ENGINEERING SERVICES AND SYSTEM SUPPLY FROM A SINGLE SOURCE: OUR E-MOBILITY BUSINESS UNIT

E-mobility has always been an important business area for BENTELER. In 2017, a dedicated global business unit for e-mobility system solutions was founded. Meanwhile, BENTELER e-mobility and its portfolio has been fully launched. We have significant expertise in system solutions for electric vehicles. We combine it with our competence in engineering and manufacturing of chassis systems and the know-how of crash and thermal management.

BENTELER E-mobility is a single-source system supplier offering global system engineering. From concept to series design, production of mules and prototypes to industrialization support and supply chain management. BENTELER can also assume responsibility for serial production or customers can take advantage from our licensing model. This provides greater independence, enabling customers to produce their systems on their own.

We enjoy a very high reputation among experts and well-known players such as Sony, Evergrande and Automobili Pininfarina. Our business network includes strong cooperation partners such as BOSCH, Vibracoustic and Pininfarina, providing in-depth expertise in every field of e-mobility applications.

Our common projects were presented at the Shanghai Auto Show in 2017 and 2019, IAA 2019 and CES 2020 and also published in various press releases. Our aim is to enable our customers to find the best e-mobility solutions for their individual needs.

THE BENTELER ELECTRIC DRIVE SYSTEM SOLUTIONS

Dear All,

In the media, you’ll often hear: “It’s easy to build an electric vehicle.” Having engineered and set up many customer cars over the years, I wouldn’t say it’s easy – it’s different and very challenging.

At BENTELER, we see ourselves as an enabler for e-mobility and with our newsletters, we’ll keep you informed about relevant activities, projects, products and services. And how we can help accelerate your business. You can explore our portfolio and services in this and future newsletters.

Feel free to get in touch if you have any questions.

Regards,
Marco Kollmeier

For further background about our e-mobility solutions please visit our website: www.benteler-automotive.com/e-mobility

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BENTELER MODULAR BATTERY PACK: MORE THAN JUST AN ASSEMBLY OF BATTERY MODULES

BENTELER is one of the market-leading suppliers of battery trays. Combined with our competence in cooling systems, we have designed a full modular battery pack ready for integration into the vehicle body. This includes the aluminum tray, cooling, battery modules, fittings and the high-voltage wiring and connections.

The tray is an aluminum extrusion frame design, which combines the competence of 10 years of battery tray series manufacturing at BENTELER. The outer frame is the main structure of the pack and supports the whole vehicle in terms of security and crash behavior. Additionally, an inner reinforcement frame protects the modules and absorbs crash loads. The base plate of the battery pack is located below the tray. It consists of three cooling plates welded together. These are manufactured by roll-bonding or, optionally, by soldering. The cooling plates are part of a water/glycol low temperature circuit, which is cooled by a chiller or, alternatively, electrically heated by a high voltage heater. The battery cooling system is designed for DC quick charging of 150kW.

The battery pack modules are a standardized format. Together with our battery partners, we guarantee the availability of high-quality battery modules and the battery management system. The wiring and fittings are developed by BENTELER and optimized to reduce cost and weight. The whole pack undergoes a high number of validation and certification tests. In this way, we ensure that all requirements, whether customer or legislative, are fulfilled. The result of the combination of all these technologies is our packaged optimized modular battery pack with a high energy density.

INNOVATIVE NEW BATTERY TRAY DESIGN

The battery tray is an underestimated system. It not only provides good packaging for the battery modules; it also fulfills high requirements of permeability and impact as part of the vehicle crash management. Our new tray design as part of the battery pack offers customers a wide range of benefits:

- Lightweight: weight-optimized tray with high-tenacity aluminum alloy
- Remarkably flat design, feasible for VDA 590er modules
- Integrated crash system
- Integrated pole test cover plate
- Easy integration for gas evacuation through side profiles

Dear All,

Today, many manufacturers invest heavily in the development of battery packs tailored to a specific vehicle design. Although battery modules are moving towards standardization, there are nevertheless numerous battery pack solutions for every application. Given the engineering effort and investment necessary, a modular battery pack that’s easily integrated into an individual vehicle concept is an enabler for cost competitiveness. That’s why BENTELER has developed a pre-integrated, pre-validated solution based on the BEDS platform. First prototypes on the street confirm the performance of our battery pack.

Regards,
Marco Kollmeier

For further background about our e-mobility solutions please visit our website: www.benteler-automotive.com/e-mobility

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TWO IS BETTER THAN ONE: BENTELER E-MOBILITY OFFERS TWO PLATFORMS, REDUCING COSTS AND TIME TO MARKET

Electric vehicles have a completely different architecture to cars with combustion engines. This is because of the complex e-powertrain, which must be integrated into the vehicle for maximum functionality and efficiency. Our solution is the BENTELER Electric Drive System (BEDS). It is an open platform, which we have, together with our cooperation partner Bosch, successfully launched globally. The platform combines our e-mobility systems such as Integrated E-Chassis Modules and our modular battery pack. Together with our partners Bosch, Vibracoustic and Pininfarina, we have optimized the interfaces to the e-powertrain, EE and body.

The current BENTELER Electric Drive System 2.0 is a showcase for the benchmark in electric vehicle platforms for the D to F segments. Meanwhile, the market has shown a strong demand for platforms in the smaller segments B and C, too. In addition to a new 3.0 version of the D-F platform, BENTELER is also working on a platform for the lower segment. Focus is on cost-efficiency and robust design, taking into account the lessons learned from the earlier platform development process.

By engineering these platforms to a maturity level ready for series application development, the customer saves a high portion of engineering costs and up to one year in reduced time-to-market. In addition, the customer benefits from the scale effects of the platform modularity and scalability. A carry over of designs and hard points, and the flexibility of the platform to vehicle dimensions, such as track width and wheelbase, is a huge lever for the efficiency of our platform solution. This is even more important as high production volumes are not yet materializing in the e-mobility market. For niche applications, a platform line-up is also often the only route to commercial success.

THE BENTELER ROLLING CHASSIS: A STRONG ENabler FOR E-MOBILITY APPLICATIONS

Based on the BEDS platform, we also offer a rolling chassis solution, often called a "skateboard". This is the integration of the platform in an underbody, covering the full functionality of the e-powertrain. The BEDS rolling chassis is provided as a steel solution for unibody architectures or with an aluminum underbody for body-on-frame vehicles. The rolling chassis is a very efficient solution and an enabler for setting up new electric vehicles very quickly, with reduced complexity and high quality. All using the scale effects of the BENTELER platform.

Dear All,

Unibody or body on frame? As a platform supplier we are often asked this. The answer is as always: “It depends.” For us, a unibody concept makes more sense with higher volumes because the amortization of press tools and investment is quite high. For lower volumes, a skateboard concept makes more sense. Actual benchmarks show there is no difference in vehicle performance and both solutions are doing well in the market. In the end, you need to assess which concept fits your strategy and business plan best. We can help you decide; we offer both concepts and have the experience in industrializing them.

Regards,
Marco Kollmeier

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SOLVING THE CHALLENGE OF COMPACT DESIGN, NVH AND DRIVING PERFORMANCE: THE NEW BENTELER INTEGRATED E-CHASSIS MODULE (IEM)

The integration of an electric powertrain in the chassis brings with it a significant increase in engineering complexity. BENTELER, with its Integrated E-Chassis Module (IEM), offers chassis system solutions for several vehicle platforms from B up to E segment for front and rear suspension. The key is scalability and modularity of the chassis.

In a close development partnership with Bosch and Vibracoustic, we have achieved excellent success within the challenge of compact design, best-in-class noise, vibration and harshness (NVH) and driving performance. As well as integrating the Bosch e-axle and steering system the new IEM also contains the driveshafts and the brake foundation (for 5-link rear suspensions, an active steering is available on demand). This leads to compact electrified chassis modules with an increased number of mechanical, electrical and functional interfaces to the vehicle body.

Besides the driving performance, one of the most important vehicle comfort criteria is the NVH behavior. BENTELER and Vibracoustic are working hand-in-hand along the development chain from component analysis up to vehicle level. In the first stage, at component and sub-system level, the behavior of the powertrain in relation to the chassis, and the chassis properties themselves were investigated, bench-tested and optimized. At this early stage, a simulation tool was already developed to compare the results tested with latest NVH simulation methods. This allows an optimized prediction of NVH properties in powertrain and chassis – especially relevant for future projects. BENTELER and Vibracoustic have jointly tested at the vehicle level and benchmarked to other electric vehicles. This test series was split into several bench tests and subjective ride evaluation.

During chassis development, NVH and driving performance always seem to be in a certain conflict. With the BENTELER IEM development, both workstreams were engineered simultaneously, with continuous alignment of the simulation and physical test results. First physical ride performance evaluation on full vehicle level has shown very good results. For further optimization and especially achievement of customer requirements, standard tuning options (e.g. optimization of elasto-kinematics) have already been considered and are waiting for application. This allows the same e-chassis-hardware to be used in several vehicle variants.

Dear all,

I often hear or read that an electrified chassis has no special challenges, just package the e-motor and it’s done! With BENTELER being a long-term chassis specialist, I strongly disagree. An e-chassis has more demanding requirements. On the NVH, on the drivability and, of course, on packaging an e-motor with up to 300KW of power. It’s sometimes more than a tight challenge. That’s why we’ve developed our integrated solutions, solving all the chassis and powertrain interfaces. By setting this up modularly, we achieve scale effects in engineering and piece costs. No starting from scratch, no reinventing the wheel.

Regards,
Marco Kollmeier

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THE RIGHT SOLUTION FOR EVERY APPLICATION:
THE NEW BENTELER INTEGRATED E-CHASSIS MODULE: FROM B TO E SEGMENT, 2 WD TO 4 WD.

Based on the Integrated E-Chassis Module (IEM) technology, BENTELER has already launched a full portfolio of e-chassis modules. This is the perfect solution for various vehicle segments with their different requirements. For the often cost-driven segments B and C, BENTELER offers an electrically driven McPherson module on the front chassis and an electrically driven twist-beam or a tieblade e-chassis on the rear. For the D/E/F segments, the IECM provides a double control arm e-chassis for the front chassis and a 5-Link e-chassis for the rear.

In addition to its performance, the IEM also perfectly meets vehicle crash requirements, thanks to its lower crash path. The e-motor bearing concept with its double insulation meets the high NVH expectations for electric vehicles. A spring suspension system with either coil springs or air springs can be installed. The bushings are designed together with our cooperation partner Vibraacoustic. The position, rigidity and damping effect are based on a detailed frequency analysis and avoid unfavorable resonance ranges.

With the new BENTELER IEM portfolio, customers can easily decide for themselves if two-wheel drive or all-wheel-drive should be implemented. All solutions achieve a high level of ride performance thanks to BENTELER’s long experience in the development of suspension systems.
EMPOWER YOUR DEVELOPMENT PROCESS - E-MOBILITY PROTOTYPES & MULES FROM A TIER 1 PROCESS SPECIALIST

Mules and prototypes are an essential step in the development process. Mule parts or mule vehicles give important information at an early stage for the engineers to validate and release their concepts. Close-to-serial prototypes show the performance of the design and give sustainable information of the needed process technologies and the manufacturing feasibility. This reduces engineering loops and saves cost and time.

As a system supplier for e-mobility, we offer the full value chain. This includes any kind of prototyping – from component up to full mule vehicle set up. Whether it’s show parts or prototypes close to serial design, BENTELER, as a manufacturing and process specialist, is a single-source supplier with the supply base of a top 50 Tier 1 player.

As you would expect, our service is global. We have prototype shops in Europe, China and in North America. So you can directly challenge our engineering in the prototype results. We deliver in time, in quality and in cost.

THE FAST TRACK – FUNCTIONAL ROLLING CHASSIS MULES IN 6 MONTHS

Yes, you understood correctly. A further advantage of our BENTELER Electric Drive System (BEDS) is that we, together with our partner network, can set up show cars or mule vehicles based on the existing BEDS rolling chassis in 6 months and with a fixed price. This is possible because BEDS is a ready-for-series application platform. And we have done it several times in Europe and in China. We call it simply “BEDS Fast Track”. Regardless of which stage of development you are in, we have the products, the services, the applications and the people to make your e-mobility solution happen.
FROM CONCEPT AND SERIAL DESIGN TO INDUSTRIALIZATION SUPPORT: BENTELER E-MOBILITY ENGINEERING SERVICES

In e-mobility there is a strong need for engineering support. Not only because there are new non-automotive players in the market but also because the amount of real e-mobility competence is still low. To accelerate our customers businesses, BENTELER E-Mobility has extended its services. We offer full system engineering on platform development, battery pack and Integrated E-Chassis Modules without any obligation on BENTELER to do the manufacturing. All supported globally from our engineering hubs in China and Germany.

Our customers receive first class engineering from a manufacturing supplier that knows how to engineer components and systems on a value-based design and with best production feasibility. Because BENTELER is a process specialist with long-term industrialization competence. We know which design is best for robust and efficient industrialization. For the customer, it means the flexibility to operate and source freely or nominate BENTELER to do it for them.

THE FEASIBILITY STUDY - A VERY EFFICIENT TOOL IN THE DEVELOPMENT PROCESS

The e-mobility momentum is strongly driven by new OEMs and start-ups defining mobility new. But because they are not so familiar with automotive processes, the specifications of the vehicle concept are often fragmentary.

As a first inexpensive step, we offer our customers a 2 to 3-month feasibility study, where we work out the target book of the vehicle together. This includes, for example, a technical overview with a visual BOM, a packaging study with first hard points and the performance data of the vehicle, and much more. After the feasibility study, the customer has a clear picture of how to implement the vehicle strategy. And of course, with BENTELER there to support the next step.

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BENTELER ELECTRIC DRIVE SYSTEM.
ONE PLATFORM FITS ALL: SEDAN, COUPE AND SUV

The performance of a platform isn't just measured by its flexibility with regard to scaling and modularity. Its feasibility for enabling vehicle types and different body integrations is also a factor.

The BENTELER platform, with its scalable and modular chassis and its specified hard points is optimally designed for this requirement. The solutions for the B/C segment cover wheelbases between 2500mm to 2800mm, with the D/E Segment platform it ranges from 2850mm to 3150 mm. The trackwidth covers a range of 1550 mm ±10 mm for the B/C Segment and 1650mm ±20mm for D/E. The ground clearance can also be adjusted depending on the battery module type. With this scalability, almost all vehicle applications are possible, plus customers can achieve additional volume and scale effects with their own vehicle portfolios.

Just because they are based on a platform, however, does not mean the same handling behavior for vehicle applications. Different vehicle sizes mean different vehicle dynamics and, with additional tuning of the chassis systems via steering application, bushing and damper characteristics, every vehicle application is customized to the customers brand profile.

THE NEW BENTELER PLATFORM CONCEPT FOR PEOPLE MOVERS: FLAT FLOOR DESIGN AND READY FOR ADAS LEVEL 4 AND 5.

The requirements for people movers are completely different to passenger cars. BENTELER has developed a special platform concept for people movers that is independent of the wheelbase. The BENTELER Electric Drive System Power Modules for front and rear integrate the e-powertrain into the chassis by using in-wheel motors and a special battery pack solution. With a tubular space frame, any type of body can be designed. It allows also the use of lightweight, cost-efficient plastic bodies. The concept supports ADAS Level 4 and 5 applications. BENTELER can manufacture this mover platform globally.
ACTUAL TEST DRIVES WITH THE BENTELER ELECTRIC DRIVE SYSTEM (BEDS) CONFIRM ITS PERFORMANCE

Together with our partners, we have built a rolling chassis technology demonstrator. Its name: BENTELER Electric Drive System 2.1. It’s an impressive demonstration of how quickly and efficiently a mule can be set up on the BEDS platform. BEDS 2.1 is a turnkey ready-to-use rolling chassis, covering almost all the functions of a full vehicle. To simulate the real weight of the vehicle, additional masses were brought in, so that the tests are representative of full vehicle behavior. With all-wheel drive, 300KW of power and a driving range of more than 400km it’s great fun to drive.

All components and systems are developed with a focus on a clear performance target book and industrialization feasibility. BENTELER, Bosch and Vibracoustic used BEDS 2.1 to optimize the interfaces while jointly work on the system integration of the platform. All functional systems were tested, e.g. brakes, steering, battery pack and especially the vehicle dynamics from the Integrated E-Chassis Modules (IEM). The robustness of the platform was also analyzed by installing strain gauges and measuring the dynamic loads of the chassis. The results confirm the engineering data from the virtual development, an important step in the maturity level of the BEDS Rolling Chassis and the platform.

This pre-validation is one of the benefits of the BEDS platform. Every customer can carry over this results for their own vehicle development when using the platform. This saves costs and shorten the development time.

Dear All,

System integration is more than the sum of the parts. The challenge is dealing with different systems from different suppliers rather than your own familiar components and systems.

System integration means changes in components or software that would not have happened with in-house development. This makes cooperation very valuable. And while that means dealing with different company cultures, processes and people.

Together with Bosch and Vibracoustic we bring a strong shared engineering culture, it's like working with friends. You can see and feel it in BEDS 2.1.

Regards
Marco Kollmeier

For further background about our e-mobility solutions please visit our website: www.benteler-automotive.com/e-mobility

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