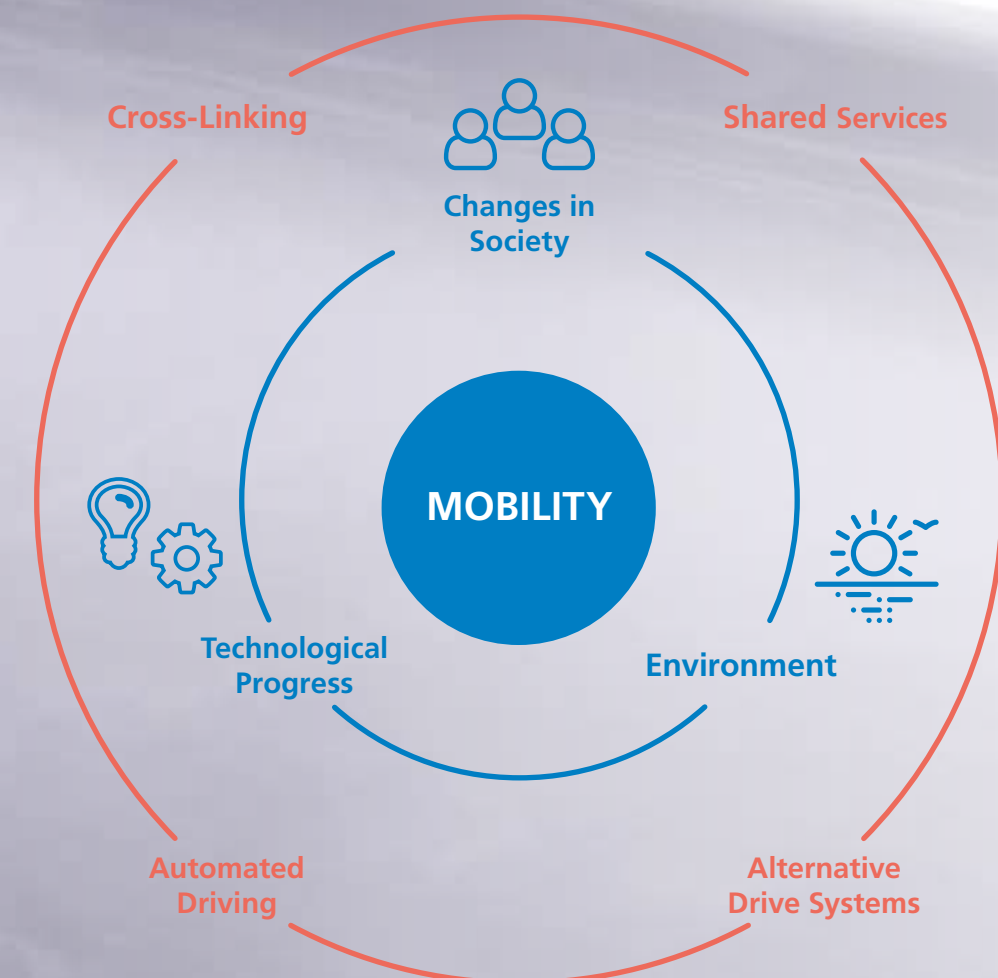
The efficient production and exchange of goods, is the basis for success in our society. In Germany, the roads are the most reliable and important mode to transport goods, handling more than 70 percent of freight traffic and approx. 80 percent of passenger traffic. With that being said, the mobility needs of people in a globalized world are constantly increasing. Therefore the question is not whether the possibilities of individual mobility will still be necessary in the future, but how can they be realized in order to meet demand.

Global climate change (a consequence to automobile CO₂ emissions), decline in local air quality by pollutants and fine dust, or failing traffic systems in cities across world, are the great challenges of our time.

The most important tasks laid out for automobile development are derived from:

- Digitization and networking of vehicles (Car2Car, Car2x)
- Autonomous driving / driverless transportation of persons and goods
- Alternative drive concepts
- Flexible vehicle use (Shared & Service)

The task of the automotive industry is therefore no longer limited to developing only motor vehicles. The greatest challenge is to ensure a functioning mobility system in cities while also maintaining the quality of life for the population living within those areas. »



COMBUSTION ENGINES VERSUS ELECTRIC DRIVES

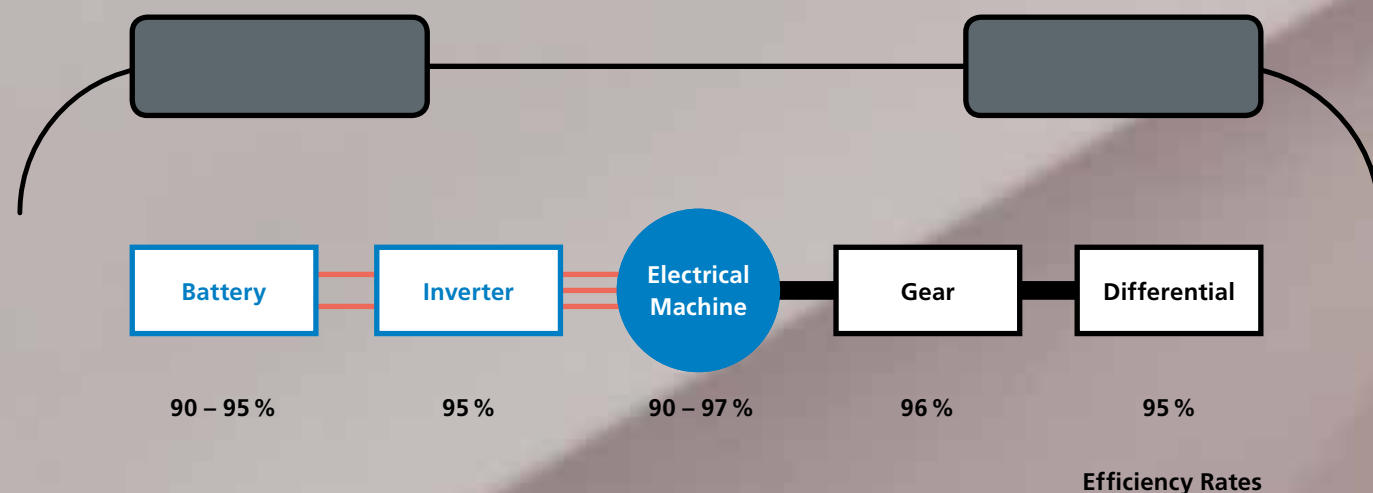
One of the most important questions in shaping the mobility of the future is that of the engine. Current forecasts assume that by 2030 only 50 percent of new cars will be equipped with combustion engines. But does electric drive really make sense? Will it contribute to the necessary progress needed for protecting the environment?

The efficiency of the various drive systems is illustrated by a comparison of their competences. As a result of heat waste and mechanical losses, the average system efficiency of the burners is 26 percent for gasoline and 33 percent for diesel. This means that approx. two-thirds of the energy is lost in the case of diesel, and three quarters of the energy is not used in the case of petrol.

The situation with the electric drive is completely different. The below figure schematically shows an electric drive train and the efficiency of the individual components.

This results in an overall efficiency for the electric drive of 0,75 as an average value. Electrical engineering forecasts that the system efficiency can be further optimized to up to 90 percent by the year 2030. In addition, the energy loss in the electric drive is reduced by approx. 15 to 20 percent through recuperation (energy recovery). The real consumption of the BEVs (Battery Electric Vehicles) available on the market shows that the efficiency of electric drives is already well above the calculated mean value in some cases. For example, an efficiency of 93 percent was determined in independent tests for the Tesla Model 3. Tesla also gives this value for the revised drives of the Model S and X.

A comparison of the efficiency rates shows that there are basically two different drive systems available—a combustion engine and an electric drive—one of which consumes three to four times as much energy. VW formulates this very vividly as follows: A Golf Diesel consumes 6 litres per 100 kilometers which corresponds to an energy consumption of 60 kilowatt hours. This means that an E-Golf can cover a distance of 400 kilometres—giving a clear sense to what an electric drive is capable of.



ENERGY STORAGE - BATTERY, HYDROGEN OR SYNTHETIC FUEL?

The question of energy storage remains open and a hot topic for discussion in the automotive industry. From today's standpoint, the battery is certainly the most technically mature solution. Significant progress has been made in recent years on the most important challenges in terms of range and charging time for battery cells. Ranges of up to 500 kilometers and charging times of 20 to 30 minutes for 80 percent battery capacity using superchargers, ensure that the vehicles are suitable for everyday practical use and not only for local transport. Other technical challenges, such as maximum speed, repeated calls for maximum performance, thermal management, etc., are no longer KO criteria.

In addition, the CO₂ balance of battery electric vehicles (BEVs) is continuously improving. The share percentage of renewable energies in the total electricity generated, continues to increase. CO₂ emissions are also continually reduced in the manufacturing of batteries. As a result, the CO₂-related climate balance of BEVs is already significantly better than that of combustion vehicles, even taking battery production into account. The acceptance of BEVs by potential customers is also increasing. The biggest challenge is therefore the inadequate infrastructure, both on the supra-regional road network (especially the motorways) and in urban centres. Considering that it is often extremely difficult to find a parking space in large cities currently, the question that awaits with the future of BEVs, is what functioning charging infrastructure can look like.

An alternative to the battery as an energy storage device, is the on-board generation of electricity from **hydrogen** using a fuel cell. This variant becomes CO₂-neutral when hydrogen is produced from regenerative electricity by electrolysis. However, with this process, an efficiency loss of factor 2 can be observed here. Today, the

system efficiency of a fuel cell drive is less than 40 percent. From these two factors it follows, compared to the battery electric solution, about five times the amount of green electricity is required. In addition to other technical challenges, such as the robustness of the fuel cell, production costs represent the greatest obstacle to the introduction of such vehicles for large-scale production. It should also be kept in mind that a completely new infrastructure must be set up for mobility using hydrogen. In Germany there are currently more than 14,000 conventional filling stations and about 60 publicly accessible H₂-filling stations. The costs for building a hydrogen filling station depend very much on the capacity. Installed in Hamburg in 2015, the hydrogen filling station generates 3.5 kg of hydrogen per hour via electrolysis and costs 2.8 million euros.

The third option is **synthetic fuels**. The energy required to produce these so-called e-fuels is around 20 kilowatt hours per litre. This means that 6 to 8 times the amount of regenerative electricity would be needed to cover the energy requirements of battery electric vehicles.

Based on the factors mentioned above, for cars the battery electric solution seems to be the best at present. The fuel cell is particularly useful for long-distance trucks and for waste disposal engines (page 76). While synthetic fuels could mainly be used in ships or aircraft, i.e. wherever a battery is out of the question due to the high energy demand.

Author: Prof. Christoph Wagener

Electro first—on the Auto Shanghai

— Fighting smog in China's mega-cities has become one of the great challenges of modern China. This is why the Chinese government is focusing on electric mobility. More than any other country in the world, it subsidizes the development of electric vehicles and the necessary infrastructure to support with billions of dollars. This became more than clear at Auto Shanghai. »

Auto Shanghai

In recent years, Auto Shanghai has developed into one of the most important automobile exhibitions in the world. China is the largest automobile market in the world—in 2018 alone almost 24 million passenger cars were sold, compared to the almost 15 million cars in Europe. Under the motto "WE.MOVE.FUTURE." KIRCHHOFF Automotive presented product innovations for the vehicles of the future at Auto Shanghai.

More than ever, manufacturers and suppliers rely on electro mobility and digitization. The focus of KIRCHHOFF Automotive's trade fair presentation this year at the Auto Shanghai included automobile safety for electro mobility in conjunction with lightweight construction technology. Using the example of a hybrid battery housing (combination of steel and aluminium), the globally active automotive supplier presented an innovative lightweight construction concept for the safe housing of high-voltage battery modules in electric vehicles. The development of this product is based on many years of experience in the development of crash-proof hybrid steel and aluminum structures for automobiles.

Another innovation presented at Auto Shanghai was a weight-optimized front axle beam in aluminum shell construction, which represents a cost-effective lightweight construction solution for the series production of assembly components. Weight reduction and the use of large-scale production processes such as deep drawing and gas-shielded welding, are advantages to this product. "At Auto Shanghai, we will present the latest technologies and product innovations to our existing Chinese and international customers. On the other hand, we also want to inspire new customers with our product portfolio," shares J. Wolfgang Kirchhoff, CEO KIRCHHOFF Automotive, at the beginning of the fair. »



Facts and Figures About the Auto Shanghai

Under the motto "Creating a Better Life", Auto Shanghai 2019 offered space for more than 1,000 renowned automobile exhibitors from 20 countries on a total exhibition area of 360,000 m². Almost 1,500 vehicles were on display, including 129 world premieres, 218 New Energy vehicles and 76 concept cars. The auto show attracted a total of 993,000 visitors from Germany and abroad.

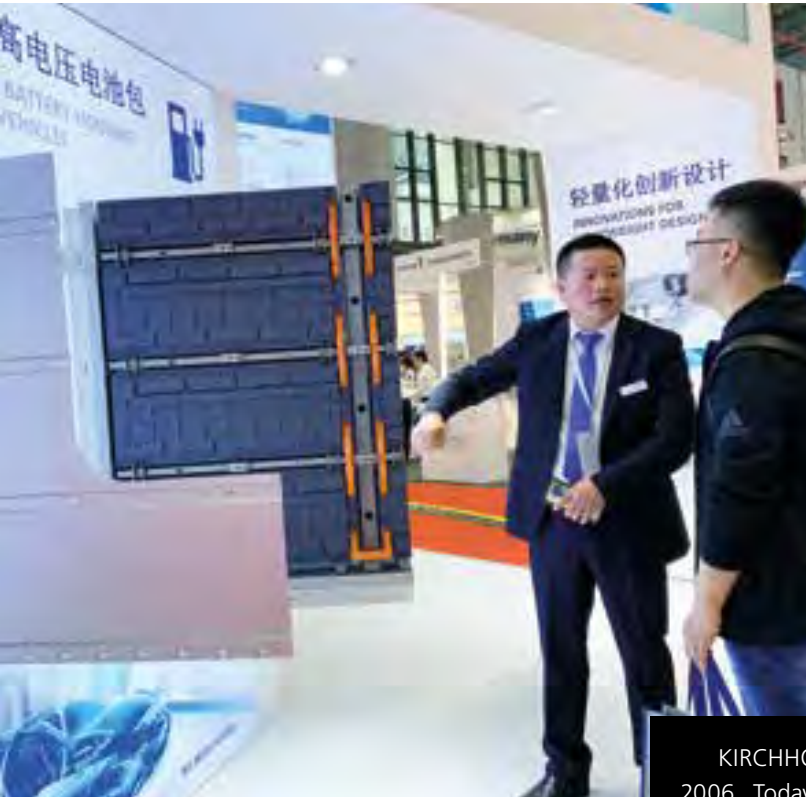


Left: Electric mobility takes over China! Presented with KIRCHHOFF Automotive – a battery housing for electric vehicles. Bernhard Mattes, VDA President, (center) was impressed. In the picture on the left Dr. Thorsten Gaitzsch, CTO and on the right J. Wolfgang Kirchhoff, CEO KIRCHHOFF Automotive.



Left: At Auto Shanghai, KIRCHHOFF Automotive was able to convince leading engineers from Nissan Motor Co. Ltd. of its competence in the development of aluminum crash management systems.





Top left: KIRCHHOFF Automotive is presenting an economical lightweight construction concept for the safe housing of high-voltage batteries in electric vehicles in the form of a battery housing that has attracted a great deal of attention.

Top right: Dr. Thorsten Gaitzsch, CTO KIRCHHOFF Automotive, uses the example of an Opel engine cradle to demonstrate KIRCHHOFF Automotive's expertise in the production of engine and axle cradles. Here in conversation with high-ranking representatives of our customer CJLR (Cherry, Jaguar, Land Rover).



KIRCHHOFF Automotive followed its customers to China in 2006. Today KIRCHHOFF Automotive operates three production plants there—in Suzhou, Chongqing and Shenyang. Production plants as well as Sales and Development offices are located in China.

China is a very important partner for the German automotive industry - in development, production, sales and cooperation. German manufacturers have almost quadrupled the number of their production facilities in China since the beginning of the decade—from eight to around 30 plants. "China continues to open up to the global economy. We support this process. We are counting on mutual market access for goods and investments, close cooperation in the WTO (World Trade Organization) and successful negotiations with the European Union for a bilateral investment agreement," said VDA President Bernhard Mattes during the press conference of the German Association of the Automotive Industry (VDA) at Auto Shanghai.

All well-known German automobile manufacturers and suppliers were represented at the world's largest automobile trade fair and all presented themselves at a high level. This time around, the German OEMs focused on the emotionality of their vehicles. SUVs, high-capacity sedans and high-performance sports cars attracted the attention of the visitors but even the new Chinese models presented at Auto Shanghai were in no way mediocre to the new car models from the German, Japanese and Korean manufacturers in terms of design, interior fittings and workmanship. In one respect, they were even far ahead of most of them: all Chinese manufacturers had various battery-powered vehicles on offer, from small city cars to mid-size sedans and large SUVs.

Author: Sabine Boehle



Left: KIRCHHOFF Automotive already welcomed high-ranking visitors on the first press day. These included Yuanhong Luo, Group General Manager of Dongfeng Industrial Co. Ltd. (2nd from right). He came together with his strategy and technology managers and showed great interest in the product portfolio of the international automotive supplier from Germany.

Counting Down the Days: **From September 12 to 22, 2019, one of the world's most important motor shows, the 68th International Motor Show (IAA) for Cars, will take place in Frankfurt/Main in Germany.**

The Association of the German Automotive Industry (VDA) promises, "Mobility of the Future Becomes the Present" on its homepage. Future topics such as autonomous driving, urban mobility, new mobility services and electric mobility will be the focus of this year's IAA. The format of the IAA will also be given a new orientation: more interactive, more networked, more digital – VDA President Bernhard Mattes describes.

KIRCHHOFF Automotive will also be represented at this important exhibition of vehicle manufacturers and their suppliers, with a 400 square meter stand. For the first time we will be exhibiting in **Hall 9, Stand No. B16** this year and show safety-relevant lightweight solutions for the vehicles of the future. We look forward to your visit.



KIRCHHOFF Automotive Opens New Plant in Romania



Opening ceremony of the plant in Pitești, from left to right: Stefan Leitzgen (Global COO KIRCHHOFF Automotive), Ian Pearson (President of Ford Romania), Sebastian Metz (Managing Director AHK Romania), Swantje Kortemeyer (Head of the Economic and Commercial Department of the German Embassy in Romania), Arndt G. Kirchhoff (CEO KIRCHHOFF Automotive Holding), Gabriel Porojan (Managing Director KIRCHHOFF Automotive in Romania), Dr.-Ing. Jochen F. Kirchhoff (Chairman of the Advisory Board and the Shareholders' Committee of the KIRCHHOFF Group); J. Wolfgang Kirchhoff (CEO KIRCHHOFF Automotive)

KIRCHHOFF Automotive in Romania

Since 2012 the company has had a plant in Romania. The Craiova site employs around 300 people. On an area of 15,800 m², the core technologies of technical development, joining and surface treatment are used to manufacture products for the Ford Eco-Sport. The most important technologies at this location are arc welding, spot welding, projection welding and sealing. Around 110,000 welding assemblies, as well as the same number of cross beams, and around 134,000 bumpers are produced here every year. The Craiova plant has had Ford Q1 supplier status since 2013.

KIRCHHOFF Automotive has invested \$30 million EUR in Romania since 2012. A total turnover of \$26 million EUR is expected for 2019 and \$32 million EUR for 2020.

The new KIRCHHOFF Automotive plant in Pitești/Romania



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01 A successful team: Management, employees of the Romanian plants and supporters in the construction of the Pitești plant

02 Ian Pearson, President of Ford Romania, speaking at the plant opening in Pitești

03 The company history as sand painting: The demonstration by the artist Ana Munteano was a highlight of the event.



03



It took less than a year from the start of construction to series production at the new plant. The second KIRCHHOFF Automotive plant in Romania produces around 90 different parts for passenger cars and commercial vehicles for customers Volkswagen, Daimler, Ford and PSA at the Pitești site. The plant officially opened May 2019.

"Today marks the beginning of a new chapter in the success story of KIRCHHOFF Automotive. This is very closely linked to our activities in Central and Eastern Europe," said CEO J. Wolfgang Kirchhoff in his opening speech. KIRCHHOFF Automotive's search for new markets began more than 25 years ago. "Initially, we wanted to build a solid base here in Europe. Europe is still the most competitive market in the world," said J. Wolfgang Kirchhoff. With the foundation of the first KIRCHHOFF Automotive plant in Mielec/Poland 21 years ago, the expansion of the company in Central and Eastern Europe began. Today, the globally positioned automotive supplier operates five plants in Poland, one in Hungary and with the new Pitești plant—two in Romania; a total of 31 plants worldwide.

In addition to the shareholders Dr.-Ing. Jochen F. Kirchhoff, Arndt G. Kirchhoff and J. Wolfgang Kirchhoff, representatives of the most important Romanian customers as well as official representatives of various institutions from the region, participated in the opening of the plant on May 8, 2019. "This plant and the one in Craiova show that you as a company have confidence in the Romanian automotive industry, the Romanian workforce and Romania itself. On behalf of Ford, I would like to reaffirm this trust,"

commends Ian Pearson, President of Ford Romania. There are currently 40 employees working at the Pitești plant. KIRCHHOFF Automotive has invested around \$10 million EUR in the 3,100 square metres plant (site area 58,000 m²). The core competencies are forming and joining technologies. The automatic servo presses with pressing forces from 250 to 630 T, correspond to the latest state of the art technology in cold forming. Up to six machines are used to assemble parts by pressing nuts and bolts. 3D measuring devices operate with an accuracy of 1/100 mm and are therefore able to meet even the smallest tolerances. The plant was built according to the latest Lean standards and all production facilities and processes are designed in accordance with Industry 4.0. Sales expected for 2019 are approx. \$3.6 million EUR, and for 2020 approx. \$4.8 million EUR.

The plant in Pitești also supplies for other European KIRCHHOFF Automotive locations with formed parts. The strategic location of the plant plays an important role: it is located close to the OEMs in Romania and the A1 motorway, which connects Romania with Europe as part of the Europe-wide Corridor IV.

Author: Gabriel Porojan

BMW Supplier Diversity Conference 2019



At the BMW Supplier Diversity Conference 2019 in Greenville, South Carolina, suppliers, salespeople and BMW employees met to exchange ideas and experience.

By invitation only, suppliers, vendors and BMW employees, participated in the BMW supplier conference in Greenville, South Carolina, which is coincidentally near the world's largest BMW assembly plant in Spartanburg.

"Events of this kind provide the perfect setting to continuously improve relationships with our customers."

Josh Forquer, Vice President Sales North America

KIRCHHOFF Automotive was in attendance at the conference—informing others about its extensive product portfolio in the field of steel and aluminum processing and presented itself as a competent worldwide supplier for metal and hybrid components as well as body-in-white structures.

The conference organized by the BMW Group, offered all participants a wide range of opportunities to exchange information on services, innovations and general industry knowledge. The focus was on networking, meeting with other BMW suppliers, refreshing contacts with already known members of the BMW team and establishing new business contacts. "Events of this kind provide the perfect setting to continuously improve relationships with our customers," said Josh Forquer, Vice President Sales North America. Mario Pimentel, BMW Key Account Manager for North America, adds, "Here we can discuss the requirements of our products and services with the customer in person and exchange information about new developments and technologies."

KIRCHHOFF Automotive also used the event, which attracted a great deal of attention with over 2,300 participants, as a platform to showcase itself as a development partner and Tier 1 supplier in the North American market. A special attraction at the KIRCHHOFF Automotive booth, for both employees of BMW and other companies, was a touch screen tablet which allowed the audience to experience the company product portfolio in a 360 degree view.

Authors: Nathalia Abreu, Sherry Lay



KIRCHHOFF Automotive also used the event to exchange information with numerous visitors about new developments and technologies with an interactive touch screen tablet that displayed the company's product portfolio in a 360 degree view.

New Ideas for Lightweight Construction

KIRCHHOFF Automotive presented innovations for lightweight construction at the Automotive Engineering Expo (AEE) in Nuremberg on June 4 and 5, 2019. The AEE is a knowledge and education platform for engineering specialists in the automotive and supplier industries that focus on the entire body construction process chain—from concept to final assembly.

Leading OEM (Original Equipment Manufacturer) and OES (Original Equipment Supplier) experts were involved in the development of the AEE supporting program, which this year focused on 'Digital development and flexible production of new lightweight body structures'. The product innovations presented by KIRCHHOFF Automotive at the joint stand of the Automotive Center Südwestfalen (acs) focused on crash safety, lightweight construction and economy.

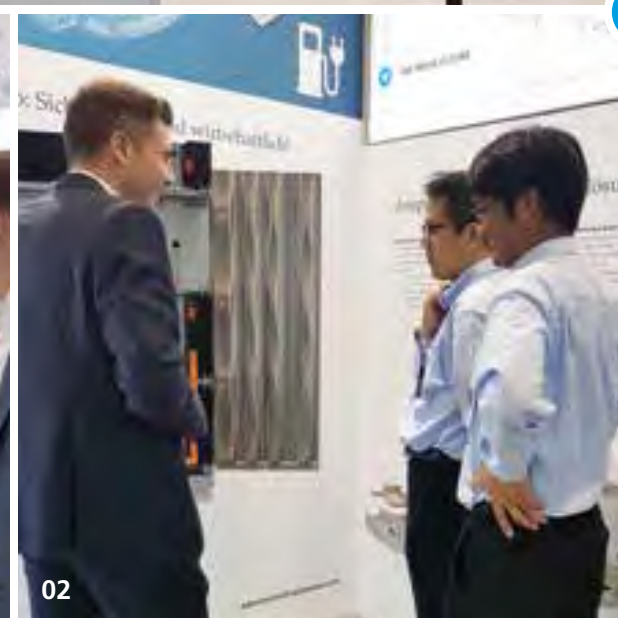
An exhibition highlight was a **scalable lightweight battery housing** made of steel and aluminum for electrically powered vehicles. The main features of this product are a cost-optimized design, an integrated cooling system and improved crash behavior. KIRCHHOFF Automotive used a **weight-optimized B-pillar** as an example to show how lightweight construction can be economically implemented for the series production of body components. The material combination of press hardening materials of 1500 MPa in the B-pillar and 2000 MPa in the reinforcement (patch area) results in a weight advantage of around ten to twelve percent with the same or better performance. The two materials can be joined to form patch blanks by spot or laser welding. Only one press hardening tool is required for forming and press hardening the patched blanks into a B-pillar. Another innovation presented at AEE started with the question: Does an **aluminum cross beam** necessarily have to be manufactured from extrusion profiles? The answer: no. The solution: The cross beam exhibited on the AEE consists of high-strength aluminum sheet shells which—continuously welded—produce a profile with a variable cross-section. In this way, the cross beam can be very precisely adjusted to loads. At the same time, the shell solution enables optimum use of the installation space. A further advantage of this solution: cost-intensive steps for processing extruded profiles are no longer necessary and thus increase the cost-effectiveness of such concepts.

Visitors to this year's AEE received first-hand technical advice and supplementary information. "AEE 2019 once again lived up to its claim as a trade fair for the bodywork process chain. Leading suppliers presented many innovative ideas and solutions at the highest level to specialists in the car body industry," said Prof. Christoph Wagener.

Author: Prof. Christoph Wagener



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The AEE is a two-day trade fair for decision-makers, planners and developers as well as designers and technicians from the automotive industry. The focus will be on a focused exchange on all aspects of body construction, body painting and final assembly. In addition to the trade fair, a specialist congress was held at which the very latest developments and trends in the body construction process chain were presented. In addition, the AEE offered half-day tutorials led by lecturers and experts from practice, which provided newcomers and career changers with a solid foundation and valuable practical knowledge. In the Innovation Park, visitors were able to examine 18 different innovative body concepts and components in detail—in some cases even before their market launch. And in master classes, OEMs and exhibitors presented fascinating technologies and amazing developments in virtual learning rooms.

01 KIRCHHOFF Automotive used the example of a weight-optimized B-pillar to demonstrate how lightweight construction can be economically implemented for the series production of body components. 02 Exhibition highlight at the KIRCHHOFF Automotive stand: a scalable battery housing in lightweight construction made of steel and aluminum for electrically powered vehicles.



Welding system with the highest possible degree of automation.

At the KIRCHHOFF Automotive location in Attendorn/Germany, technology development, process planning, sales, and plant management have developed and programmed a special system for manufacturing the B-pillar for the Mercedes-Benz Sprinter. The welding system was redesigned to achieve the highest possible degree of automation.

First, the system is loaded with filled containers from the press shop, the component is then removed with camera and laser support, spot and resistance welding is carried out during the joining processes, and the components are then stacked in the finished part containers. The main part is joined by a B-pillar, two welding nuts and a reinforcing plate by spot welding.

This project is one of the first to be planned and implemented by the site itself. Meanwhile, 5.500 sets of B-pillars are produced on the line every week and delivered to the customer sites in Düsseldorf and Ludwigsfelde/Germany.

Author: Tobias Halbe

The Future is Autonomous— Even in Manufacturing

— The use of autonomous manufacturing methods for labor-intensive processes are becoming increasingly important. A high degree of automation ensures competitiveness in international comparison.



The V165 plant in Attendorn.



Automatic removal of components and feeding to the joining processes.

It's All About Aluminum

Objective fulfilled. The first Supplier Innovation Day at the KIRCHHOFF Automotive plant in Attendorn, Germany, offered a successful exchange of best practice ideas and effective innovations from aluminum experts.

Aluminum experts from nine leading companies including ATLAS COPCO, TRIMET, and the Fraunhofer Institute IWU, provided insights into various topics related to the aluminum process chain during the Innovation Day. These experts shared ideas for bonding and joining in battery electric vehicles (BEV), new joining technologies from research, and many others. In a complementary exhibition, visitors could learn more about high-speed joining technology, adhesive applications and coupling agents for electric vehicles, among other things.

The IWU presented a new method that showed in order to join aluminum sheet with die-cast parts, a rivet can be shot "on-the-fly" into the material at high speed. This reduces cycle time and can also be achieved with one-sided accessibility. The process is currently being further developed to series production capability in funded joint projects of the IWU with industrial partners and OEMs.

Also of particular interest was a Daimler vehicle floor presented by Fira HAI, in which profiles are

joined using the friction stir welding process. This process is particularly suitable for joining thick-walled components with long straight joints. It can also be used to join dissimilar materials such as light metal and steel. KIRCHHOFF Automotive is already investigating possible applications for friction stir welding.

"I am convinced that this event will bring about a lot of positive feedback internally as well as from the suppliers and that another date for this kind of event is only a question of 'when' and not 'if'," said Andreas Pernerstorfer, Head of Central Sales at Heinz Arens GmbH. Klaus Hömberg, Managing Director of ASP GmbH, described the event as a, "successful win-win situation for organizers and presenters."

Silvia Rauterkus, Director Sales, adds, "Today's presentations and the complementary exhibition have hit the spirit of the times focusing on the use of aluminum for electric vehicles."

Authors: Klaus Lawory, Andreas Dannheisig



Experts from nine leading companies from ATLAS COPCO to TRIMET as well as the Fraunhofer Institute IWU accepted the invitation to the first Innovation Supplier Day at KIRCHHOFF Automotive.



Best practice ideas and successful innovations were presented by aluminum experts.



Before curing, the component shows silicates and blue zones. The KTL coating adheres less well to the blue zones and the parts are more susceptible to corrosion.

Rustless

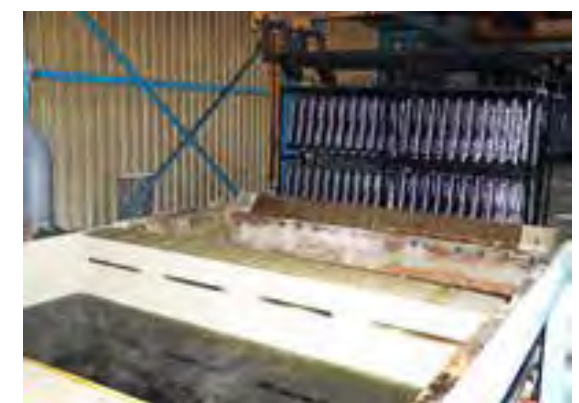
— MAG (Metal Active Gas) welding produces silicate slag on the weld surface, which can lead to corrosion problems on the surfaces of steel products. To counteract this, KIRCHHOFF Automotive has integrated an innovative curing process into the pretreatment of its products.



After curing, the component shows only residual silicates, the blue zones have been removed.

Before the cathodic dip coating, bumpers or trailers passed through the appropriate degreasing and rinsing basins. These have now been supplemented by an acidic curing basin. "The newly installed curing process ensures that the surfaces are low in silicates and better protected against corrosion," explains Egon Peglow, Plant Manager Welding and Surface Technology at the Iserlohn, Germany plant.

For the curing process, a former alkaline degreasing basin of the plant was emptied and filled with an acidic curing agent based on sulphuric acid. The circulation pumps for tank were also replaced and they are now made of acid-resistant plastic. In addition, a new extraction system ensures fast and reliable extraction of the vapours produced during curing. This exhausts the vapours directly at the pool edge.



The curing basin was lined with acid-resistant PP plastic and ventilation slits suck off the vapours produced here.

Author: Egon Peglow

Burkard Oppmann, Sales Manager FAUN Germany and Managing Director FAUN Services GmbH, in front of the Mercedes-Benz GLC F-CELL.



Have you ever driven electric?

— We wanted to know and tested three electric models to compare the drives. It was an obvious choice which electric cars to test - Mercedes-Benz GLC F-CELL, Tesla Model 3, and Audi e-tron, all vehicles KIRCHHOFF Automotive manufactures series parts for.



Interieur Mercedes-Benz GLC F-CELL.



Trunk Mercedes-Benz GLC F-CELL.

FOUR IN ONE: THE MERCEDES BENZ GLC F-CELL

Burkard Oppmann, Sales Manager FAUN Germany and Managing Director FAUN Services GmbH, tested the primarily hydrogen-powered vehicle that has a total of four operating modes available. This vehicle is above all one thing—absolutely quiet. The high level of drive comfort and a large number of safety assistants are strikingly positive.

Mercedes-Benz has succeeded in installing the fuel cell stack with all the associated units under the hood. The electric motor, power electronics and the heavy battery pack are located on the rear axle and its two hydrogen tanks under the vehicle. The space conditions in the rear are not lavish, but sufficient. A disadvantage is the high empty weight. The driver notices this when braking and when cornering fast. The relatively small radius when turning is surprisingly pleasant.

As mentioned, four operating modes are available. In **hybrid mode**, the vehicle draws power from the battery and the fuel cell. This mode should work most efficiently with the available energy. In **F-Cell mode**, only the energy supply of hydrogen is consumed. This mode should be optimal for constant long-distance driving. In **battery mode**, the F-Cell runs exclusively on power from the battery, ideal for short journeys. In **charge mode**, charging the battery has priority.

The driver does not notice the electronically controlled energy changes. In contrast, they register the recuperation clearly. The process can even be influenced by gradually adjusting the steering wheel by means of rockers. At the maximum setting, the vehicle decelerates to such an extent that there is almost no need to step on the brake pedal. »



Technical data Mercedes Benz GLC F-Cell

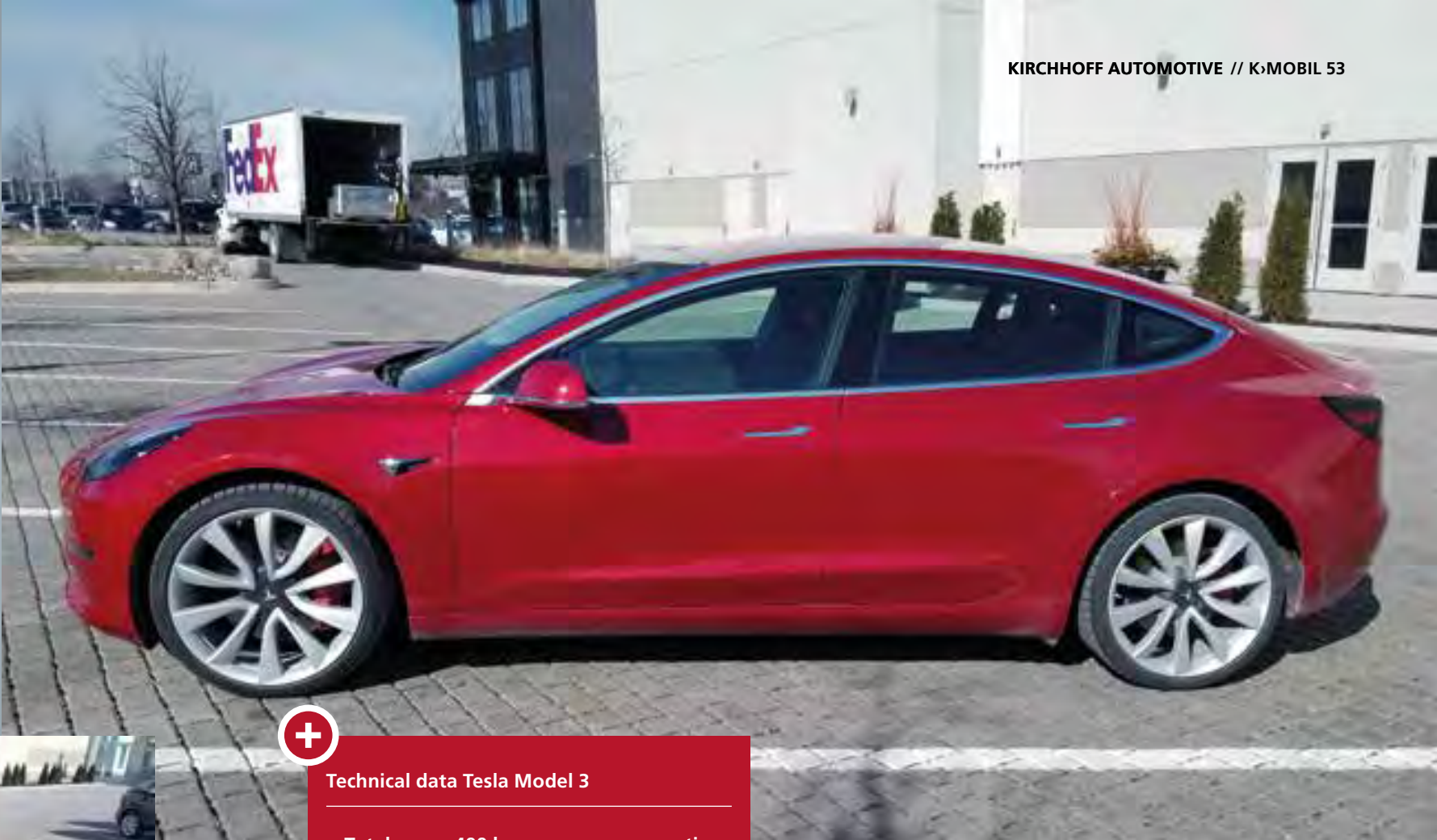
- **Drive/battery:** Fuel cell drive (PEM) with electric motor, 155kW/211 PS, 365 Nm from 1 rpm. Battery gross/net 13,5/9,3 kWh
- **Mileage:** peak 160 km/h (regulated)
- **H₂ consumption F-CELL/Hybrid mode:** approx. 1 kg/0.34 kg H₂ per 100 km
- **Range H₂/rechargeable battery:** 430/51 km
- **Dimensions:** L 4.67 m / B 2.10 m / H 1.65 m
- **boot:** 500-1.600 l
- **Unladen weight:** 2,130 kg
- **Price (full service rental):** 799/month, excluding H₂ fuel costs. A purchase is not possible, only the rent for 48 months
- **Products of KIRCHHOFF Automotive in this vehicle:** A-pillar, cross beams, reinforcements, struts

TESLA - ELECTRIC RIGHT FROM THE START

Elon Musk has built the Tesla brand with the aim of developing purely electric vehicles. From the very beginning, all technologies and processes were geared towards electro mobility. Tesla's pioneering spirit took the development of e-mobility to a new level and became a pioneer in this type of drive. Sherry Lay, Communication & Marketing Specialist at KIRCHHOFF Automotive in Aurora/Canada, tested Model 3.

"Spacious and with a clear design," is how Sherry describes the Tesla Model 3. Although the 5-passenger electric vehicle accelerates from 0 to 62 m/h in just 3.4 seconds and reaches a top speed of 225 km/h, you can hear little to no driving noise. The regenerative braking can be adjusted in "creep mode" via the central control monitor. This allows slow forward movement when the brake pedal is released and replenishment of the battery—a plus in stop-and-go traffic.

Many features can be controlled centrally via a digital control monitor in the middle of the cockpit. The alignment of mirrors and wheels, lights, locks, display, drive, autopilot mode and even the tension of the steering wheel. A very responsive touch navigation system not only calculates the energy requirement for a particular route, but also guides the driver to charging stations if recharging is necessary before reaching the destination. »



Tesla Modell 3



Front view Tesla Model 3



Trunk Tesla Model 3



Technical data Tesla Model 3

- Total range 499 km, energy consumption 18 kWh/100 km, battery capacity 75 kWh (power model)
- Maximum speed 225 km/h
- Acceleration from 0 to 100 km/h in 3.4 seconds
- Dimensions: L 4.69 m / B 1.85 m / H 1.44 m
- boot: 542 l
- Unladen weight: 1.847 kg
- Price: converted 27.000 - 49.000, plus autopilot function for 2,650 €
- The KIRCHHOFF Automotive plant in Querétaro, Mexico produces a cover plate for Model 3.



Interieur Tesla Modell 3



Eva Rademacher, Communication & Marketing Specialist, in front of the Audi e-tron.

AUDI E-TRON: LARGE ON THE OUTSIDE, QUIET ON THE INSIDE

Our test drivers Jens Römer, Audi Key Account Manager at KIRCHHOFF Automotive in Attendorn and Eva Rademacher, Communication & Marketing Specialist at KIRCHHOFF Automotive in Iserlohn, Germany, especially liked the sports mode of the Audi e-tron with boost function.

From the outside, the Audi e-tron looks big and bulky. Inside, the vehicle offers almost as much space as in the luxury class. Compared to the Audi models with internal combustion engine, you hardly have to make any changes to the controls. An additional "range monitor" shows how the range can be increased by switching off various energy consumers such as the air conditioning system.

The e-tron accelerates from 0 to 100 km/h in 6.6 seconds - in boost mode 5.7 seconds. A light pedal press on the accelerator pedal is enough for acceleration, and the braking effect starts immediately when the driver lets go of the gas. With up to 300 Nm torque and 220 kW electrical power, the e-tron recuperates and feeds braking energy back into the

Technical data Audi e-tron

- **Battery type:** Lithiumion high-voltage battery
- **Mileage:** max. power 265 kW (boost mode 300 kW), maximum speed 200 km/h
- **Total range** 370-417 km, energy consumption 26.2-22.6 kWh/100 km, battery capacity 95 kWh
- **Accelerates from 0 to 100 km/h in 6.6 seconds (5.7 seconds in boost mode)**
- **Dimensions:** L 4.90 m / B 1.94 m / H 1.62 m
- **boot:** 660-1,725 l
- **Unladen weight:** 2,565 kg
- **Price:** 79,900 euro (standard equipment) - 81,350 euro (advanced equipment)
- **Products from KIRCHHOFF Automotive in this vehicle:** Wheel arch inside/outside, sill with A-pillar, rear end section, front wall

battery. The range can thus be increased by up to 30 percent. The driver can select three different levels of recuperation via the steering wheel rocker. At the highest level, the deceleration caused by releasing the accelerator pedal is so strong that the brake pedal does not have to be pressed at all. The maximum speed of the e-tron is limited to 200 km/h. Even at high speeds, our test drivers found the e-tron to be very quiet.



Interieur Audi e-tron



Front view Audi e-tron



Trunk Audi e-tron

OUR CONCLUSION:

The **Mercedes-Benz GLC F-CELL** is an optimal concept from the standard-production point of view. The fuel cell technology is perfectly matched to the usual Daimler quality standard. A purchase is not possible, only the rent for 48 months (799,00 euro per month). Due to the increased weight the operation and the increased consumption need getting used to. Also the still rudimentary hydrogen filling station network is not optimal at the moment.

With **Tesla Model 3** overall, it is a new generation of driving with tech at its core. Since the brand did not have to switch from combustion to electric motors, Tesla is highly popular with potential buyers of electric vehicles but with that, it will take some getting used to the digital monitor.

The **Audi e-tron** is absolutely suitable for everyday use. You quickly get use to driving this car. Driving fun is not neglected, especially in sports mode.

Authors: Burkhard Oppmann, Eva Rademacher, Sherry Lay

Sold out Goldsaal in the Schauburg in Iserlohn at the Culture Attack afternoon.

A Cultural Program Conquers Europe

In the first half of the year, various KIRCHHOFF Culture Life events in Germany, Portugal and Poland found a lot of enthusiastic followers.

The great success of the Culture Attack events in Attendorn/Germany, Esztergom/Hungary and Gliwice/Poland last year was followed up by the cultural event afternoons on January 27 in Iserlohn/Germany and on May 18 in Ovar/Portugal. Filled with singing, clapping, drumming, laughing, watching, listening - there was something to suite everyone's taste. So it was no surprise that the events offered to employees of the company and their families were completely sold out.

"Every item on the programme was something very special. The afternoon at the Schauburg was so intense that it continued over the next few days. Thank you for offering us such an event," says Sabine Montenbruck, Iserlohn Production Management Secretariat. »

The Amadeus Duo (Prof. Thomas Kirchhoff and Dale Kavanagh) enthused the audience with a virtuoso performance.

In addition to the big cultural afternoons, the Culture Life Initiative had a lot more to offer. Here is a colourful excerpt from the programme for the first half of 2019.



COLOURFUL THROUGH THE YEAR

Barack Obama, Naomi Campbell, Alexander Gerst—the KIRCHHOFF Colors photo workshops that took place at the German locations are not about these celebrities, but rather the professional photographer Sascha Schürmann in front of his lens. As teacher and workshop leader, he gladly passed on his knowledge about the design of a perfect photo to the workshop participants. Their task now is to find a motif for the KIRCHHOFF Automotive Photo Calendar 2020 and to skilfully stage it. Which pictures make it into the calendar is decided by the jury—the entire staff of the German plants. For Christmas 2020, each employee will receive a copy of the final calendar.



LEARNING THE UKULELE - IN THREE HOURS

Anyone can learn to elicit a few chords from this instrument playfully in a short time. Neither age, musical education nor talent play a role. Some start at the age of three, others at 83. In autumn 2019, all KIRCHHOFF Automotive employees in Iserlohn and Attendorn, together with their families, will have the opportunity to get to know and play this great instrument. As part of the KIRCHHOFF Culture Life Initiative, a three-hour workshop will be offered. Frank Gerstmeier (in the picture above) will lead the Ukulele fast track. He is a lecturer at the Musikhochschule Detmold, teacher at the Musikschule Dortmund and himself a guitarist and enthusiastic ukulele fan.



KEEPING RELAXED WITH BUSINESS YOGA

"Done really well"—is the general consensus after 90 minutes of business yoga at the Attendorn and Iserlohn, Germany plants. In a relaxed atmosphere, the Yoga & relaxation coaches Katharina Köhler and Constanze Taralli showed meditative and mobilizing exercises. For some it was a pleasant break in their everyday working lives, for others it was a completely new way to start or end a shift.



EXPRESSIVE IN FORM AND COLOUR

The fact that our employees in Esztergom, Hungary and Gliwice, Poland are not only very good at their jobs, but also have an artistic flare that they were able to prove during the live painting event with artist Katja Oelmann. Armed with brushes, spatulas and adhesive tape, they transformed a white canvas into an abstract work of art. "Actually, I never liked painting. But since today it's different - the event was a lot of fun and it would have been a shame to miss it," says recruitment specialist Marcell Jászberényi from Esztergom. Marzena Goździk, Senior Inside Sales Specialist in Gliwice, was also enthusiastic, "A great idea. We were not only able to maintain contact with our colleagues, but also express ourselves with colours and shapes." The final paintings were auctioned off and the proceeds were donated to a good cause.

"Such a thing is unique in Germany," says Professor Thomas F. Kirchhoff, who organizes all actions and events of this kind. The employees of KIRCHHOFF Automotive can also look forward to more great events from KIRCHHOFF Culture Life in the future. "We still have so much to do," he announces.

Author: Eva Rademacher



KIRCHHOFF Culture Life

The multifaceted cultural program Culture Life, is intended to shape the corporate culture at KIRCHHOFF Automotive in the best sense of the word. The aim is to strengthen the cohesion of all employees of the family-run company. In addition, the company uses the proceeds from entrance fees to support social projects and non-profit associations within the regions of their plants. "In Iserlohn, we donated the money to the 'Hilfe ganz nah' ('Help Close at Hand') association," says Prof. Thomas F. Kirchhoff, responsible and organizer for KIRCHHOFF Automotive's cultural events.

First Colleague, Then Boss

— How do you manage to live up to your new role as a superior and not lose touch with your colleagues? KIRCHHOFF Automotive's recently introduced new mentoring program provides answers.

Two employees from the Iserlohn plant were the first to take part in this program. One of them was promoted to master fitter in 2017 and thus became manager of the ten other employees in his team. Previously, he and his colleagues had been on the same hierarchical level, doing the same work. Now the task was to give instructions and, in an emergency, to put his foot down. The change was not that easy. He got support and was one of the first employees to take part in the company's mentoring program.

Dragan Petkovic has been working for KIRCHHOFF Automotive for almost seven years. He has held a managerial position as team leader in production logistics since 2014 and has thus already gained experience managing a team. He also uses many leadership methods in his private life as a football coach.

"Leadership is one of the most challenging tasks of a manager. I didn't think long about supporting my colleague in his new role," he says about becoming a mentor.

At the beginning, the two met every 14 days. "It was important for me to get to know the colleague as a person, but also how he sees himself as a manager and what methods he uses. Knowing both the leadership and social skills of the other person is enormously important in mentoring," explains mentor Dragan Petkovic.

In addition to leadership, team development is also an important part of the mentoring program. "It is important to quickly find one's way into the team role and form one's team," says Dragan Petkovic.

How can this be achieved? "In the exchange with the employees, a common perspective is first built up in order to put oneself in everyone's shoes. Through this, you learn how the individual team members tick. This makes it easier to find teams that work in a goal-and-result oriented way," says the mentor.

A piece of advice Dragan gives everyone is: "It is important to always listen actively and attentively."

Author: Eva Rademacher

"Leadership is one of the most challenging tasks of a manager. I didn't think long about supporting my colleague in his new role"

Dragan Petkovic, Mentor

Quality First



Carlos Tavares, Chairman of the Groupe PSA Managing Board (6th from right), together with the suppliers of the year awarded by PSA.

Employee Development —Always In View

— A digital learning platform (K>People Learning Management) in future will be used to control all internal personnel development measures and external training.

The range of e-learning courses is to be expanded step by step as digitalization at KIRCHHOFF Automotive progresses. Via an individual development plan, employees have access to an internal learning catalogue in order to book training courses or carry out e-learning directly in the system. Various selection options help to limit the available offer to, for example, a location or a learning objective.

K>People Learning Management thus offers a uniform, transparent platform that enables managers to keep an eye on the development process of their employees, while employees have an extensive range of opportunities to shape their own professional development.

Author: Lisa Kitterer

— On 13 June, KIRCHHOFF Automotive was awarded the "Quality First" Award by the Groupe PSA at a festive ceremony in Paris.

The Groupe PSA selected 15 companies from 7,000 worldwide suppliers who were honored in the categories Program Management, Indirect Material Machinery & Equipment, Aftermarket Performance, Competitiveness, Quality First and Corporate Social Responsibility as well as with a President Special Award. The award for outstanding quality was presented by PSA for the first time this year and honors the achievements and commitment of a total of three suppliers in terms of industrial development and production while meeting the quality requirements of the Groupe PSA at the same time. "This is a very special award for KIRCHHOFF Automotive. It is an incentive and motivation for us to continue working closely and intensively with the Groupe PSA in the future," said Dr. Thorsten Gaitzsch, CTO KIRCHHOFF Automotive, who received the award from Patrick Labilloy, SVP Quality Groupe PSA and Michelle Wen, EVP, Global Purchasing & Supplier Quality Groupe PSA.

In his closing speech, Carlos Tavares, Chairman of the Groupe PSA Managing Board, highlighted the PSA Group's high expectations of its partners in terms of quality, cost and on-time delivery. This is the only way to face the challenges of the automotive industry together.

Author: Sabine Boehle



The companies that received the award were diverse, including an exhibition stand construction company and a major telecommunications provider.

Dr. Thorsten Gaitzsch, CTO KIRCHHOFF Automotive (center) accepted the award from Patrick Labilloy, SVP Quality Groupe PSA (left) and Michelle Wen, EVP, Global Purchasing & Supplier Quality Groupe PSA.



060 Many Applications by NIVO Rear Cut-Out

063 NIVO, Turny and Co. for People in their Prime



KIRCHHOFF
MOBILITY

Custom-made cars

Many Applications by NIVO Rear Cut-Out

KIRCHHOFF Mobility makes the new identical models of the PSA group Opel Combo Life, Peugeot Rifter and Citroen Berlingo accessible to wheelchair users with the NIVO rear cut-out. The new and flexible conversion solution is available for the models with short and long wheelbases and offers sufficient space for one wheelchair user and additional passengers.



At a glance: NIVO Rear Cut-out for Opel Combo Life, Peugeot Rifter and Citroen Berlingo

- XL floor cut-out
- Short wheelbase: (depending on equipment) up to 4 persons + wheelchair user
- Long wheelbase: (depending on equipment) up to 5 people + wheelchair user; without wheelchair user can allow up to 7 people
- Excellent driving comfort thanks to independent wheel suspension
- Reversing sensors remain unchanged
- Optional Flex ramp for a flat boot surface
- Two optional turn- and swivel seats for the long wheelbase
- Many more extras available for customization



NIVO's wide floor cut-out and non-slip ramp allow the wheelchair user a comfortable and easy entry and exit.

NIVO's wide floor cut-out and non-slip ramp make it easy for wheelchair users to maneuver on and off. Maximum comfort and safety on the road is ensured by the independent wheel suspension and the passenger and wheelchair restraint system. When traveling without a wheelchair, the boot can be used without restriction thanks to the optional folding Flex ramp.

The shortened version of the NIVO Combo Life, Rifter and Berlingo offers space for two people and a wheelchair user as standard. If required, additional seats can be fitted in the rear so that the short version can be used by up to four people and one wheelchair user. With the long version, the entire second row of seats remains usable, depending on the wheelchair. Up to five passengers and one wheelchair user can be seated in the vehicle at max. Thanks to two optional turn- and swivel seats, the long version can also be used as a Seven-Seater when driving without a wheelchair occupant.

Author: Souscha Nettekoven-Verlinde



The NIVO NewLine rear cut-out for the Volkswagen Caddy and Caddy Maxi as well as a drive-on ramp—presented by KIRCHHOFF Mobility at the 2019 Geriatric Care Exhibition—help to ensure the safe and comfortable transport of senior citizens in wheelchairs. And with the swivel lift seat Turny Evo the getting on and off for seniors with reduced mobility is easily possible.

NIVO, Turny and Co. for People in their Prime

— For the first time this year, KIRCHHOFF Mobility presented senior-friendly conversion solutions at the Nursing, Therapy, Care + Professional Patient Care Exhibition in Nuremberg, Germany. This exhibition is considered one of Europe's leading trade fairs for the care sector and was the meeting place for around 28,000 visitors and 700 exhibitors from April 2 to 4, 2019.

Presenting themselves at a 28 m² stand, KIRCHHOFF Mobility informed numerous interested parties about their product portfolio for vehicle conversions for people with reduced mobility. With the NIVO NewLine rear cut-out for the Volkswagen Caddy and Caddy Maxi (that was presented at the fair this year), KIRCHHOFF Mobility's vehicle retrofitter showed a safe and comfortable solution for transporting senior citizens in wheelchairs.

In addition, KIRCHHOFF Mobility demonstrated the Turny Evo swivel lift seat as a simple but effective seating solution at its stand. The Turny Evo conversion makes it possible to position the passenger seat at a comfortable height above the ground by remote control and lift it into the vehicle so that citizens in need can get in and out comfortably. Alternatively, the Turny Evo is also available as a driver's seat for active drivers.

Author: Souscha Nettekoven-Verlinde



066

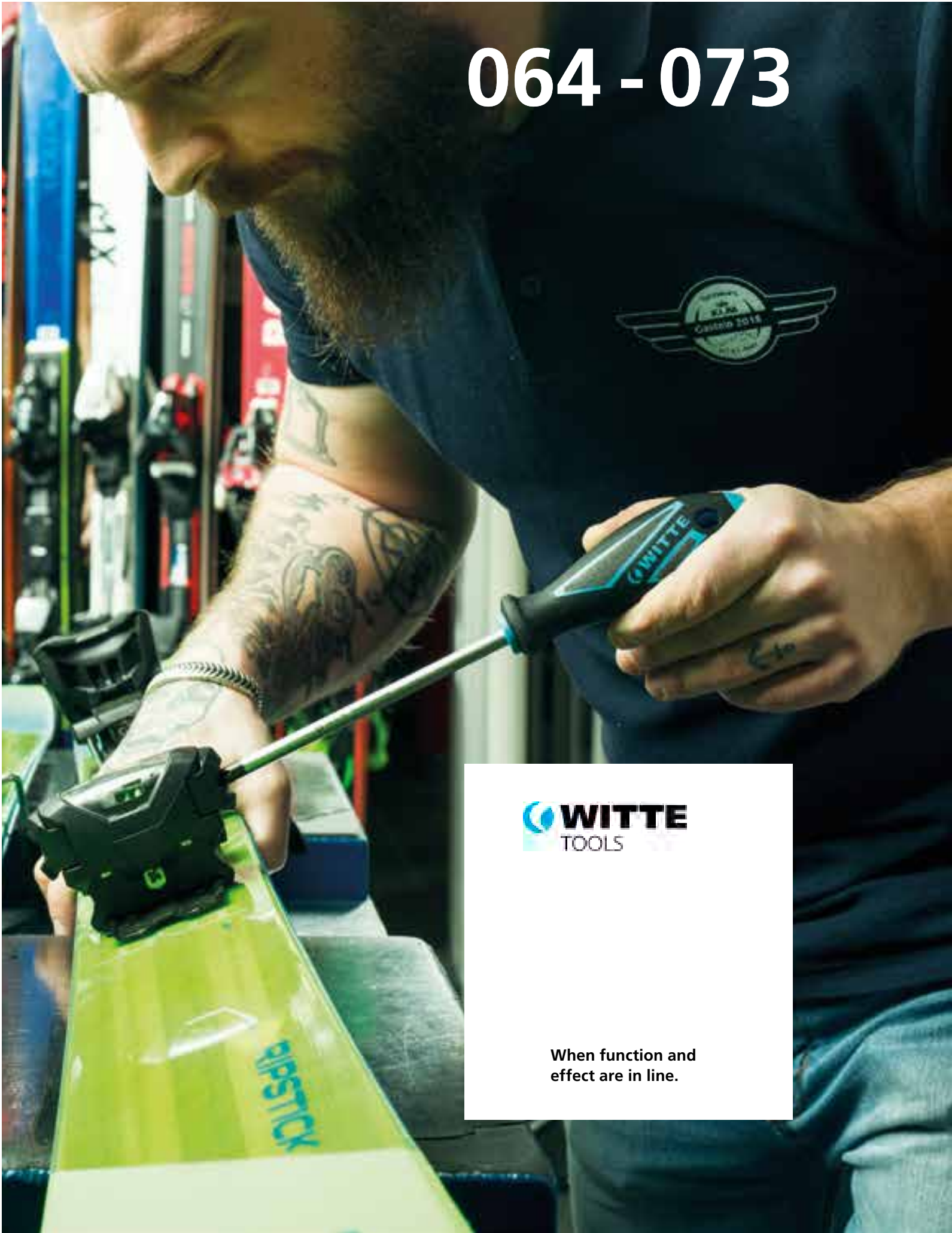


070



072

- 066 MAXX Plus on tour—A sporty "Hello" from the Salzburg Region
- 070 A Success Story: 20 Years of WITTE Tools Screwdrivers for MATCO Tools
- 072 On TV: WITTE Tools



064 - 073

WITTE
TOOLS

When function and
effect are in line.

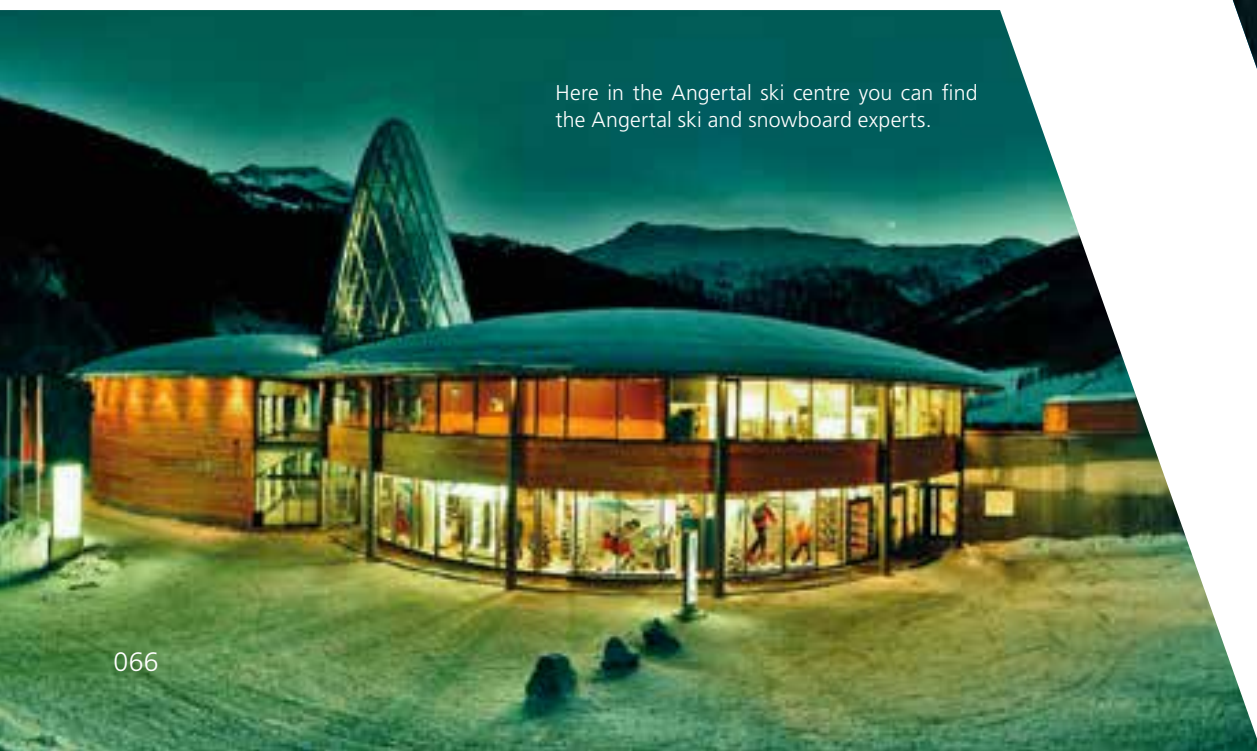
MAXX Plus on tour— A sporty "Hello" from the Salzburg Region

— This "MAXX Plus on tour" story focuses on skiing. The journey goes to the Angertal valley in Austria, where the KIRCHHOFF ECOTEC Group organizes ski-sporting events for the sales team every winter. The professional tools from WITTE Tools are present in daily use at the in-house workshop of the Angertal ski centre.

Here in the Angertal ski centre you can find the Angertal ski and snowboard experts.



Angertal ski centre team – at the in-house workshop you can rely on professionalism, in addition to high-tech equipment you will also find professional tools from WITTE Tools.



The Austrian Angertal is a very popular destination for families, especially in winter. Whether young or old, beginner, advanced or professional—there are various winter sports offered.

Safety is top priority. This starts with perfect and above all, safe equipment. Customers and guests can expect nothing less of this from the ski experts at the Angertal ski centre in the local equipment rental shop. The employees of the service centre take care of the correct maintenance and of the equipment. With properly prepared skis, turns can be initiated with noticeably less effort. Optimum edge grinding also increases safety on hard snow.

In order to match the ski or snowboard binding perfectly to the rider and their skill level, the binding settings are checked and adjusted with the aid of a computer. However, if there is a need to manually adjust, the microfiber-coated MAXX Plus from WITTE Tools is there to help and the right choice by experts at the rental shop. Then it is off to have fun on the hills, which winter sport enthusiasts out there can fully enjoy, especially on the Hohe Scharte Nord, with over 10.4 km of downhill runs and 1,440 m of altitude differences across the hills.

Author: Martina Hageböling



MAXX Plus on Vimeo



Angertal Adventure Arena

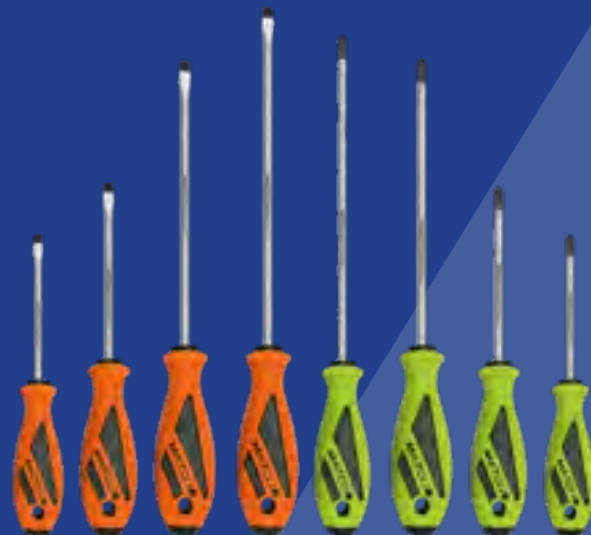
The Angertal is located in the Gasteinertal near Bad Hofgastein in Austria. The lower part of the valley is a mountain pasture region, the upper part was once a mining area for gold and silver. Today gold panning is offered there as a tourist attraction for warmer seasons. In winter, the region promises pure skiing pleasure: the Schlossalm and Stubnerkogel ski areas form the largest ski area in the Gasteinertal, Salzburger Land. In summer, the region offers both recreation and sporting activities—for example, guests can choose between a hiking or a mountain bike tour. Guests also get their money's worth in culinary terms: in addition to Wiener Schnitzel and traditional Kaiserschmarrn (fluffy shredded pancakes), Angertaler Ripperl (ribs) or Kasnocken (Austrian cheese noodles) are right at the top of the menu.



Important before you hit the slopes: the ski binding is expertly adjusted in the workshop of the Angertal ski centre. It ensures that the ski boot holds perfectly and must be individually adjusted to the body weight and skiing experience of the individual.

A Success Story: 20 Years of WITTE Tools Screwdrivers for MATCO Tools

The current MATCO design. The designs in orange and fluorescent green that are very popular with MATCO customers deserve special mention here. Whichever color is chosen, the screwdrivers for MATCO Tools are always supplied with the patented, non-slip WITTE microfiber coating.



The MATCO Tools Truck is the heart of MATCO Sales.

The WITTE Partner Award for MATCO Tools for their double anniversary in 2019: 40 years of MATCO Tools and 20 years of successful business partnership with WITTE.



Both companies have a good reason to celebrate in 2019: WITTE Tools has been producing screwdrivers for the successful American brand MATCO for two decades now. MATCO Tools has been in business for 40 years as of this year. In recognition of this success story, MATCO Tools received the WITTE Partner Award at this year's 2019 MATCO Tool Expo in Las Vegas.

The MATCO Tools Inc. (based in Ohio, USA) is a manufacturer and supplier of tools and workshop equipment. Since 1979, MATCO has distributed its products directly to professional mechanics and those who value quality tools and workshop equipment through a network of mobile franchise partners: Car dealerships, workshops, agricultural and industrial companies as well as the marine, motorsport and aviation industries.

WITTE received its first order to develop a screwdriver line for MATCO back in 1999. At that time, WITTE had already established a reputation as a manufacturer of well-known national and international tool brands and could look back on four decades of

experience as a premium manufacturer in the development and production of customer-specific solutions for private labels.

During that time, MATCO Tools recognized the potential for a special WITTE innovation: a patented microfiber coating for the screwdriver handle. The new MATCO screwdriver line with a non-slip, microfiber-coated handle became a bestseller on the North American market. Since then, no screwdriver produced by WITTE Tools for MATCO Tools in Hagen, Germany, has left the factory without this unique coating. When the screwdriver arrives in North America, it finds a home in the MATCO Tools Truck—ready for customers.

The MATCO Tools Truck is the heart of MATCO Sales—a mobile showroom that also serves as a warehouse and office for the company representative/driver. MATCO Tools has a fleet of around 1,600 mobile sales vans that drive directly to their customers, advise them on site, present new products or hold product training sessions. A service that is well received by customers. In contrast to many other regions of the world, craftsmen in North America buy their own tools for use at their workplace.

Every year, including this one, WITTE Tools supports MATCO Tools as an active partner at the MATCO Tool Expo. 2019 is particularly important for MATCO Tools because they will celebrate a double anniversary: 40 years of MATCO Tools and 20 years of a successful business relationship with WITTE Tools.

Author: Martina Hagebölling



WITTE Tools Sales Manager Alexander Hingst at the presentation of the WITTE Partner Award to Timothy J. Gilmore, President of MATCO Tools.



WITTE Tools Sales Manager Alexander Hingst with Ben Gambrel, Vice President Marketing of MATCO Tools. The picture also shows the first MATCO Tools catalogue with WITTE Tools products and the first screwdriver line produced by WITTE Tools for MATCO Tools in 1999.

On TV: WITTE Tools

— Since the beginning of this year the professional tools from WITTE Tools have been available from the online brand shop of the DMAX television channel. The successful launch of the WITTE brand online shop was accompanied by an advertising spot that was shown several times a day on DMAX, TLC and Eurosport for one month.



To the WITTE TV Spot by DMAX



The DMAX branded online shop – the hunting ground for extraordinary products and gift ideas – recently equipped with WITTE Tools.

The private Munich television station DMAX, which belongs to Discovery Inc., specializes in reports, documentaries and real-life programs appealing to a wide audience. Topics such as adventure, motor sports and technology, vehicle tuning and the most dangerous jobs in the world are the focus of the coverage—perfect fit for WITTE Tools. In the "DMAX Tool Time" television slot, tools are the focus above all. The commercial, in which WITTE products are shown during 'Tool Time', fits perfectly into the daily program and in particular around the topics of workshop and garage work.

The DMAX online shop is the 'hunting ground' for a lot of viewers and people who are interested in the themes mentioned above. Anyone who is hunting

for interesting products for adventures outdoors, motorsports, etc., find a lot of selection through DMAX. New products and genuine classics for camping and survival sectors can be found here, as can products from the fields of technology, fashion, styling, barbecue and furnishings. For real DMAX fans, the shop also offers fan articles for their favorite shows.

Whether for a work colleague, partner, friend, father or grandfather—the products in the DMAX Shop often make hearts beat a little faster. Just take a look at the DMAX branded world of WITTE if you are looking for suitable tools or perhaps the perfect gift idea.

Author: Martina Hageböling

First WITTE TV spot – to be seen on DMAX, TLC and Eurosport.





- 076 Drive Zero
- 080 Technical innovations take unusual paths
- 082 Trucks Insight
- 084 Please refill oil
- 086 Flying high
- 087 Built for the toughest jobs
- 090 100 PERCENT CLEAN
- 092 Powerfull partner
- 094 Brewing and Malting
- 096 On Track
- 098 Something is spinning
- 100 Number 178 has outdated
- 102 Trendy sweepers in Austria
- 104 Sunny bins
- 106 Seine-Sational



-  **KIRCHHOFF**
ECOTEC
-  **FAUN**
KIRCHHOFF GROUP
-  **ZOELLER**
KIRCHHOFF GROUP
-  **HIDRO-MAK**
KIRCHHOFF GROUP
-  **SUPERIOR**
PAK
KIRCHHOFF GROUP

Drive Zero

— Our aim is to collect waste cleanly and not to produce waste within the process. An all-round clean disposal cycle with environmentally friendly vehicles. This is why ZOELLER and FAUN rely on hydrogen as the drive of the future. »



BASIC PACKAGE

- Chassis with high-voltage battery for energy storage and electric drive. On one day this is enough for 2 tours of 10 tons of waste each with an intermediate charge of approx. 40 minutes.
- Nominal capacity batteries EoL: 85 kWh
- Weight: approx. 1,000 kg
- Battery (depending on availability): LiFePo or NMC



Alternative drives in refuse collection vehicles and sweepers improve the environmental balance in polluted cities and conurbations and give operators the opportunity to bypass the driving bans and consciously do something for the environment. FAUN and ZOELLER are working intensively on hydrogen propulsion for refuse collection vehicles and sweepers, because hydrogen is the alternative for sustainable mobility and long distances. The first battery-electric vehicles will soon be in operation at BEG in Bremerhaven, Germany. At the end of the year, two pre-series vehicles of the hydrogen refuse vehicle will be available. A modular drive with safe battery and hydrogen fuel cell technology. The chassis will be equipped with its own electric drive and braking system.



THE CLEAN PLUS

Hydrogen fuel cells are used as range extenders. For greater performance and range, depending on the application. This means that the vehicle only runs with as much alternative drive as it actually needs. This is because fuel cells and hydrogen tanks can be upgraded and retrofitted on a modular basis. A range of up to 560 km is possible (depending on the operating conditions).

- Fuel cells: 30 kW, 60 kW or 90 kW
- Hydrogen tanks: 1 to 4 tanks á 5 kg H₂

ZERO EMISSION

With the drive, energy savings of 40 percent can be achieved. By recuperating the braking energy, tyre wear and repairs are reduced and we save fuel. Noise emissions are also significantly reduced. We operate CO₂- and NO_x-free and operators of waste incineration plants can generate their own hydrogen using electrolysis. The range of hydrogen filling stations is constantly expanding. The website gives an overview of all the filling options.

ELECTRIC DRIVES

Until the hydrogen vehicles are ready for series production on the road in 2021, KIRCHHOFF Ecotec offers further battery electric alternatives. CONTENA OCHSNER and STUMMER cooperated with the Swiss start-up Designwerk on the FUTURICUM COLLECT 26E, which is in use in Schweiz municipalities and

also in Germany. The trend towards alternative drive systems is also continuing in France. SEMAT offers a battery-powered refuse collection vehicle and FAUN Environnement cooperated with the chassis manufacturer Renault and an e-version of the VARIOPRESS. With Volvo, the FAUN E-ROTOPRESS is realized for the City of Hamburg. In addition to the superstructures, the electric variants of the lifts are also being developed. The E-Delta 2307 Premium electric is a split, electrically driven automatic lift with two independently working lifting/tipping units with comb attachment and a 24V DC supply voltage.

EXEMPLARY REGIONS

Lower Saxony relies on the possibilities of hydrogen and has initiated various projects. For example, the city of Osterholz-Scharmbeck plans to invest in a biogas plant. Grimma has also recognised the trend and founded a centre for energy economics and mobility, in which FAUN Viatec plays a major role. Because vehicles are to be operated with the help of green energy and hydrogen. In March, a declaration of intent for the Hydrogen Competence Centre was signed by all participating companies. This would be a novelty in Central Germany. FAUN is one of the five players, because the new energy centre is important for the hydrogen fuel cell strategy for refuse collection vehicles and sweepers.

Authors: Sonja Grässle & Claudia Schae



SEMAT



E-ROTOPRESS

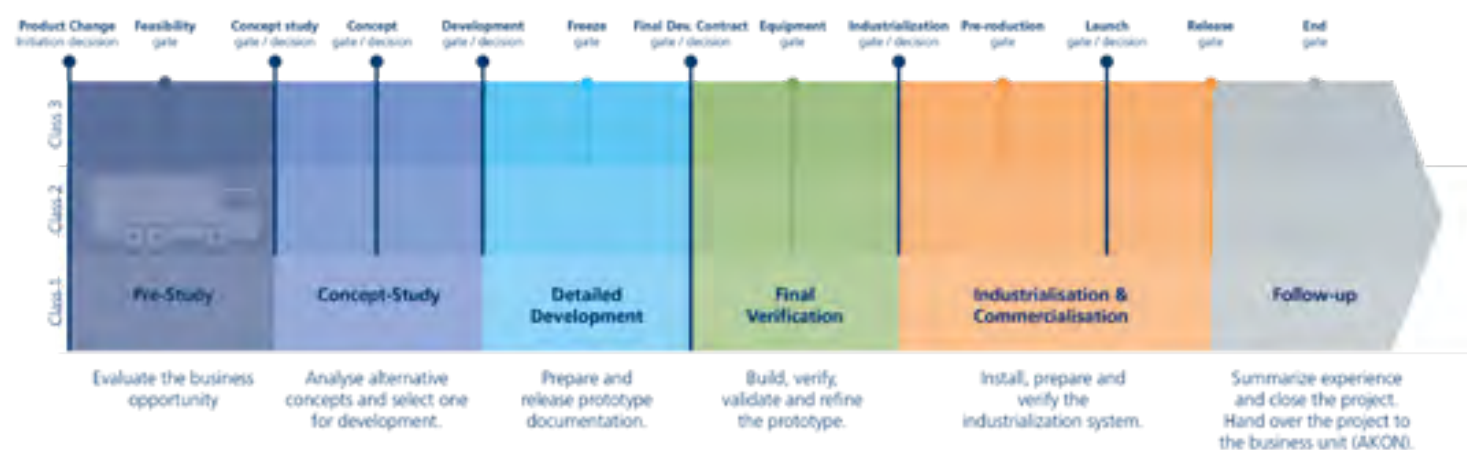
Technical innovations take unusual paths

— Our aim is to always provide our customers with the best possible vehicles and to implement ecological and economically sensible concepts at the same time. Therefore, the TEC Center of KIRCHHOFF Ecotec was founded a few years ago.

The TEC Center combines, in a unique way, the expertise of the internationally operating engineers and technicians of FAUN and ZOELLER and develops new vehicle technologies. The TEC Center will further strengthen its commitment to electrification projects and autonomous solutions. To ensure that the processes within the business units at the various locations can run smoothly, the employees of the TEC Center have initiated the "New Development Process" and use it to structure processes and workflows.

This not only networks data and projects, but also knowledge and people. Process management is designed to be sustainable and powerful, in order to demand and simultaneously promote cooperation and exchange among employees across projects and disciplines. Training by the TEC Center is an essential part of further development.

New Development Process



Discussion on the joint oil and filter strategy between Philippe Coulmont and Thomas Lippardt

His French colleague Philippe Coulmont comments: "This photo is one of my best professional moments. Two experts, two people from different companies, come to a unique idea in an open view to serve the Kirchhoff Group. Thank you Thomas for being so open."

Philippe Coulmont

The "New Development Process" is based on strategic priorities and promotes integration in a new context. Transparency and quality management are clearly presented. Work is also simplified by the fact that the TEC Center uses a common SharePoint. In this tool, all necessary information about a project is stored and is accessible to all responsible employees. This enables an efficient process.

"In a globally operating company, it is important that project-related information is shared. I think it's great that the TEC Center relies on this efficient way of working." (Thomas Lippardt, Product Manager ZÖLLER-Kipper GmbH)

The employees of the TEC Center exchange information at regular communication meetings. The dialogue between engineers and teams supports the growing cooperation. Part of the TEC Center is the team of the KIRCHHOFF ECOTEC Center from Breslau, formerly the engineering office Seltin (K>MOBIL reported in issue 52).

"Web conferences are efficient and fast, but sometimes a face to face meeting helps a lot in cooperation." (Philippe Coulmont, Global Project Manager TEC Center France)

For example, ZOELLER Product Manager Thomas Lippardt and the French Global Project Manager Philippe Coulmont met at Frankfurt Airport to discuss current projects. After committed discussions, the two discovered together concepts for common hydraulics as well as an oil and filter strategy for the vehicles. After all, solutions need personal discussion at eye level.

"Every local production facility had gained a completely different experience with hydraulic steering systems, which from the top level view was an opposite approach. So it will take some time before the new common system is fully operational, but the result will be fantastic". (Philippe Coulmont)

Discussion regarding the joint oil and filter strategy between Philippe Coulmont and Thomas Lippardt. "Perhaps it was because of the short timeframe, but we still found a good compromise for both parties and signed it symbolically on the notebook. Technical innovations sometimes require unusual approaches," Thomas Lippardt summarizes the meeting.

Author: Sonja Gräßle



Trucks insight

— Reliable data about your vehicles with KOCO connect directly ex plant in fall 2019.

The world is becoming more and more digital and as a result our working environment is changing. We always want to know what's "in", to retrieve knowledge around the clock or to show our followers what we are doing. This constant availability does not stop at our industry. The driver of a refuse vehicle wants to know the status of his vehicle, the dispatcher wants to be able to choose the most efficient route and the next inspection needs to be planned punctually in the garage. All of this information is possible ex plant with **KOCO connect** products from fall 2019. The control system and sensors installed in the vehicle generates the relevant data that facilitates reliable decisions for the office, dispatching department or the workshop and can document services without manual effort. For example, the recording of the lane up to the indication to refill the grease. This data helps to monitor the fleet at all times and to use the vehicles efficiently.

In addition to pure location and logistics support, integrated telematics systems can also provide data within the control units, such as event messages, error codes, operating and performance data as well as further diagnostic data outside the vehicle, in order to provide comprehensive support for the garage and dispatching staff during their work. The difficulty with retrofit systems is the continuous availability of data and the reliability of the data acquisition. Different chassis types of different ages do not make safe and reliable data collection any easier.

With **KOCO connect**, for the first time, the KIRCHHOFF Group is showing a **comprehensive telematics** solution that is optimally integrated into the FAUN and ZOELLER vehicles and lifters and can provide the data holistically. This enables complete access to performance and diagnostic data of chassis, body and lifter. With only one data channel, all vehicles are online and always in view. Existing and special vehicles can also be connected independently of the manufacturer in order to reduce the number of different portals.

KOCO connect is available ex plant at FAUN and ZOELLER in fall 2019, so that time-consuming on-site installations are no longer

necessary and sources of error can be eliminated by controlled access to the body electronics. The desired amount of data can be activated remotely so that the function can grow with the requirements of the waste disposal company.

For the first time, **diagnostic data** from the body and lifter are **available online** for the workshop and disposition, so that incidents, occurrences, error codes and maintenance requirements can be open to inspection without coordination with the driver. Consequential damage caused by "manually pushing away" error messages on the vehicle is outdated. The service life is reduced and vehicle availability is increased by plannable workshop deployments with shortened duration. This is due to fast and uncomplicated remote fault diagnosis and troubleshooting.

Specifically, the ability to access error codes and to set parameters within the FAUN Control System (FCS) and the G12 control from ZOELLER, as well as the lifter controls, is a decisive innovation. **KOCO connect** records performance data of body, lifter and chassis with local and time reference. For example, the number of fills including position, fill level, payload and shield position, mileage and fuel consumption are available without additional sensors.

KOCO connect can be expanded to include weighing, identification and various other assistance systems and can therefore be adapted to the requirements here. The recorded data can be viewed, checked and evaluated in a separate **web portal**. With clients using ERP and dispatching systems, the recorded data can also be integrated into the existing systems via gateways —without having to change the system.

KOCO connect is a product of KOCO solutions based in Darmstadt and Zug, Switzerland. An electronics and software development team takes care of the customers wishes and can react flexibly to their requirements. The direct line: **koco.solutions**

Author: Matthias Siegel

Please refill oil

With **FAUN complete**, FAUN offers waste disposal companies a 360-degree service for the vehicles, so that the vehicle status is displayed in real time. This service will be available in 2020.

Top up with water, top up with grease, next inspection in 3,000 km. Information that you know, register, quickly press away and then forget. With **FAUN complete** such instructions can no longer be ignored. Condition monitoring monitors the body and lift and displays the status so that faults do not remain undiscovered for long. In addition, manual interventions are also documented and if a vehicle is used for too long with the error message, the FAUN service technician actively calls the customer with a corresponding recommendation for action. FAUN functions, so to speak, as a wingman who pays attention to the customers' vehicles 24/7 and 360 degrees and coordinates workshop appointments. The KOCO-Box (K>MOBIL reports in this issue) installed ex works makes real-time data acquisition possible. The package can of course be retrofitted into the existing vehicle fleet. **FAUN complete** is available individually or as an upgrade to FAUN Full Service. If full service subscribers opt for the 360-degree package, they will receive a refund.

360 DEGREE FAUN COMPLETE:

- Capture
- Analyze
- Contacting
- Recommend this page

Author: Burkard Oppmann

Flying high

— The airport expert Roman Bakhteev is the new Pfundskerl within the FAUN export team.

Born in Moscow, he has been strengthening the FAUN export sales team since March. The 40-year-old studied engineering in construction and airport operations at the University of Automotive and Road Economics in Moscow. He gained professional experience as a sales manager for a sweeper supplier, as area sales manager for a mechanical engineering company and as a ground support equipment manufacturer. Bakhteev will remain true to his passion for airports in the future and will take care of the international sales activities in this area and promote the sale and development of FAUN airport products.

Author: Claudia Schae



Product Manager Airport: Roman Bakhteev

NO DIRT IS TOO TOUGH FOR US TO TACKLE!

FAUN - BUILT FOR THE TOUGHEST CHALLENGES



BAUMA 2019

— Stains of oil, heaps of dirt, building site muck? No problem for FAUN sweepers. They're built to handle the hardest situations, when the going really gets tough.

BAUMA in Munich is where the Who's Who of the construction industry get together every three years. FAUN was one of around 4,000 exhibitors showing off building site equipment. The fair's motto? Great. Greater. BAUMA. With 614,000 square metres of exhibition space, it's a superlative event. FAUN presented two special sweeping machines from the VIAJET 7 series, designed for special operational situations. »

VIAJET 7 R/L HS WITH HS 2000 HYDROSTATIC DRIVE



- VIAJET 7 R/L HS with HS 2000 hydrostatic drive is a high-performance, universal sweeper equipped with a vast array of options
- 7 m³ body volume
- Scania G410 chassis
- Sweeper units are fitted to both sides of the machine, enabling it to be used on local and major roads and to also sweep one-way roads and roundabouts in the correct direction
- The manual suction hose at the rear can be used to easily pick up sweepings and leaves and to also clean gullies
- Rear suction system (an attachment variant on the machine) is particularly useful on construction sites when used in conjunction with the washer jets on the high-pressure pumpVIAJET 7 R/L HS with HS 2000 hydrostatic drive
- Additional high-pressure washing beams on the shaft, broom and central brush extend the machine's area of application beyond conventional sweeping operations
- Interchangeable weed broom at the front of the vehicle
- The operator can adjust the angle of the broom and change the direction of rotation, enabling it to be used for conventional weed removal and also for sweeping ahead of the front wheel to prevent the sweeper from compacting milled material when it is being used behind milling machines.
- The weed broom can also be easily removed, enabling the manoeuvrable sweeper to carry out municipal maintenance cleaning.
- Wide range of light sources including working lights and side-mounted ambient lights as well as cameras and safety sensors make the machine easy to control and exceptionally safe
- The working speed in sweeping mode can be continuously adjusted up to approximately 27 km/h. The Opticruise system eliminates the need for manual gear changes during transport journeys.
- Ergonomic place to work because of the large, air-conditioned, sound-proofed driver's cab with an integrated cool box provides operators with plenty of space. All driving and sweeping functions are clearly laid out on the well-structured operator terminal—making sweeping an enjoyable task.
- The customer was keen for the machine to be equipped for a wide range of application scenarios to ensure it could be used flexible

VIAJET 7 R/L HS AQUATHERM

- VIAJET 7 R/L HS AQUATHERM – Road sweeper with thermal surface cleaner
- 7 m³ body volume
- 1843L Arocs chassis from Mercedes Benz with a 4,500 mm wheelbase
- Drives smoothly thanks to its PowerShift gear box combined with an HS2000 hydrostatic drive
- Instead of no longer need to be sent two sweepers separately to the site of an accident. A single VIAJET AQUATHERM can be used efficiently and cost effectively
- Warm water from the 4,200 l clean water tank and a surfactant concentrate are sprayed onto a contaminated surface such as spilt oil
- The surface is cleaned and the contaminants vacuumed up across the entire width of the vehicle
- The water is heated by a mobile heating system that delivers 300 KW of power
- Contaminated surfaces are cleaned in line with RAL GGVU regulations defined by the German Institute for Quality Assurance for cleaning transport surfaces and cleaning up after accidents, and regulation 4089 set out by the Association of German Engineers (VDI)
- Particularly stubborn contaminants can be removed using the numerous washer jets for high-pressure cleaning
- A 136 l/300 bar high-pressure system, underbody-mounted suction system combined with a HYDROJET and TURBOJET system and the manual high-pressure floor cleaner round off this special road sweeper
- AQUATHERM is used by fire departments and specialist companies

Author: Claudia Schaeue



SEE YOU IN MUNICH,
4 - 10 APRIL 2022.

100 PERCENT CLEAN



CLEAN DISPOSAL

Together with chassis manufacturers such as Renault Trucks or the Canadian company and EFFENCO from Montréal, FAUN Environnement produces clean refuse vehicles. The "Active Stop-Start TM" system was developed by EFFENCO. The vehicle engine is switched off when the vehicle is at a standstill, while the transmission and body remain in operation. The system is used in 84 refuse collection vehicles on gas chassis of the customer Derichebourg for the city of Paris. A large proportion of nitrogen oxides can be saved with environmentally friendly chassis. Chassis manufacturers are therefore making great efforts to develop new environmentally friendly products. At the last Pollutec exhibition in Lyon, Renault Trucks exhibited its first second-generation electric refuse collection vehicle. FAUN and Renault worked closely together to develop the RCV D WIDE Z.E.

— The protection of the environment plays an important role at FAUN in France. The following products have a very good ecological footprint.

DRIVE SENSIBLY WITH CIN-ENERGY

A few years ago, the French introduced the Cin-Energy system to the market. The kinetic energy released when the vehicle brakes is absorbed, stored and reused to tip the garbage bins. This can reduce the fuel consumption of the refuse vehicle by up to 14 percent and CO₂ emissions by up to 7.9 tonnes per year and vehicle.



SUSTAINABLE PRODUCTION WITH RECYCLABLE ALUMINIUM

Environmentally friendly products are good, recyclable products are better. The CITY series containers, manufactured by the FAUN Environnement subsidiary in the south of France, are made of aluminium. This means that they are not only durable, but also 100 percent recyclable.

Author: Helen Campens

Powerfull partner

— To assist Southampton City Council improve their Fleet of Refuse Vehicles and minimise spending, they specifically needed a vehicle that could easily collect wheeled bins and bulky items/side waste and trade waste. They went for eight VARIOPRESS.

Southampton is the largest city in the ceremonial county of Hampshire, England. It is 70 miles South-West of London and 15 miles West North-West of Portsmouth. Southampton is a major port and the closest city to the New Forest. It lies at the northernmost point of Southampton Water at the confluence of the Rivers Test and Itchen with the River Hamble joining to the South of the urban area. The city, which is a unitary authority, has an estimated population of 253,651. The city's name is sometimes abbreviated in writing to "So'ton" or "Soton", and a resident of Southampton is called a Sotonian. Significant employers in the city include Southampton City Council, the University of Southampton, Solent University, Southampton Airport, Ordnance Survey, BBC South, the NHS, ABP and Carnival UK. Southampton is noted for its association with the RMS Titanic, the Spitfire and more generally in the World War II narrative as one of the departure points for D-Day, and more recently as the home port of a number of the largest cruise ships in the world. Southampton has a large shopping centre and retail park, Westquay.

Following a competitive tender exercise, FAUN ZOELLER UK were awarded the vehicles after demonstrating the best overall value utilising by removing existing bodies and lifters and reusing the chassis. The order was to replace eight existing bodies and lifters with brand new VARIOPRESS bodies fitted with two types of lifters for trade and domestic waste. Five ZOELLER ROTARY XL lifters and three Omega Trade lifters mounted on existing Mercedes Econic 6 x 2 rear steer chassis. The ROTARY XL lifter offers a full width hopper aperture which gives the operator maximum flexibility. The vehicles are being delivered in stages throughout 2019.

David Tyrie, Service Lead at Southampton City Council said "Throughout the tender process to the delivery of the vehicles, Pat Brown at FAUN ZOELLER UK, has been exceptional both with his product knowledge and information which he has shared with us, this information gave us the confidence to make the right choice of vehicles and lifters we needed".

Author: Catherine Kings

Brewing and Malting

— FAUN ZOELLER UK were awarded to deliver waste trucks for Bury St Edmunds.

Bury is located in the middle of an undulating area of East Anglia known as the East Anglian Heights, with land to the east and west of the town rising to above 100 metres, though parts of the town itself are as low as 30 metres above sea level where the Rivers Lark and Linnet pass through it. Bury St Edmunds, commonly referred to locally as Bury, is a historic market town and civil parish in the St Edmundsbury district, in the county of Suffolk, England. Bury St Edmunds Abbey is near the town centre. Bury is the seat of the Diocese of St Edmundsbury and Ipswich of the Church of England, with the episcopal see at St Edmundsbury Cathedral.

The town, originally called Beodericsworth, was built on a grid pattern by Abbot Baldwin around 1080. It is known for brewing and malting (Greene King brewery) and for a British Sugar processing

factory, where Silver Spoon sugar is produced. The town is the cultural and retail centre for West Suffolk and tourism is a major part of the economy.

In order to improve their Trade Waste Service during 2018 the Local Authority and following a competitive tender exercise, FAUN ZOELLER UK Ltd. were awarded the vehicles after demonstrating the best overall value. The order was for 3x POWERPRESS fitted on 26 t Mercedes Econic 6x4 rear steer chassis which have proven to be ideal for this particular type of very specific work. Recently during March 2019 Bury St. Edmunds have also taken delivery of 3x VARIOPRESS fitted on 26 t Mercedes Econic 6x2 rear steer chassis for domestic waste collection.

Author: Catherine Kings



Rob Hudson Hill (Middle) Workshops Manager at St. Edmundsbury Borough Council said: "We are extremely happy with the FAUN ZOELLER vehicles. FAUN ZOELLER UK, has proven to be very supportive, knowledgeable and information which provided us with confidence". Pat Brown (left) and Martin Hughes from FAUN ZOELLER UK Ltd.

ON TRACK

50 years of TRACKWAY. A product evolution of its own.

With research and development at the heart of FAUN TRACKWAY's engineering department, our pioneering design engineers have been focusing on product innovation projects to further advance our TRACKWAY solutions to improve their capabilities. Fifty years after launching our M30 TRACKWAY (originally named MLC 30) we are proud to release our M30H TRACKWAY. The M30H TRACKWAY is an aluminium panel that, when interlocked in multiples, forms an access route for vehicles of up to 30T. The panel is used by militaries worldwide for land and over the shore operations where ground stabilisation is required.

The M30H TRACKWAY utilises the strength and durability of our original M30 TRACKWAY but with the addition of a locking bolt for the

quick release of panels should they need to be added or removed. This innovative feature also eliminates the requirement of any tools previously required to replace the panels once in situ. Additionally, the new modular design allows for increased flexibility for dual directional rolling to improve conformity over uneven ground, along with grip enhancing grooves to provide grip when the panels are dirty.

Gareth Williams, Engineering Manager:
"We are proud to hold a strong belief in the continuous improvement of our TRACKWAY products and are delighted with the results of our product evolution thus far".

Author: Danielle Thomas



Something is spinning



— The ZOELLER rear loader family has grown. The rotary drum vehicle MEDIUM T1 completes the ZOELLER refuse truck range and it's currently on demonstration tour.

Visitors of the Mercedes show Kommunal Live experienced the premiere of MEDIUM T1, the new addition to the ZOELLER programme. Apart from the drum, the most eye-catching features are the stylish grey-white cover plates with the ZOELLER symbol.

An integrated DIN connection frame is mounted on the MEDIUM T1. In combination with an appropriate lift system, the rotary drum vehicle can pick up and empty containers from 60 to 1,100 litres in accordance with DIN EN 840-1 to DIN-EN 840-3 when transporting household, organic and light fractions. The highlight of the rotary drum principle is that the waste is continuously circulated, shredded and transported to the driver's cab through two worm gears inside the rotary drum.

The MEDIUM T1 will now be seen more frequently in everyday waste disposal operations. Especially suitable for organic waste collection, the MEDIUM T1 can also be used for household waste and light fraction collection in residential, inner-city and rural areas.

Author: Claudia Schae



ADVANTAGES WITH THE TURN

- Mature technology in combination with the ZOELLER Control System
- Particularly suitable for organic waste, as organic recyclable materials are loosely mixed and thus homogenised in an excellent way during collection. The continuous circulation aerates the waste and liquids are bound in the waste.
- Advantage axle load distribution, because direct payload distribution to the front axle at the start of loading
- High payload, as the MEDIUM body weighs less and a higher payload is possible with the same wheelbase. (depending on option)
- Minimized operating costs, as the wear protection plates of the press screws can be easily replaced.
- Increased manoeuvrability, as the MEDIUM T1 scores with low overhang.
- Numerous optional extras possible

— A real treasure stands in the yard of the Technisches Betriebs-Zentrum in Neumünster

(TBZ). A MEDIUM XL from 2003 with the serial number 178.

Number 178 has outdated

The fact that the rear loader has done 16 years of service shows only the few rust spots and the faded orange. "Otherwise it's still in top form and has done good service," sums up Hans-Hinrich Pohlmann, Technical Manager at TBZ.

Number 178 is now obsolete. Three new MEDIUM XL with 22 m³ body on Econic chassis have been reinforcing the vehicle fleet since the end of 2018. The new ones are really well equipped. "Above all, the health protection of our workers is important to us. Therefore it can also be a little more equipment. For example, they are exposed to harmful odours and dust," says Pohlmann. The new rear loaders are therefore fitted with the CLEAN OPTION extraction and filter system. According to Pohlmann, the regular team is not very enthusiastic when they have to switch to an older model. Jürgen Kowalke adds: "Such feedback from the field is the best reward for our work. Then we know we've done everything right and can continue to develop our products." The waste trucks were fitted with additional equipment such as: Turning Assistant and Bi-Line, a safety line

on the roof. During their stay in the workshop, Bi-Line serves as a fall protection for the fitters. LED lighting including work lights for the loader round off the "Environment" safety package. The turning assistant is immensely important. When the direction indicator is actuated, a camera mounted below the exterior mirror is activated. The monitor image supplements the exterior mirror display on the right-hand side of the vehicle. "We want to offer the boys on the vehicle and the citizens the greatest possible safety," says Hans-Hinrich Pohlmann.

Jürgen Kowalke and Hans-Hinrich Pohlmann have known each other for years. The Bad Oldesloe team maintains intensive contact with them. Hans-Hinrich Pohlmann: "The people involved in everyday life make up the cooperation. The team in Bad Oldesloe is great, they are quickly on the spot and if there is a problem, it can be solved quickly and easily. That's how I imagine a good cooperation."

Author: Claudia Schae

Trendy sweepers in Austria

The STUMMER EUROJET sweeper is already fully booked. Whether with an auxiliary engine, a hydraulic or hydrostatic traction drive, which is EUROJET the right sweeper for all needs.



On the occasion of the annual conference of the Association of Austrian Waste Management Companies (VÖEB), STUMMER Kommunalfahrzeuge presented its latest products in Reichenau, Austria.

The STUMMER team put together a colourful vehicle potpourri for the guests and association members. The highlight was the eagerly awaited EUROJET sweeper. After 20 years of abstinence, the ZOELLER subsidiary again offers street sweepers in Austria. The sweeper was very well received, so that the demonstration tour is fully booked for the next weeks.

STUMMER also had the MEDIUM X4 with ZOELLER Delta Lifter on Mercedes Benz chassis in its programme. The newly developed hydraulic control in the MEDIUM X4 offers the possibility of increasing the payload by up to two tons for packaging materials, especially when collecting recyclable materials. This means an increase in the payload of almost 50 percent with the same body volume. STUMMER Managing Director Johannes Streif: "I am sure, and the tests as well as the first deliveries of the pilot series vehicles prove it, our new MEDIUM X4 will clearly exceed our expectations". Despite higher compaction performance, the energy consumption could also be considerably reduced by an improved and more efficient kinematics of the compaction unit.

The greatest interest of the trade visitors was the hydrogen drive of the KIRCHHOFF Group. A refuse vehicle with battery and fuel cell technology (we report in detail in this issue). From the beginning of 2020, STUMMER will go on tour with a MEDIUM X4 demo vehicle in Austria and Switzerland. "The combination of battery and fuel cell will prevail sooner or later. The electric drive alone will not be able to meet

the needs and requirements 100 percent," Johannes Streif is certain. KIRCHHOFF's own development, which for the first time considers the chassis, body and lift, i.e. the complete vehicle, is specially adapted to the needs of waste management and the industry.

Author: Johannes Streif



They are in favour of a clean separation - but only with the waste collection. Otherwise they go together for a clean environment: VÖEB President and Host KR Hans Roth, Anita and Johannes Streif (STUMMER Austria) as well as BDE President Peter Kurth (Federal Association of the German Disposal, Water and Waste Management Industry), from the left.

Sunny bins

Besides beer, the Germans' favourite drink is coffee. Hip coffee shops and bakeries also offer the aromatic black liquid to take away. In Germany, 320,000 hot drinks are drunk per hour from disposable cups. This also means that 320,000 times more waste is produced.

Of course it is advisable to bet on returnable cups. But if it's not at hand, where to go with the coffee cups to go or empty French fries cones? To go cups are often too big for the small filling slots of the trash bins. The result is overflowing rubbish bins or flying waste. Not too appetizing to look at. The use of a STUMMER SOLARPRESS can help.

The modern waste bin is ideal for city centres or parks, because it works with environmentally friendly solar energy and gel batteries and is ideal for light packaging. The waste is minimized by a factor of five. The waste bin is equipped with sound effects, LED night light and level indicator in order to make the throwing of garbage more attractive for the citizens. When the bin is full, a web portal provides information about the local waste disposal company or building yard. Their small garbage trucks are on the move in the city centres or green areas. This means that collection tours can be planned efficiently and in an environmentally friendly manner. The 120 litre large refuse container can be emptied easily with small refuse vehicles, such as the ZOELLER

MICRO HG, with DIN comb holder. Some cities, such as Rüsselsheim in Germany, already use the modern and funny waste bins. ZOELLER Project Manager Olaf Schneider is sure that other inner cities will follow this example: "Never before has garbage been thrown away so entertaining and environmentally friendly. Litter bins, users and operators communicate with each other". For ZOELLER, the expansion of the product portfolio is a logical step. "We complete our product range. We have waste bins, the right vehicles and lifts," Schneider continues.

Author: Claudia Schae



SOLARPRESS, one scan away:
www.zoeller-kipper.de/produkte/solarpress/



50 vehicles mounted on clean energy chassis (CEC) will patrol the streets of the capital, which welcomed nearly 40 million visitors in 2018. As a designer and manufacturer of street cleaning vehicles (12 t to 26 t chassis powered by Diesel, NGV and batteries) for many years, SEMAT has developed the new model to better meet the demands of the city of Paris. Issues like driver ergonomics, intensive usage, clean energy, noise, etc. have been involved in the development. Through its partnership with the chassis manufacturer—the 2019 AMARINE was born, redesigned with a new control system and new hydrostatic drive.

With a capacity of 4,500 to 7,000 l, the AMARINE is multifunctional. Four side jets, two front half-ramps, a broom and a 25 m rear hose reel provide optimal cleaning capabilities, even in hard-to-reach areas, e.g. under cars or other objects.

Lastly, the AMARINE is perfectly integrated into its environment:


- Low noise (enhanced soundproofing of equipment)
- Can use water from the river Seine (new filter)

Author: Christophe Bigre

Seine-Sational

— SEMAT will be rolling out its next generation of “AMARINE” street cleaning vehicles in Paris from 2019 to 2020.





**We wish you a
refreshing summer.**