



From zero to future.
Perfectly safe.

Test it. Heat it. Cool it.



Innovation at full speed.

With weissttechnik you can really accelerate.

The automotive industry is facing major challenges. It needs innovative concepts to deliver lower consumptions and reduced emissions with enhanced and performance, higher safety and more entertainment. At the same time, it wants to push ahead with the development of self-driving vehicles. Whoever is to succeed in these tasks must be developing tomorrow's automotive trends now.

Connectivity - the car of the future is digital

Industry 4.0 hits the road. The car of the future will be digital. Internet, entertainment electronics and data services open up a new dimension of driving.

Composites - the car of the future will be lighter

To deliver higher performance with reduced fuel consumption and lower emissions, the weight of cars must be reduced. The key to this is fibre-reinforced plastics, including carbon fibre composites such as have been used up to now exclusively in racing cars.

Alternative drives - the car of the future will be cleaner

To achieve the ambitious climate targets and ensure that cars can enter inner cities with environmental zones, alternative drive concepts are needed. These include battery-powered electric motors, hybrid systems, fuel cells and alternative fuels such as hydrogen.

To reliably fulfil the increased requirements on cars, their equipment and functions, car manufacturers and their suppliers must tread new ground, for example by reorganising their development and production processes. We support you in this with proven standard solutions and individually developed test systems.





Weiss Technik companies are amongst the most innovative and significant developers and manufacturers of systems in the field of environmental simulation, temperature processes and air conditioning. Specially for the automotive industry, we have developed solutions that meet the highest demands. These are in use around the world with renowned automotive manufacturers and their suppliers.

Test it. Environmental Simulation

As one of the pioneers of testing and environmental simulation, we offer customised test systems for your industry for the simulation of airflows, extreme heights and drastic temperature changes. These can be combined with our standard range of systems for weathering and corrosion tests under all climate conditions, anywhere in the world.

Heat it. Industrial Heating Technology

Our subsidiary Vötsch Industrietechnik complements our product range in the area of heat treatment systems and technology. We develop, plan and produce reliable heating systems of the highest quality. This helps us realise tailor-made solutions for you, e.g. for curing and shaping of composite materials - a future-oriented approach in the field of automotive engineering.

Cool it. Climate Control Technology

Complex manufacturing processes and operating conditions require the best possible climatic conditions. In addition to clean rooms and containment systems to protect people, products and the environment, we also offer air conditioning systems for optimal temperature control of IT equipment. As one of the leading providers of climate control technology, our experts will guide you from the planning to the implementation of your projects.



Taking every curve with ease.

With **weisstechnik** you get there easier, cleaner and safer.

We love extremes, repeatable results, energy-efficient processes and excellent service, which is why we offer you exactly that. As a partner of the automotive industry for many years, we know about the challenges of increasing requirements, shortened development times and ever more demanding customers.

Special Installations

We give everything for our customers. In addition to single units, we supply system solutions - from engine test chambers to wind tunnels. Benefit from our competencies.

Industrial Heating Technology

We can supply you with modern production ovens for curing of composite materials, moulded resins and adhesive connections, for annealing, solution and heat treatment of metal parts or for cross-linking of elastomers.

Solutions

Production

Equipment

Testing

Climate Control Technology

At the micrometric scale, a grain of dust is too large. We therefore develop clean-room technology for various requirements, special systems for measuring rooms, containment systems and server cooling.

Environmental Simulation

The best materials and processes right from the start and audit-compliant in production. With our test chambers, you ensure that single parts as well as the complete system work reliably.





Some like it hot.

Fire up your processes - with vötschtechnik.

Maximum precision, reproducible processes and reliable documentation are important factors for success in the automotive industry. In many manufacturing stages, heat processes play a central role. We supply a wide range of CQI-9-compliant temperature-controlled production systems for car manufacturers and their suppliers.

Renowned car manufacturers and leading suppliers use our systems for heat-setting of plastic pipes, vulcanisation of elastomers, solution for annealing of light metals or curing of fibre composites and adhesive compounds.

Benefit from clear advantages

- Short process times thanks to rapid heating and cooling
- High-quality products due to even temperature distribution in the work area
- Reproducibility through the use of uniformly high-quality components
- 100-% traceability based on a networked control
- Installations optimally matched with the production processes by the development of customer-specific solutions

How does a material or combination of materials behave under the influence of temperature? What effects can thermal ageing processes have on a component? These questions are decisive in the development of lightweight construction concepts. The Fraunhofer LBF uses a **vötsch**technik oven combined with optical measuring technology so that it can reproducibly simulate complex processes. To determine reliable values, a uniform temperature distribution - one of our core competencies - is essential.

The future of driving is plastics.

Profit from the advantages of a true multi-talent.

Plastics are light, flexible, versatile and usually cheap to produce. Their importance in the automotive industry is therefore continually increasing. To make optimum use of the advantages of different plastics, it is important to match the production precisely with the particular material.

Manufacturing ovens with optimised design

For optimum realisation of desired plastics properties and to exclude undesirable side-effects such as odours, deformation or the fire risk posed by exothermic reactions, the design of the manufacturing ovens must be optimised.

This applies to the cross-linking of sealants following injection moulding as well as to the heat-setting of plastic hoses. We offer our customers a wide range of special high-temperature systems from simple chamber ovens to complex, automated in-line production systems.



Special solutions for the automotive industry

- Powerful extraction for effective removal of process vapours and therefore significantly reduced condensation
- Optimised sealing of equipment and reduced pressure in the work area to prevent the escape of vapours and the imposition of odours on workers
- Continuous monitoring and documentation of temperature distribution and interior pressure for maximum process reliability
- Easily removable air ducts for ease of cleaning and low maintenance costs
- Feed mechanism matched with the product for maximum productivity

4-Zone Continuous Oven with cold water cooling zone

When heat-setting plastic hoses, they are brought to the correct shape when cold and then subjected to defined heating and cooling. Defined airflows ensure optimum flow over the product and a highly uniform temperature. This ensures good quality of the resulting product.

4-Zone Continuous Oven with cold water cooling zone VDU 80/80/1000-200 °C*

- Nominal temperature: 200 °C
- Heating power: 132 kW



Hot rods for perfect quality.

The optimum way to produce and encapsulate electronic assemblies.



Continuous Oven with cooling zone

The production of pressure controllers for motor vehicle engines and other electrical components in quantity requires the use of continuous ovens. Using various forms of heating, these ensure rapid heating and short processing times with optimum heat transfer in independently regulated heating zones. The flexibly configurable conveyor system simplifies handling and the integral cooling zone allows direct post-processing.

Continuous Oven with cooling zone VDU 120/20/240-200 °C*

- Nominal temperature: 200 °C
- Heating power: 40 kW



Continuous Oven

Important vehicle components such as ABS and airbag systems or engine management must be protected from environmental influences. To achieve this, the housing of the electrical module is sealed. For curing moulded resins and seals, optimum heat transfer and rapid cooling in an integral cooling zone are decisive for quality.

Continuous Oven VDU 100/150-150 °C*

- Nominal temperature: 150 °C
- Heating power: 27 kW



Hot-Air Oven with vertical silo (lifting cage)

Heat treatment systems with vertical silos such as pater-noster systems and lifting cages permit continuous production at minimum space. Thanks to optical position detection, individual incorporation in the production line is possible with high process reliability. This approach is used, for example, for the heat treatment of piezo-electric actuators for injection systems.

Hot-Air Oven with vertical silo (lifting cage) VTU 75/200/75-160 °C*

- Nominal temperature: 160 °C
- Heating power: 18 kW



Vacuum Drier

Vacuum driers are used for the heat treatment of anodes and cathodes in the manufacturing of lithium-ion accumulators for electric cars. The low residual oxygen content inhibits oxidation processes in the product. The use of steam or hot water from other processing steps enables especially economical heating.

Vacuum Drier VHT 85/85 E*

- Nominal temperature: +200 °C
- Heating method: electric

From gearwheels to bodywork.

Perfect temperature conditions for each of your components with **vötschtechnik**.

Throughflow System with cooling zone

The drying and annealing of bulk materials, e.g. sintered metal, requires a high throughput and rapid cooling of the components to enable immediate processing of the material in the next production stage. At the same time, this must only take up a small production area. The freely programmable logic controller (PLC) permits optimum integration in the process control system.

Throughflow System with cooling zone VDU 100/10/650-350°C*

- Nominal temperature: zone 1 and 2: T = 200 °C, zone 3 and 4: T = 350 °C
- Heating power: 100 kW



CQI-9-
COMPLIANT

Annealing Oven

Even large components, such as engine bonnets or the complete bodywork, can be treated at high temperatures. Here, the uniformity of temperature and the comprehensive process documentation play an increasingly important role. In the work area, the chambers which can accommodate forklift trucks achieve a uniform temperature of ± 2 K.

Annealing Oven VAW 60/100-650 °C*

- Nominal temperature: 650 °C
- Heating power: 20 kW



Infra-Red Oven

Infra-red is the component of sunlight which we sense primarily as heat. The infra-red method provides "quick heat" which transfers energy without direct contact or a transfer medium (e.g. air or water) in the form of electromagnetic radiation at speed of light. The main advantages are rapid heating and transfer of high heat energy. The correct choice of the IR radiator ensures optimum heating and production results. To determine the required characteristic values, infra-red testing can be carried out on our premises. An application example is paint drying on complete shells. The uniform quality of the protective top coat achieved, makes an important contribution to the durability of the vehicle. The combination of infra-red with, for example, convective heating permits optimum curing of carbon fibre composites and thus contributes to the reduction of weight and fuel consumption.



Dimensionally stable, lightweight components for energy-efficient cars.

At the Fraunhofer Institute (IWU), new materials become comprehensible.

Hybrid structures in various materials are used for lightweight design concepts in vehicle construction. Differences in their thermal expansion coefficients can present a risk. To minimise this risk, we have developed an analysis oven which validates the models for simulating paint drying.

The bodywork plays one of the most important roles in the development of a new vehicle. Lightweight design concepts such as mixed constructions reduce the overall weight. The challenge here is to keep control of tolerances such as the accuracy of individual parts, the clamping, spot welding, folding and the drying of parts with cathodic dip coating

(CDC drying). Variations in functional dimensions are visible and reduce the quality. In mixed constructions with aluminium, deviations from tolerance due to differences in thermal expansion can occur during thermal processes. This influences the quality of seals, closing forces and wind noise. A numerical prediction of the dimensional stability



for early product assurance is therefore needed before the genuine parts and equipment become available in order to keep quality and costs within the planned range.

The Fraunhofer Institute for Machine Tools and Forming Technology (Fraunhofer IWU) in Dresden works on the prediction of assembly geometry as a function of the relevant process parameters. The focus here is currently on the development of methods for identifying parameters for the substitute models and representation of the dimensional changes resulting from the thermal expansion of components. Particular attention is required to the fixing of this state through the curing of adhesives in the paint drying process. To simulate the paint drying processes and validate the models experimentally, Vötsch Industrietechnik has developed an analysis oven to permit precise control of the temperature of the components and their optical measurement during this process.

Two constraints were imposed on the oven as an experimental platform for the CDC drying process step. The temperature distribution must be uniform and the component deformation and movements must be recorded using optical measuring techniques. For this, the oven has a large window to permit precise optical measurement of the reference marks on the components, which can be covered for maximum energy efficiency. The temperature of 220 °C corresponds to CDC drying conditions.

The temperature uniformity within the oven is ± 2 K, i.e. in the best possible technical range. As soon as the oven is heated up, the heating power is reduced to one third during heating phase. Optimum temperature distribution is achieved by high air circulation and additionally supported by a special door construction. Air circulation is created by three blowers, enabling defined ramping up and down of the temperature with the help of an extractor fan and the program control. The known temperature profiles of CDC continuous ovens in bodywork construction can be optimally reproduced.

Aided by rails in the floor and a loading trolley, the workpieces can be aligned, marked at the required reference points and positioned in the oven. To obtain precise measured values, the window is made of borosilicate glass with a low refractive index and a low coefficient of expansion. To provide good illumination under all circumstances, four temperature-resistant, individually switched and dimmable halogen spotlights are fitted in the working area of the oven.

A cascade control system permits precise control of the temperature on the workpiece, measured by up to six sensors attached to it. A special function of the SIMPAC® control system permits control via the hottest sensor.

Via an Ethernet interface, the oven can be connected to a supervisory computer system to make the captured data such as the temperature curve directly available in SIMPATI®.

The measurement method during temperature control consists of an in-line 3D geometric measurement (GOM PONTOS). Global component deformations and local expansion in the area of the joint due to differences in thermal expansion are analysed. The substitute model for the oven process is verified by comparison of the deformations measured in the experiment with the predicted geometric deviations.

Thus, with this complex test system, the high-temperature behaviour of the various materials used in mixed constructions can be analysed. Precise measurement of the parts during the test procedure enables detection of possible expansions. Different materials can thus be tested and analysed before the parts are mass-produced.





Simply shift up a gear.

Accelerate your products to market readiness with weisstechnik.

Whether sun, rain or snow, de-icing salt or a sea breeze, stopped or at full throttle, it's all the same: before a vehicle goes on the road, it must be ensured that built-in materials and components will work and remain intact long-range under all conditions. After testing in our systems, your development is weatherproof.

Tropics, arctic zone, deserts

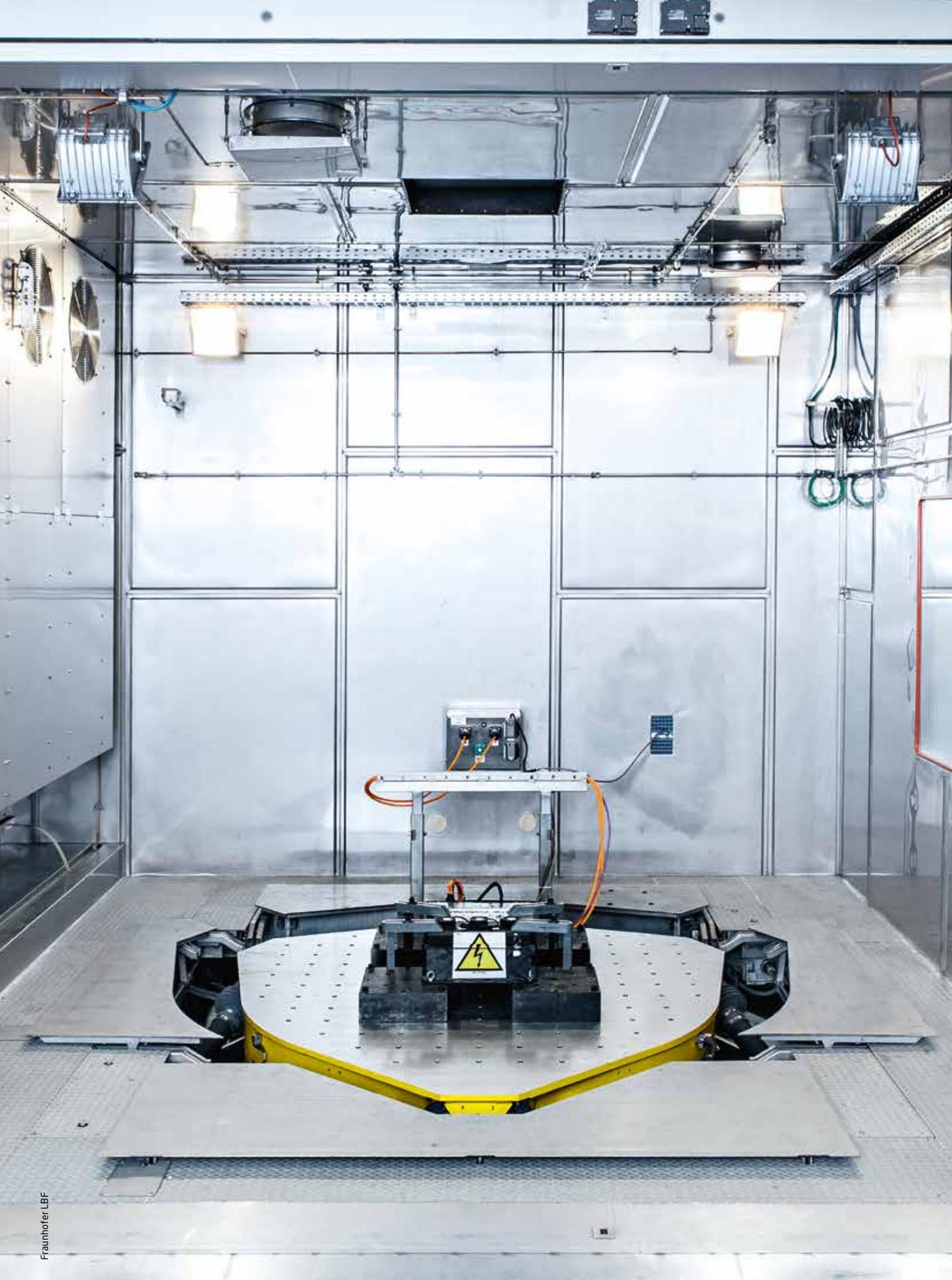
We are specialists in standard test chambers and large, customer-specific installations and test harder than nature. Our testing technology permits comprehensive simulation and trial of the widest range of climate conditions around the world in time lapse. The high precision of the test systems ensures very high reproducibility of the results.

Securing a competitive advantage

If the weak points in a product can be detected in the development phase, they can be corrected at an early stage. Our testing technology therefore helps to shorten development times, reduce development costs and improve product quality. The result is high-performance components with longer service life and maximum safety.

As specialists in standard test chambers and large, customer-specific installations, we want you to always be one gear ahead of your competitors.

weisstechnik: For your success, we test harder than nature.



E-mobility on the safe side.

Test your batteries and fuel cells - explosion proof.

Alternative drives are a central part of the automotive future and make environmental sense, especially in combination with regeneratively generated power. On the one hand, this enables demands for driveability and comfort to be met, on the other hand, the requirements of environmental zones in city centres can be complied with and environmental impacts can be sustainably reduced.

Meeting increasingly stringent requirements

In comparison with other mobile storage systems, lithium-ion batteries and fuel cell technology have prevailed. The need for ever greater ranges and applications as well as links to solar installations demand storage technologies that are highly loadable and safe.

Test mobile storage systems safely

To test their reliability, lithium-ion batteries undergo various tests in temperature cycling or climate test chambers. During temperature tests, the batteries may malfunction, be overloaded or even destroyed. With increasing battery size, the effects and hazards of such failures rise. This makes safety and the protection of personnel in the laboratory particularly important for such tests. Our test chambers for lithium-ion batteries have safety devices which comply with the EUCAR Hazard Levels and provide optimum test safety.

High performance at the Fraunhofer LBF

The high-performance chamber with a multi-axis vibration table at the Fraunhofer Institute for Structural Durability and System Reliability (LBF) has a volume of 56 m³ and a load capacity of up to one ton. It permits temperature fluctuations of between -40 °C and +80 °C with a gradient of 4 K/min.

Keeping track of emissions.

With weisstechnik systems, you can test safely and with repeatable results.

Emission and Performance Test Chamber

Our highly complex test chambers simulate the widest range of environmental conditions under which emission and performance tests are carried out. The combined temperature and climate test chambers are so equipped that they can reproducibly simulate real driving conditions.

Versatile simulation possibilities

Our installations are fully equipped with an integral roller test rig, airstream and sunlight simulation, combustion air and CVS dilution air conditioning systems, exhaust extraction, simulation of hot road surfaces and tank temperature control system. They permit the performance and certification of driving cycles according to EPA, SFTP (US06, SC03), FTP-75, UDDS, NYCC, ECE 15, EUDC, Cold CO, cold start and defrost, as well as numerous, non-standardised development tests.

To significantly reduce vehicle testing cycle times, an optional cool box for vehicle conditioning (soak room) can be installed, in which the test vehicles can be brought to the correct temperature before insertion into the test chamber.





Incidentally - we also have fuel temperature control systems suitable for AdBlue®!

SHED Test Chamber

weisstechnik SHED (Sealed Housing for Evaporative Determination) test chambers are equipped with the necessary analysis technology and test bench software for carrying out trials and documenting the results. These are standard for the measurement of fuel evaporation and are needed by vehicle manufacturers to demonstrate with the prescribed evidence procedures prior to approval that the limit values (EU, EPA, CARB, NSCN) permitted by the legislation are met. Our range extends from the Mini-SHED to the VT/VV-SHED.

SHED Test Chamber WT 12'/+15-45 SHED*

- Temperature range: +15 °C to +45 °C, with volume compensation
- Test volume: 12 m³



Emissions Test Cabinet

Emissions of volatile organic compounds (VOC) are always present in car interiors and can cause illness. They therefore present a continuous health hazard for the occupants. In new cars or those less than one year old, emissions often lie between 800 and 4000 g/h and increase under certain conditions, for example, if it is unduly hot. Different concentrations are a challenge to test methods, since results may vary depending on external ambient conditions. With our VOC test chamber, you can meet the requirements of DIN EN ISO 16000-9.

Emissions Test Cabinet 1 m³ E-WK-I 1000*

- Temperature range: +20 °C to +30 °C
- Relative humidity range: 40% to 60% RH





Running smoothly.

weisstechnik supplies test benches for engines, gearboxes and drive train components.

With the integration of Automotive System Solutions in the Weiss Umwelttechnik portfolio, we have extended our range of turnkey engine test benches. As a general contractor, we devise individual installations for stationary dynamic and highly dynamic testing.

Versatile product range

Our products include modular container solutions and test benches of conventional construction for research and development, production and end-of-line tests, including media supply, control, automation and measurement techniques. The range extends from autonomous, individual test benches to complete test rooms.

We take account of extreme environmental requirements, the integration of safety devices and the implementation of a high level of automation in order to achieve efficient and reproducible test results.

In addition to standard test rigs, we supply a wide variety of test installations:

- Gearbox test benches
- Drive train test benches
- Swivelling test benches
- Exhaust supercharger test benches
- Injector test benches

weisstechnik engine test benches are used throughout the world. Amongst other things, they are used for testing tools, such as motor saws, automotive, railway and marine drives and engines for industrial, generator and military applications. Our largest system is for engines and generator sets and tests drives of up to 10000 kW.

With flexible and customised solutions, we optimise installations for:

- High measurement precision
- High reproducibility of the measured results
- Short test times

Flexible test capacity thanks to mobile container solutions.

Conditioning in research allows knowing the variables in practice.

Our conditioning systems ensure you optimum test conditions.



Temperature Control Unit for external rooms

The compact temperature control unit supplies specimen under test with conditioned air, defined humidity and temperature. It is frequently used to supply incident air to vehicle brakes, for example, to simulate the airstream to the brake in acoustic tests. Furthermore, it can also be used for air-conditioning an isolated area.

The temperature control unit is supplied as a compact unit, consisting of base frame, air treatment unit, humidifier unit, cooling and switching system.

Temperature Control Unit for external spaces*

- Temperature range: -20 °C to +60 °C max.
- Relative humidity range: 10% to 90% RH at +5 °C to +50 °C, $x = 5$ to 25 g/kg
- Fresh air volume flow: 0 to 6000 m³/h, 0 to 25 m/sec
- Exhaust air volume flow: 500 to 6500 m³/h
- Circulating air volume flow: 4500 m³/h, constant



Test Benches for Engine Cooling

weisstechnik test rigs permit high-precision simulation of the entire field of air and liquids, with absolute reproducibility and integration of all relevant supply modules for charging air, engine and gearbox oil and coolant. The test benches are suitable for calorimetric and functional testing as well as thermal stability and endurance tests.

Test Benches for Engine Cooling*

- Airstream control range: 1200 to 40000 m³/h, ± 0.5 K
- Air temperature control range: +20 °C to +90 °C, ± 0.3 K
- Maximum IUT pressure drop: 2000 Pa
- Cooling performance: up to 250 kW

Combustion Air Conditioning Systems

Our mobile and compact combustion air conditioning system is used for the research and development of internal combustion engines. They enable standardised conditions of intake air and the implementation of special states for intake air on engine test benches.

The following parameters are taken into account:

- Intake pressure
- Intake temperature
- Relative humidity of intake air

Combustion Air Conditioning Systems*

- Air mass flow: 0 to 1000, 1500, 2000, 2500, 3000, 4000 kg/h
- Temperature range: +15 °C to +35 °C, ± 1 K
- Pressure range: 900 to 1100 mbar, ± 1 mbar
- Relative humidity range: 15% to 75% RH, tolerance 3% RH



Test Benches for Vehicle Air Conditioning

To achieve an optimum picture of the vehicle architecture, we supply integral or modular conditioning units based on both the usual and alternative refrigerants. These are suitable for carrying out system performance and endurance tests as well as calorimetric and functional tests. The test benches are characterised by their high availability and are ideally complemented by our sophisticated software and functional HMI.

Test Benches for Vehicle Air Conditioning*

- Air conditioning temperature range: +10 °C to +60 °C
- Dew point temperature range: -30 °C to +45 °C
- Air humidity range: max. 95% RH
- Circulating volume flow: max. 4000 m³/h
- Air measurement range: 0.5 to 25 kg/min



Lasts on and on and on.

weisstechnik, so that your light materials withstand heavy conditions.

Corrosion Test Chamber

Rain in summer, road salt in winter, salty air or seawater: everywhere and in all seasons, vehicles are subjected to corrosive conditions. Corrosion does not just affect base metals but also highly-alloyed, tempered materials, plastics and painted surfaces. In view of growing customer demand for durability and warranties, corrosion protection is gaining importance as a purchase decision and quality criterion. For vehicle manufacturers, continuous checking and optimisation of protection measures is highly important for quality assurance and the achievement of competitive advantages.

We have a comprehensive range of equipment for carrying out corrosion tests. With our corrosion test units, tests can be carried out according to customer-specific requirements as well as in accordance with the generally applicable standards. Identify the stress limits of your vehicle.

Corrosion Alternating Test Chamber SC/KWT 1000*

- Test space volume: 1028 l
- Temperature range salt spray test: 5 K above ambient temperature up to +50 °C
- Temperature range condensation test: 5 K above ambient temperature up to +42 °C



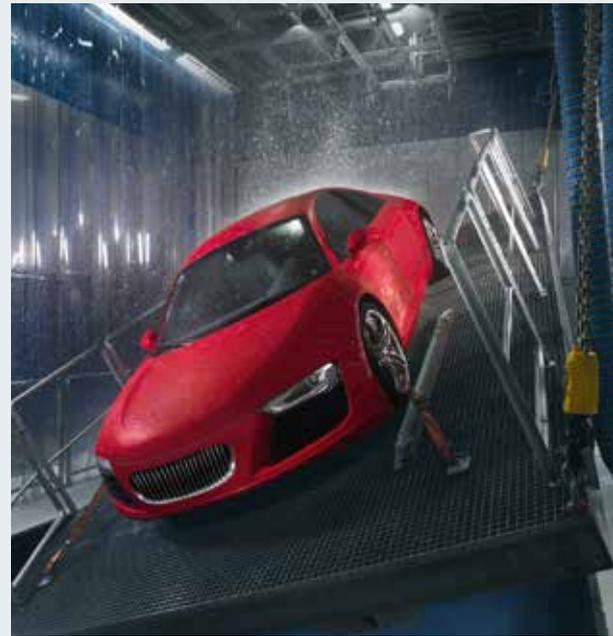
Rain Chamber/Sealing Test System

weisstechnik rain chambers are used in development, for quality assurance and in end-of-line operations. They test complete vehicles for sealing under reproducible conditions, from drizzle to heavy rain.

The sealing test can be carried out with the vehicle at various angles and under different types of rain. Sealing test systems are often used in production as a 100 % test and are similar to conventional car washes. After passing through, the vehicle is checked for leakage by visual inspection and the use of sensors and other test devices.

Rain Chamber/Sealing Test System*

- Interior dimensions of test space (L x W x H in cm): 700 x 725 x 500
- Rain input height above ground: 23 m²
- Rain intensity: up to 3000 l/h
- Drop size: <0.5 to 5 mm



Sunlight Simulation Cabinet

Sunlight is not just stressful for human skin. We have therefore developed special test cabinets that simulate the effect of sunlight on the ageing processes in an extensive range of materials. For this, further climate influences such as temperature and humidity variations are used for the accelerated induction of typical ageing phenomena. On the one hand, the ageing phenomena affect visual aspects, such as loss of gloss, changes in colour, cracking and brittleness. On the other hand, they adversely affect the technical durability of materials and must therefore be minimised.

Sunlight Simulation Cabinet SunEvent 600*

- Temperature range: -20 °C to +100 °C with irradiation
-30 °C to +100 °C without irradiation
- Relative humidity range: 10% to 80% RH with irradiation
10% to 90% RH without irradiation
- Test space volume: 600 l



Always optimally connected.

Check the connectivity of your car through its paces.

Climate Test Cabinet with integrated measuring robotics

The WK BM 1000 is the first cabinet to make a complete solution available, consisting of measuring robots and a climate cabinet. This is ideal for the function-dependent testing of digital equipment such as on-board computers and entertainment systems under extreme climate conditions and rapid temperature changes in trials and in production. It can thereby be ensured that, for example, the touch panel of the on-board computer works correctly under all environmental conditions.

Climate Test Cabinet with integrated measuring robotics WK BM 1000

- Temperature range: -40 °C to +85 °C
- Relative humidity: 5 % to 95 % RH
- Heating and cooling rates according to IEC 60068-3-5: approx. 5 K/min
- Test space volume: 1000 l



Always safe on the road.

Test your components absolutely reliably.



Headlight Test Bench

Our headlight test rig combines climate and temperature testing. For this, a wind blower unit, a rain unit and a reduced-pressure unit can be connected. In addition, the system can be expanded with a sunlight simulator to form a total package which tests all requirements.

Headlight Test Bench*

- Installation consisting of 2 climate test cabinets
- Test space volume: 600 l
- Standard equipment: wind and rain unit
- Additional equipment (e.g. sunlight simulation, reduced-pressure unit, temperature control of the rain water etc.) is possible



Airbag Test System

Our temperature chamber for pre-regulating the temperature of airbag modules combines a temperature setting chamber with an automatic travelling system for airbag modules on a rail system with a drive unit. It has an automatic, quick-opening and closing lifting door and an electrical control cabinet. The airbag is fired and filmed with high-speed cameras from in front of the chamber. This permits free positioning of the camera and filming from all angles.

Airbag Test System*

- Temperature range: -40 °C to +120 °C
- Temperature change: 1.5 K/min
- Test chamber interior dimensions (H x W x D in cm): 200 x 240 x 400
- Door opening (H x W in cm): 200 x 180

Operating load simulation on the basis of real driving data.

Test bench for the multiple physical laboratory testing of high-voltage energy storage systems at the Fraunhofer LBF.

The continuing increase in the complexity of technical systems of current and future generations places high demands on the testing of function, service life and reliability. In particular for HV battery systems for electric vehicles, test benches must uncompromisingly meet these demands. The Fraunhofer LBF meets these expectations with its unique test environment.

Initial situation

The system reliability describes the operational reliability, availability and serviceability of a totality of interdependent technical elements. Examples are energy storage devices and the drive train of electric and hybrid vehicles. With a battery as the largest single mass in the vehicle,

there are significant implications regarding overall and local resonances and waveforms as well as load and energy contributions. Not only that, the battery system itself - a component made up of a large number of cells and modules with its own supporting structure - is subject to complex,



multiple physical stresses which are characterised by mechanical, electrical and thermal values. In general, system reliability can be determined experimentally, analytically or with the aid of simulation, in which case it must be considered as obligatory that coupled stresses of an electrical, mechanical and thermal nature are taken into account.

The solution

Since 2013, the Fraunhofer LBF has used a specially equipped research fleet of electric and hybrid vehicles to investigate these stresses in order to present them in a suitable form for laboratory-supported operating stress simulation and use them in a corresponding test installation for testing battery systems. For this purpose, the relevant operating conditions are described primarily with regard to mechanical and electrical stresses, and the deduction of corresponding driving cycles for electric traction. The stress-time sequences measured during operation then form the basis for the operating stress simulation in a laboratory test environment which is available at the Fraunhofer LBF in Darmstadt and in which the central component is a multi-axis, parallel kinematic vibration table (MAVT) which, for test samples with a mass of 250 kg, can be driven at test frequencies up to 200 Hz up to more than 100 m/sec^2 (approx. 10 g). With dimensions of 2.2 m x 1.9 m for a maximum load of 1000 kg, the MAVT was installed in a 60-m³ climate chamber (floor area 16 m²) manufactured by Weiss Umwelttechnik. Temperature changes between -40 °C and +80 °C can be implemented with a rate of temperature change of 4 K/min. In addition to the possibility of complete nitrogen inertion and control of the humidity between 10% and 90%, the high-power climate system (250 kW) has safety devices for pressure relief, a sensor-controlled gas warning system and a water mist extinguisher system.

The **weisstechnik** high-power battery test bench consisting of MAVT and climate chamber is unique in its construction and equipment. The MAVT can perform translation and rotary movements about the three spatial axes, so that acceleration, movement in any direction and vibration can be simulated. The side walls of the chamber consist of an elastic material, so that the mechanical stress on the test sample from the motion of the MAVT is not transferred to the climate control components. With this test system, fully reproducible tests combining motion, vibration and various climate influences can be carried out under realistic conditions. The conditions are therefore optimally adapted to the requirements of the automotive sector.

The combination of MAVT and climate chamber is complemented by a high-performance battery tester with a voltage range of 8 to 800 V with currents of up to 600 A, bi-directional. In addition to the functional link of the battery system cooling, IT integration of the battery management system into the remaining vehicle bus simulation can be implemented. Full automation of the test procedures via hardware in the loop (HIL) and coupling of the system tests with digital models of the whole vehicle can be carried out for various drive concepts and with different operating strategies. Where a customer has developed and produced its own, oversized incorporation design for battery systems, by iteration of the predicted stress-time sequences, it can be ensured that the signals and excitations desired by the customer are reliably transferred to the product.

Utility and experience

Christian Debes: "The Fraunhofer Institute for Structural Durability and System Reliability (LBF) positions and establishes itself as a provider of comprehensive battery system testing. The targeted application of our system know-how will permit decisive cost savings in the material, development and production processes of traction batteries. Attractive test methods for reliability and service life considerations and their evaluation and the deduction of optimisation recommendations are of decisive added value for project partners from industry and research."



Individually planned. Competently implemented.

**weisstechnik - your expert for decades
in climate controlling.**

Optimum feel-good climate for your applications

Decisive factors for sophisticated development, production and test processes are conditions such as purity, temperature, humidity and pressure and their permitted variation tolerances.

The use of process climate control makes it possible to set the required narrow limits and control these precisely in both space and time.

In addition, in various processes, people, the environment and the product itself must be protected from contamination. These core areas require significantly more complex control than other process stages.

Standard products and individual solutions

With its wide-ranging product portfolio, Weiss Klimatechnik supplies systems for every application, from complete clean rooms to process conditioning systems, including measuring rooms, from process climate control and individual workbenches to special air conditioning systems for computer centres. Our strong point is customer-specific solutions.

Compact, universal and reliable

From precision air conditioning units to mini-environments, our components and systems stand out for their compact design combined with innovative technology. We provide you with comprehensive support right from the start - from planning to acceptance measurements and instruction of your employees. Through our service network, we ensure constant availability of our systems and installations.



Safety knows no compromise.

Reliably protect your workers, your products and the environment.



WIBOjekt® Cleaning Workstation

In the automotive industry, components are frequently cleaned using solutions and chemicals that can present a risk to both workers and the surroundings. This is where the WIBOjekt® Safety Workstation with its WIBOjekt® Airflow System comes into play. Specially shaped air outlets create a veil of clean air that safely encloses dangerous pollutants such as gases or airborne dust particles. This enables the work to be carried out with unimpeded access. Equipped with explosion protection, the WIBOjekt® Workstation offers additional safety when dealing with highly flammable substances.

WIBOjekt® Cleaning Workstation TCRE 200/98*

- Customer-specific design
- Robust retention capability
- Explosion protection compliant with ATEX directive 94/9/EC



WIBOjekt® Economy Safety Extractor for QA laboratories

Quality assurance in the automotive industry means continuous checks in production, from incoming goods to material testing. The WIBOjekt® Economy Safety Extractor is used, for example, for investigating fire-tested components in the quality assurance laboratory. With the patented WIBOjekt® Airflow Technology, a stable veil of clean air is set up which guarantees safe protection of persons and the surroundings. In addition to innovative standard laboratory workstations, we supply customer-specific solutions which meet all legal regulations, requirements and standards.

WIBOjekt® Economy Safety Extractor for QA laboratories EL12F2*

- Personal protection tested in accordance with DIN EN 14175-3
- Large interior space permits ergonomic work
- Low air quantities through efficient airflow system



Safety Workbench for research laboratories

Handling toxic substances in automotive research laboratories requires special safety workstations such as our class II microbiological safety workbench. The BDK-SB range is type-tested by the TÜV, is GS marked and reliably prevents the escape of toxic aerosols from the work area and the ingress of airborne bacteria from outside the work area. The dual filter safety workbenches provide a high level of protection for products and personnel and prevent cross-contamination in accordance with DIN EN 12469.

Safety Workbench for research laboratories BDK-SB, class II*

- HEPA filter, filter class H14
- Digital air velocity indication
- Monitoring of extracted and circulated air



Laminar Flow Workbench for product protection

For the assembly of sensitive components such as injection pumps, a clean and dust-free environment is vitally important. For optimum product protection, special clean-air workstations are required. The BDKlaminar flow workbenches work with low turbulence displacement flow and meet the requirements of air cleanliness class 5 in the work area according to DIN EN ISO 14644-1. In addition, BDK laminar flow modules are also used in automotive production. The clean-air hoods and superstructures for conveyors and production lines provide the necessary product protection during production.

Laminar Flow Workbench for product protection BDK KVF*

- Product protection in accordance with DIN EN ISO 14644-1
- HEPA-filtered air
- Customer-specific design

Cleanliness and quality are measurable.

Secure your products with a controlled process environment.



Clean Room

Clean rooms are indispensable for high-precision assembly and manufacturing stages. Coatings for headlights, foil coating of vehicle interiors etc. are carried out under the conditions of clean-room classifications according to VDI 2083 or DIN EN ISO 14644. Sensors and micro-electronic components which are incorporated in the electronics of a motor vehicle are developed and manufactured under the strictest clean-room conditions.

Measuring Room

Measuring rooms are central components for quality assurance during production. The golden rule: the greater the measurement certainty, the smaller the reject rate. This is particularly important for the close manufacturing tolerances of sensitive components such as engine and gearbox components.

Ambient conditions, especially temperature, have a significant influence on the measuring uncertainty. Weiss Klimatechnik plans and produces individually tailored measuring rooms in accordance with the requirements of VDI/VDE 2627.

Measuring Room*

- Area: 112 m²
- Clear room height: 3.50 m
- Airflow: turbulent mixing flow through swirl outlets

Semi-clean Room

Semi-clean rooms are areas in manufacturing and assembly which are not subject to the requirements of DIN EN ISO 14644 as the critical particle sizes are considerably larger than the usual maximum particle sizes of the clean-room standard. The assembly of injection systems is a classic example of their use.

In such cases, evaluation of the cleanliness can be in accordance with VDA 19 or DIN EN ISO 16232. This is where the field of use of a semi-clean room begins.

- Low particle concentration
- Constant comfortable temperature and humidity
- Dehumidification as far as necessary for process conditions
- Control of particle sources from process, equipment and operators

Your flexibility for higher efficiency.

Intelligent climate control for your data centre.

IT Climate Control

An absolute innovation in the area of IT climate control: CoolW@II® turns the entire technology room into a refrigerator and makes it possible to achieve extremely high cooling performance with low energy consumption. The technology is built into the walls which saves space in the server room. Say goodbye to climate control cabinets!

IT Climate Control CoolW@II® 300.4 CW*

- Air volume: 30000 m³/h
- Cooling output: 150 kW at 10/15 °C water and 30 °C recirculation

The most important benefits of CoolW@II® at a glance:

- Most energy-efficient water-cooled climate control system for data centres
- Highly useful cooling output with a small installation area
- Modular system design with coordinated individual elements
- Can be freely adjusted to every room's infrastructure
- Maintenance-friendly walk-in system



By the way: our latest product, the innovative air conditioner deltaclima® mini DC, won second place in the Deutscher Rechenzentrumspreis 2015.



Special installations for special products.

weisstechnik - we plan and build for you.

We design individual installations and complete system fields and build them as turnkey solutions. Our customers therefore benefit from our many years of experience.

Comprehensive product range

Our range covers the whole spectrum of media supply, control, automation and measuring techniques. In addition to building and product-specific requirements, we take into account the integration of safety devices as well as the achievement of a high level of automation.

Safe test facilities

For the quality assurance of automotive components, numerous, complex tests are often necessary. We plan, deliver and install complete test facilities, from the test bench itself to the control system, including ambient air conditioning, fuel supply and exhaust extraction.

Reliable heat treatment

For cooling or heat-treating automotive components, such as thermal setting of hoses and plastic components, we supply installations and continuous ovens which can be integrated into existing manufacturing processes.

Precision measurement rooms

In order for components to fit together perfectly and operate reliably, high precision and measurement accuracy are required during manufacture. Our measuring rooms, in which control measurements can be carried out at constant temperature and under constant ambient conditions, ensure the precision of your measurements and the highest product quality.

Perfect test conditions for research and the automotive industry.

Climate chamber with roller test bench and sunlight simulation at KFE Lippstadt.

The automotive segment is one of the toughest markets with the highest quality standards worldwide. The requirements for test systems are correspondingly high. For the KFE Kompetenzzentrum Fahrzeug Elektronik (Vehicle Electronics Centre of Competence), we have built a climatically controlled roller test bench that is used by research institutions and automotive and component manufacturers.

Unique building concept

The construction of climate chambers and roller test benches often demands compromises since they must be integrated into an existing building. In the case of the roller test bench at the KFE in Lippstadt, optimal planning was possible right from the start as the building could be constructed around the test bench.

For this reason the cellar was first excavated and topped out. After that, the heavy rollers were integrated. Only then was the building completed - around the rollers. In order that the roof of the building did not have to be removed if necessary, an additional cellar shaft was constructed to permit easy replacement of the 42" rollers.



Thanks to the freedom to plan the building, the layout of all the pipes and lines for fresh air and circulated air could be optimised. This increases efficiency and ensures that the system can be easily cleaned and maintained. The collaboration is described by Wolfgang Hartmann, General Manager of the KFE, as follows: "In Weiss Umwelttechnik, we found a competent, committed and cooperative partner for the future. The company supported us with advice and practical assistance in every phase of the project and helped us to realise our ideas exactly as planned."



In addition, it permits sunlight simulation at up to 1000 W/m². On the test bench, an airstream blower creates wind with a velocity of up to 120 km/h, proportional to the simulated driving speed.

"Thanks to Weiss Umwelttechnik, vehicles drive on our rollers from the Sahara to Alaska without moving. This enables us to simulate the widest range of conditions of use and make reliable statements to our customers about their vehicles or individual components," explains Tobias Möller, Head of Marketing & Sales at KFE, regarding the performance range of the installation.

Precise test conditions with the smallest control variations

The sophisticated climate control technology permits climate conditions to be produced to the nearest degree. A decisive contribution to this is made by the proven and versatile control system. In practice, endurance and stress tests of individual components or complete assemblies take place in the chamber. It is used by both researchers and the automotive industry and delivers valid test results which take the German automotive standards into account.

The climate is made in the cellar

The heart of the climate chamber is the cellar. The fresh air drawn in is led down there and cleaned and dried in special units. It is then prepared as required and its humidity and temperature are adjusted so that exactly those conditions prevail in the climate chamber which are required for the test. Since air is continually withdrawn from the chamber by the engines of the vehicles and discharged externally as exhaust, this volume of air must be replenished in the chamber.

Versatile climate roller test bench

The 80-m² climate chamber with roller test bench and sunlight simulation meets all the requirements of the automotive industry and the scientific community. It is suitable for cars and SUVs with a wheelbase of up to 3.20 m. The climate chamber produces climate conditions from -30 °C to +50 °C with up to 80% relative humidity.

KFE: Enabling industrial research

The KFE, which opened in 2013, is an ultramodern test centre which is used by both research and industry. It was funded by the EU and the state of North-Rhine-Westphalia and has set itself the goal of shaping the future of (electric) mobility. With this research assignment, the KFE is, amongst others, closely linked with the University of Hamm-Lippstadt and works for both automotive manufacturers and their suppliers. In addition to the climate chamber with a roller test bench and sunlight simulation, the KFE facilities include a HALT/HASS laboratory and an environmental laboratory with various **weisstechnik** temperature and climate test cabinets.

Long-term stable connections in the engine compartment.

Thermosetting in the continuous oven at the NORMA Group.

Modern vehicles are equipped with numerous pipe and hose systems. A narrow engine compartment and simple assembly place high demands on the geometry and dimensional stability. In order to form the pipes and hoses into the perfect shape before installation, the NORMA Group, a specialist in connection technology, works with **vötschtechnik** thermosetting systems.

Thermosetting ensures good fit and work processes

In vehicle engine compartments, a wide range of media such as air, fuel, oil and coolant must be exchanged between engine components. The available installation space is significantly limited. In order to make optimum use of space, create long-term stable connections and ensure rational work processes at the same time, the thermosetting of assembly-ready preformed pipes and hoses has proven to be the best possible process.

When thermosetting pipes and hoses made from thermoplastic materials such as polyamides, the pipes and hoses are placed in a device with the required component geometry. They are then heated to a precisely defined temperature - depending on the material and the required product properties - and then quickly cooled down.



When heated above glass transition temperature, the material becomes fluid and adapts to the geometry of the device. When cooling, the molecular structure solidifies in the fixed form and retains the required shape. The pipes and hoses are leakproof and resistant to pressure, temperature and chemicals. They are also very lightweight. Depending on the intended purpose, the plastics can either be made elastic or more rigid.

These properties are controlled by the cooling speed, which determines the proportion of amorphous and crystalline components in the plastic. On the whole, thermoset pipes and hoses offer clear advantages compared with traditional metal and rubber pipes.

Technical functionality of the system

At the beginning of the project, the NORMA group determined all the requirements for the system in a detailed specification book. This particularly included the product geometry, the required throughput and the need to switch easily between different products. The heat technology experts at Vötsch Industrietechnik planned the thermosetting system on this basis.

The system was designed as a continuous concept with a continuous conveyor system and features connected infeed and outfeed zones for the filling and emptying of the loaded pipe racks. It is equipped with four electrical heating zones, and the cooling takes place via water surge. In the cooling zones, the pipes are rapidly cooled down to room temperature. The loaded devices are transported via a double-strand chain conveyor with a freely selectable speed.

The system is controlled via touch screen. The specially developed SIMPAC® measuring and control system stores up to 100 different programs and is easy to operate. This makes it possible to quickly and easily modify production to different products and materials with different temperatures and throughput times.

Components and customisation

Thanks to the longtime experience of Vötsch Industrietechnik in the field of industrial heating technology, especially in thermosetting, the system could be constructed using tried and tested components and modified according to individual customer requirements. This ensures quick planning on the one hand and high reliability and operating safety on the other hand.

A further advantage is the excellent process reproducibility with evenly heated products and constant high product quality as a result.

“What impressed us was the operating safety of the system and apart from that the flexibility to switch quickly and easily between different products. In everyday use it smoothly fulfils all our requirements, with the result that we have already ordered additional models of the same specifications for our production,” explains a spokesperson of the NORMA Group.

NORMA Group: Connections for the automotive industry

The NORMA Group is an international market leader and technological pioneer for advanced connection technology, with more than 60 years of experience in production and product development. The company portfolio includes leading brands for hose and pipe connections.

Precision precisely to the μ .

Precision measuring rooms guarantee accurate measurement for HAWE Hydraulik.

In the manufacture of many machine parts, absolute measurement accuracy and precision are vital. Both during the manufacturing process and in quality management, close and exact control measurements of the products are needed. These are only possible under closely defined ambient conditions with minimal variation: in particular, the key parameters of airflow, temperature and air purity must be maintained. For this, the Munich hydraulics developer, HAWE, relies on the expertise and long experience of Weiss Klimatechnik. Two autonomous measuring rooms ensure compliance with factory standards and customer requirements.

HAWE Hydraulik in Kaufbeuren manufactures products including hydraulic valves intended, for example, for mobile hydraulic systems in construction machinery. "The measurements throughout the production process serve for the continuous control of internal processes. To this end, components are regularly measured - the feedback must be as fast as possible," explains Jörn Winkler, whose responsibilities at HAWE Hydraulik include the technical requirements which the measuring techniques place on the measuring rooms. One of the two measuring rooms planned and installed by Weiss Klimatechnik is intended for incoming goods. Here, the engineering company





checks supplier's parts for dimensional accuracy. The second measuring room is concerned with quality assurance during and at the end of the in-house manufacturing process. "Some of the manufacturing tolerances to be measured are about one μ ," says Jörn Winkler.

Weiss Klimatechnik took responsibility for planning the execution of the two measuring rooms for quality control and installing them as well as for calibrating the in-house measuring equipment. The team completely took over the installation of the two measuring room cabins, based on the measuring room class III according to VDI/VDE 2627 - from the technical design to their equipment with high-efficiency precision climate control. Based on decades of experience in the establishment of highly precise climate conditions for production processes and clean rooms, a building time of only three weeks was required up to hand-over and instruction of the employees.

Technically, the two rooms are identically equipped and the main requirement was to find a space-saving solution. Here, the compact construction of the **weisstechnik** ultraconstant® air conditioning units came into its own. The main space-saving factor in the inhouse-produced equipment is that the refrigeration system for cooling is integrated into the air circulation unit. "The compact construction of our air conditioning equipment permits cost-effective and sparing use of space, which is usually restricted. No separate air conditioning system is required to dehumidify the exterior air," explains Hans-Joachim

Weitzel, Project Manager Cleanroom at Weiss Klimatechnik. HAWE Hydraulik is very satisfied with the implementation of the project. "The solution presented by Weiss Klimatechnik was convincing both in its concept and in its cost structure - as well as the entirely professional presentation of the company. In discussion with the employees of Weiss Klimatechnik, we very quickly gained the impression that we had found a partner with whom we can confidently collaborate - and the result has confirmed this impression," reports Andreas Gilnhammer, Project Leader New Factory Construction at HAWE Hydraulik in Kaufbeuren.

HAWE Hydraulik: Tailored solutions

HAWE Hydraulik, a family-run business with over 65 years of tradition and production in Germany, is a reliable development partner for hydraulic solutions. Customers can rely on experience in more than 70 fields of machine and plant construction. The range of products includes constant and adjustable volume pumps, hydraulic units, valves, sensors and accessories. Electronic components which are ideally matched with to the hydraulic components supplement the modular system and facilitate control, signal evaluation and fault detection.

Become more efficient.

Use our solutions to save time and money.

Developed exclusively for you:
the unique software simulation package for the perfect testing process.



Process management/documentation/networking

- Up to 99 systems can be networked
- Programs for automatic processes
- Documenting, visualising and managing process data
- Traceability of process data for seamless quality control

Reliable series control



Digital measurement and regulation system for operation, monitoring and documentation of your testing cabinet.

Green Mode®



Even our standard testing cabinets stand out with best insulation values and low operating costs. With Green Mode® you can save an additional 40% of electric energy and thus many tons of CO₂. We achieve these savings through optimised hardware and software and through customer-oriented system planning.



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Our services - lots of good arguments:

- Global service network
- Wide selection of preventive maintenance
- Reliable spare part supply
- Special deployments available any time
- Training programmes for our customers
- Certified proper disposal of outdated devices

You can always find a **weisstechnik** expert near you.

weisstechnik

Test it. Heat it. Cool it.

Our solutions are deployed around the world in research, development, production and quality assurance of numerous products. Our experts from 21 companies are available in 14 countries, ready to provide support services to ensure high operational reliability of your systems.

Weiss Umwelttechnik is one of the most innovative and pre-eminent manufacturers of environmental simulation systems. With these testing systems, we can simulate all climate conditions around the globe, and beyond in time lapse. Whether temperature, climate, corrosion, dust or combined shock testing: We have the proper solution. We supply systems in all sizes, from standard versions up to customised, process-integrated facilities - for high reproducibility and precise test results.

Vötsch Industrietechnik, a subsidiary of Weiss Umwelttechnik, offers a wide product portfolio in the field of heat technology. With an experienced team of engineers and designers, we develop, plan and produce high-quality and reliable heat technology systems for virtually any field of application. Products include heating/drying ovens, clean-room drying ovens, hot-air sterilisers, microwave systems and oven systems. The programme reaches from technologically sophisticated standard versions to customised solutions for individual production operations.

A further Weiss Technik company, Weiss Klimatechnik, also offers reliable climate solutions wherever people and machinery are challenged: in industrial production processes, hospitals, mobile operating tents or in the area of IT and telecommunications technology. As one of the leading providers of professional clean-room and climate solutions, we deliver effective and energy-saving solutions and expertly guide you through your entire project, from planning to implementation.

Weiss Pharmatechnik, another Weiss Technik company, is a competent provider of sophisticated clean-room and containment solutions. The product range includes barrier systems, laminar flow facilities, security work benches, isolators and double door systems. The company emerged from Weiss GWE and BDK Luft- und Reinraumtechnik and has decade-long experience in clean-room technology.

Weiss Umwelttechnik GmbH
Greizer Straße 41-49
35447 Reiskirchen/Germany
Phone +49 6408 84-0
www.weiss-technik.info

Weiss Pharmatechnik GmbH
contact@weiss-pharma.com
www.weiss-pharma.com

Vötsch Industrietechnik GmbH
Environmental Simulation
info@v-it.com
www.voetsch-technik.info

Vötsch Industrietechnik GmbH
Heat Technology
info-wt@v-it.com
www.voetsch-ovens.com

Weiss Klimatechnik GmbH
info@wkt.com
www.wkt.com

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