

CASE STUDY

Germany

Benien Produktionstechnik GmbH NVH Testing of Advanced Automotive Materials

Automotive

PULSE, Transducers, Calibrators

Benien Produktionstechnik, based near Bremen in northern Germany is a leader in the development and manufacture of high performance products, systems and solutions for noise control, vibration damping, shock isolation and cushioning. The automotive industry is a core market and the company supplies its advanced products to many leading automotive manufacturers.

A PULSE™ system, transducers and wide range of application software are used in the development and testing of new materials for noise and vibration reduction.



History

Benien Produktionstechnik, based in Delmenhorst, near Bremen in northern Germany was founded by Mr. Olaf Reedwisch in 1996. From the beginning there was a strong focus on the automotive industry. Today the company is a leader in the development and manufacture of high performance products, systems and solutions for noise control, vibration damping, shock isolation and cushioning. The broad product base includes polyurethane and PE foams, technical non-woven and melamine foams, and composite materials. Although some 90% of Benien's production is for the automotive industry, noise and vibration solutions are also developed for the construction, electrical and electronic industries.

The company, still privately owned by Mr. Reedwisch, had grown rapidly and now has 160 employees. It moved to a new premises in 2000. The area of buildings was doubled two years later. and the factory is specially designed. Benien Produktionstechnik has a highly modern and impressive state-of-the-art manufacturing facilities. It runs on a three-shift basis and delivers more than one million items each year.

A Niche Market

Benien Produktionstechnik works very closely with its customers and suppliers of raw materials in developing products and solutions for noise and vibration reduction.

Within the automotive industry, there is a focus on engine noise and the latest "smart materials" are designed using laminated, composite formulations. These composite materials can be designed to maximise the reduction of noise at selective frequency ranges.

Fig. 1
A cylinder-head collar



As examples of Benien Produktionstechnik's expertise, special foam absorbers are developed for use in a vehicle's engine compartment, other solutions are used for collars and covers placed around the cylinder head, or around the sump. Other materials are used for noise reduction panels inside the cabin.

With great experience in this market segment, Benien Produktionstechnik delivers its products and solutions on a "just in time" basis, and every working some seven tonnes of materials are shipped direct to many major European automot-

ive manufacturers including Audi, DaimlerChrysler, Jaguar, Ford, PSA and Volkswagen. Customers on other continents are being developed.

Benien Produktionstechnik's products are environmentally friendly as all materials, including production scrap, are recyclable.

Product Development

Fig. 2
Ulrich Heise is the NVH Development Manager at Benien. He is using Sound Intensity Probe Type 3599 to investigate noise sources from an engine



Ulrich Heise is the NVH Development Manager at Benien Produktionstechnik. He has a Master's Degree in Electrical Engineering from The University of Braunschweig, near Hannover. Mr. Heise has always worked in the field of acoustics and joined Benien Produktionstechnik in 2002.

Mr. Heise says, "The acoustic and vibration damping properties of our products are highly important. The specifications are constantly increasing due to the demand from our customers for products that make cars quieter. When developing a product or solutions, we have to consider a number of factors including the mechanical properties, temperature range, contact with other substances including petrol, oil, diesel fuel and gas, fire risk, the acoustic or vibration reduction that is required, and cost".

He continues, "The automotive manufacturer tells us what he wants to achieve. We then work very closely with our customers to determine the final specification. This is generally a compromise because increased noise and vibration damping generally requires more material and, although the material NVH properties are constantly improving, the cost of the solution must always be considered. We use our experience and expertise to provide the best cost-effective performance."

Benien Produktionstechnik can respond to customer requirements very rapidly. Prototypes can be made by hand in as little as two weeks and bulk supplies can be delivered in two or three months. The company designs and manufactures all the high-tech production tooling in its own CAD/CAE equipped toolshop.

Mr. Heise says, "The main reasons for the fast expansion of our company are that we are fast, competitive, flexible and deliver high quality solutions."

NVH Testing

Benien Produktionstechnik has designed and built an impressive range of NVH test facilities. These include two semi-anechoic rooms. One is $10 \times 12 \times 4.5$ m high – large enough to accommodate a complete vehicle or very large components. It has a cut-off frequency of about 200 Hz. The nominal acoustic coefficient of materials starts at about 300 Hz.

Fig. 3

*Left: There are two semi-anechoic rooms. This one is large enough to accommodate a complete vehicle
Right: Each semi-anechoic room has a network connection panel for fast setup of the test system*



Mr. Heise explains, “The environmental control system of blower and silencer is very quiet. Using PULSE, we have measured the background noise at 16.9 dB(A). But because the temperature increases during the measurement, and this has a significant effect on the test data, we have an air conditioning system to maintain a near constant temperature. Again using PULSE, the background noise with the system running only increases to 18 dB(A). We are currently working on the design of a special acoustic absorbing material that will be placed inside the semi-anechoic room to decrease the specific room modes at low frequencies”.

The other semi-anechoic room is used for consulting work. Each semi-anechoic room has a network connection panel for fast setup of the transducers, and other equipment, and remote control of the PULSE data acquisition system.

Mr. Heise and a colleague have built an impedance tube for material testing. The temperature can be controlled from -20°C to $+60^{\circ}\text{C}$. The system is completely computer controlled and materials can be tested in the frequency range of 400 Hz to 1.8 kHz. It can focus on very small frequency band. Using the generator function within PULSE, a stepped sine wave is applied to the sample under test via a power amplifier and loudspeaker. A microphone measures the response and the acoustic signal goes through an A/D converter. The test data is post-processed using MATLAB.

An additional smaller impedance tube is currently being constructed. It will be able to measure to 6.4 kHz.

Mr. Heise says, “We purchased our 6/1-channel PULSE system about two years ago. We wanted an advanced data acquisition system that runs under Windows®. We expect our testing demands to grow continuously and therefore we need a system that can be easily expanded with no limitations”.

He continues, “We investigate noise and vibration sources on the whole car and make many types of test, according to the customer’s requirements”.

In addition to FFT & CPB Analysis Type 7700, Benien Produktionstechnik has a wide range of application software including:

- Data Recorder Type 7701
- Noise Source Identification Type 7752
- Acoustic Test Consultant Type 7761
- Modal Test Consultant™ Type 7753
- ME'ScopeVES™ Type 7754
- PULSE Bridge to ME'ScopeVES™ Type 7755
- Operational Modal Analysis Type 7760

The company also has Sound Intensity Probe Type 3599, Mini Shaker Type 4810 and range of Brüel & Kjær microphones and accelerometers. These are calibrated using Sound Level Calibrator Type 4231 and Calibration Exciter Type 4294.

Fig. 4
A special engine cover using a high-tech composite material



Mr. Heise continues, “Our tests investigate the sources of noise. We make sound intensity measurements using PULSE, Noise Source Identification Type 7752 and Sound Intensity Probe Type 3599. This is an excellent tool. We also consider the transfer functions, both from structural vibration and airborne sound.”

NVH tests are made in the semi-anechoic rooms, and on the test track. Benchmark testing is also carried out on competitor’s products and for troubleshooting.

“When making tests in the lab, two monitors are connected to the PULSE system. We can look at two different functions simultaneously such as CPB, FFT, overall analysis, frequency vs time etc. We can also listen to the noise in real time”, says Mr. Heise.

Mr. Heise says, “Our PULSE system is used every day. I like the accuracy of the measurement system and it is also easy to use and set up. The OLE interface is a great advantage as it enables us to export ASCII or Excel files to work with other programs, and of course because it is small and compact, we can easily transport it together with a laptop to the test site”.

“We often need to compare data and this is very easy using PULSE Data Manager. I have used Brüel & Kjær products for the last ten years and the service and support has always been excellent.”

Accreditation

Benien Produktionstechnik is fully accredited to ISO 9001 and is working towards QS 9000 accreditation. It is also approved to ISO/TS 16949:2002. This new standard was jointly developed by IATF members and adopted by ISO. It is a common automotive quality system requirements catalogue based on ISO 9001:2000, AVSQ (Italian)=, EAQF (French), QS 9000 (IS) and VDA6 (German). The standard will be widely used within the automotive industry on a global basis.

The ISO/TS 16949:2002 IATF third-party registration scheme provides many benefits including:

- Improved product and process quality
- Additional confidence for global sourcing
- Reassignment of supplier resources to quality improvement
- Common quality system approach in the supply chain
- Reduction in multiple third-party registrations

The Future

Mr. Heise concludes, “I expect everything to grow in the future – our company, our product range, the demands from our customers, and our testing needs”.

Key Facts

- Benien Produktionstechnik is a leader in the development and manufacture of high performance products, systems and solutions for noise control, vibration damping, shock isolation and cushioning
- The company has modern manufacturing facilities – it delivers more than one million items each year
- The automotive industry is a core market – the company supplies its advanced products to many leading automotive manufacturers
- “The acoustic and vibration damping properties of our products are highly important”
- Specifications are constantly increasing due to the demand for products that make cars quieter
- “We use our experience and expertise to provide the best cost-effective performance”
- “We purchased our 6/1-channel PULSE system about two years ago. We wanted an advanced data acquisition system that runs under Windows®”
- “I like the accuracy of the measurement system and it is also easy to use and set up”
- Benien Produktionstechnik has a wide range of application software
- Benien Produktionstechnik is accredited to ISO 9001 and ISO/TS 16949:2002
- “I expect everything to grow in the future – our company, our product range, the demands from our customers, and our testing needs”