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A SOUND IMPRESSION

Johnson Controls optimizes automotive seating noise quality through unparalleled sound management

Johnson Controls, the world's leading manufacturer of vehicle seating and seating components, has very strict requirements for all-round high quality automotive seating sound impression. The Sound & Vibration Lab at Johnson Controls' Solingen, Germany location employs a team of acoustic engineers who specialize in this complex task.

Integrated sound management includes sound design as an element of product development, in-house software and hardware for acoustic testing and a unique remote testing system. This facilitates the continuous, uninterrupted monitoring of 219 test benches at Johnson Controls' manufacturing locations around the world, making the company the global leader in acoustic quality assurance in automotive seating.

"We encounter innumerable products with individual sounds in our everyday routines from morning to night – from the dependable noise of the cap of a shampoo bottle being closed and the crispy crunching of cornflakes in the mouth to the sonorous hum of an automotive seat when the height is adjusted," said Stefan Lingnau, head of the Sound & Vibration Lab at Johnson Controls in Solingen.

In all three cases, the manufacturer draws upon sound design to convince consumers acoustically of the effective functioning of the cap, the freshness of the cornflakes or the premium quality of the automotive seat.

The sound of a good automotive seat

As one of the most mechanically complex parts of an automotive interior, the vehicle seat has numerous sources of noise, including gears, rails, springs and electric drives. This is where the work starts for Lingnau and his team.

Beginning with the seat's construction, their goal is to eliminate unpleasant noises and ensure that the seat sounds good. Lingnau explains what "good" means in this context using the term "value appropriate": "The individual noise profile of a seat must acoustically implement the customer's requirements and match the interior of the respective vehicle model."

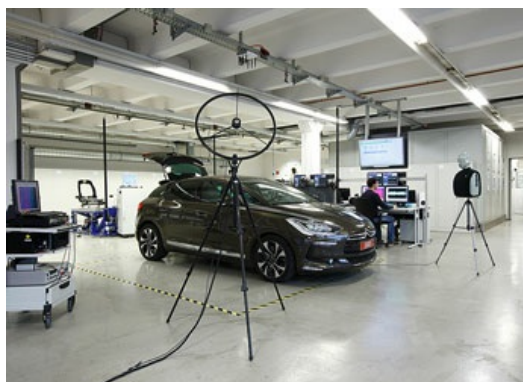
As a result, the distinctive brand consciousness and different sound identities of the automakers play an important role.

"The doors in a mid-level or luxury class model convey a brandspecific auditory experience when closed. With



the sound design of seats, we are consistently continuing this experience into the interior, as well,” said Lingnau.

In addition to the physical acoustics, psychoacoustic methods and knowledge are also essential for the engineers. What is technically meant when a seat “squeaks”, “rattles” or “clicks”? With the aid of noise patterns, the subjective perception of sounds can be recorded, described and made measurable and reproducible. At the end of the development process, the seat has an optimally designed and coordinated sound profile.



Unbeatable combination: human ear and technical measuring instrument

The next step in sound management leads to the measuring technology utilized at the Sound & Vibration Lab. “No people without machines and vice versa” is the rule of thumb there. All test benches and measuring instruments are developed in-house.

“We design test methods for the requirements, implement them onsite with hardware and software and calibrate the measuring instruments ourselves, as well,” said Lingnau. Every new test bench is built in duplicate, and then the validation starts with a series of tests in a bi-directional procedure: One machine works with the values that the trained human ear of an acoustic engineer picks up and the other with data from the technical measurement alone.

“Only when the people and machines reliably reach the same result do we approve the new test bench. On average, that happens somewhere between the thousandth and three-thousandth test,” said Lingnau.

An ear to the production line – from thousands of miles away

Within a few years, the small series of acoustic measuring instruments in Solingen has grown to an internationally networked testing system that is globally unique. Using data lines, the acoustic engineers from the Sound & Vibration Lab always have their ear to the assembly line. Every seat from series production undergoes testing in all adjustment directions on the acoustic test benches. The sound data linked with the product series data is recorded. If a measurement exceeds defined tolerance values, the acoustic engineers are informed.

“We then get the sound clip via remote access, listen to it, look at the graphical information and start to analyze the fault. Often from thousands of miles away,” said Lingnau.

Without even looking at the seat, the engineers can identify the root of practically every fault. They have a 98 percent success rate in solving acoustic problems.

This interaction of highly developed instruments, global applicability, traceability, precision and efficiency has won over Johnson Controls’ customers and also the German Society for Acoustic Quality Assurance (DGaQS). It has proposed that the system and its data format be adopted as an international format to standardize acoustic quality assurance. The enormous savings potential in respect of response times and personnel costs is clear. Even more significant, however, is the estimate of the costs that do not arise thanks to the remote testing system: Approximately 65 percent of all complaints about seats in new vehicles are related to noises that bother the buyer.

A total of 219 acoustic test benches form the "extended ear" of the Solingen team at Johnson Controls manufacturing locations in the U.S., China, Poland, Romania and Hungary. In order to develop its role as a global leader in acoustic quality assurance, Johnson Controls Automotive Seating is continually expanding its remote testing network. By the end of 2013, the number of acoustic test benches in Johnson Controls plants will have increased to 260.

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