

CASE STUDY

Inalfa
Michigan, USA

USA, Europe
Automotive
Production Testing

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Production Testing of Sunroof Systems

Sound and vibration are growing in importance as critical factors in product quality. Therefore, manufacturers are required to perform noise and/or vibration quality testing prior to shipping a product. The proper implementation of such a test is a significant challenge – one that can offer a very large return on investment. To address this challenge, Brüel & Kjær has developed a turn-key system designed to interface with production test standards and perform all the needed sound and vibration tests to verify product quality. The resulting PULSE™ Production Test System provides repeatable, calibrated, objective sound and vibration measurement and evaluation. Inalfa Roof Systems use this system to perform vibration tests on their sunroofs. Inalfa needed a product quality evaluation system that would meet the requirements of their high-end, luxury vehicle customers. Brüel & Kjær was able to provide a superior solution.

The Company

*Headquarters in
Venray, The
Netherlands*



Inalfa Roof Systems is one of the world's biggest providers of vehicle roof systems for the car and truck industries. Inalfa designs, develops and manufactures sunroofs and open-roof systems for the automotive industry. With Headquarters in Venray, The Netherlands, Inalfa also has facilities in Italy, USA, South Korea, China, Brazil and Japan and employs 1700 people worldwide.

Auburn Hills Facility

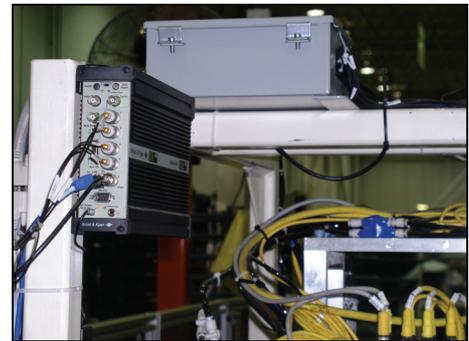
Inalfa's 12-year old Auburn Hills Plant in Michigan, along with a smaller facility in Grand Blanc, Michigan, USA, produce the majority of the North American sunroofs. The Northern American Technical Center in Auburn Hills, Michigan, USA is where the Northern American roof systems are designed, assembled, tested and inspected. Most Inalfa customers are Original Equipment Manufacturers (OEM) and include GM, Daimler, Ford, Mitsubishi, Nissan, BMW, Chrysler and Audi, but there is also a small after-market demand. At Auburn Hills, 300 people work in two shifts on eight production lines with a further line to be added later this year. The production lines are designed locally and Inalfa's R&D group has Production Test Advisor (PTA) viewer licenses so that they can analyse historical data. Brüel & Kjær's PTA system is now standard at this facility while Inalfa's Headquarters in Venray has a Brüel & Kjær PTA unit on test. Production test systems are also being planned for Inalfa facilities in Korea and Brüel & Kjær will, ultimately, become the Inalfa global standard.



The System

A typical sunroof has from one to three DC motors (with the exception of Audi, which has four), and the glass assembly moves back and forth on side rails. As sunroofs have grown in size and complexity to include multiple panes of glass, motorised sun shades (rollo), and the need to manufacture multiple models down the same assembly line, the PTA systems have grown from a few channels of data acquisition to six channels with multiple removable tool sets designed to be automatically swapped for each model run down the same line. A typical PTA system consists of a PULSE B-frame with four, uniaxial DeltaTron®

Accelerometers Type 4514-B located near each motor and in the middle of each side rail. These measure the vibration from the DC motors. In addition to the vibration measurement, a current probe clamp is also installed over the power lead to the sunroof, and the signal used to determine the RPM of the motor. The test takes about one minute. On average, the throughput is one complete sunroof system every three minutes on each production line.



Production Line Performance



The Pass/Fail vibration parameters are set by the OEM and jury evaluation is often used to ensure that the objective vibration limits are in accordance with customers' subjective noise evaluation. This substantially reduces warranty claims. On completing a test, the operator sees a simple Pass/Fail indication. If the unit has failed, it is tested one more time. If it still fails, it is taken to a special quiet room where the vibration problem is evaluated by specialists in a semi-anechoic chamber. "This has proved to be so successful that our parent company in Vernay will also install a semi-anechoic chamber with a PULSE system,"

says Senior Manufacturing Engineer Trevor Brown, who has worked at Inalfa for 11 years.

Brüel & Kjær is the complete solution provider for this system. Brüel & Kjær's external partners Sound Answers, who operate from the Brüel & Kjær Application Research Centre in Detroit, installs and supports the system. The production line manufacturer and their electrical engineers make the PTA system interface using Signalysis standard software with Brüel & Kjær PULSE LabShop running in the background. The PULSE interface is, therefore, not seen by the user. "The combination of Brüel & Kjær Sound Answers and Signalysis is excellent. The product quality is first class and we get great support. We have not had to replace a PULSE unit or a single accelerometer on any of the lines," says Trevor Brown. He continues, "And because our customers know that our production line test system is based on Brüel & Kjær's advanced technology, they never challenge us on noise or vibration issues. Specifying Brüel & Kjær production test solutions is an important quality selling point for our customers and we regard it as a key product differentiator".

However, BMW initially insisted that Inalfa use a test system provided by a Brüel & Kjær competitor. "There was no local support," says Trevor Brown. "The company proved difficult to work with and the software was not user-friendly. In addition, there were issues with the ambient noise level. As a result we have persuaded BMW to replace their test system with Brüel & Kjær's PTA and this is in the budget for 2010," he concludes.

The Future

Inalfa are pleased with the Brüel & Kjær solution. Trevor Brown elaborates, "The Brüel & Kjær PTA systems are highly reliable, have never failed and don't cause maintenance issues". He continues, "We have always used the PULSE B-frame but we are very impressed with LAN-

XI. In future, we intend to purchase larger front-ends with six channels to measure in the frequency range from 0.5 kHz to 6.4 kHz.” The most recent Inalfa system employs a LAN-XI module as part of the solution package. Inalfa were pleased to see how easily they could incorporate this leading edge hardware.

Future plans also include Inalfa’s intention to use Brüel & Kjær’s PTA for trend analysis. Trevor Brown explains, “Our current failure rate is about one percent, so by analysing the reasons for failure we can make informed decisions regarding suppliers of components”.

And looking even further ahead, Trevor Brown forecasts, “With the global focus on quieter, hybrid and electrical vehicles, our customers will be even more demanding and will set tighter test parameters. Ten years ago, in the US, an average 25% of new vehicles were equipped with a sunroof. Today it’s 45% and still increasing.”

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