AUTOMOTIVE ENGINEERING

2017

Official newspaper of the VVAutomotive.cz magazine and VVA 2017 seminar

Interview

WERNER FERREIRA DA SILVA: I'D LIKE TO SEE ALTRAN IN THE TOP 3

The automotive industry has never been more exciting, says a seasoned manager who's worked in many positions in technology and industrial companies and who recently took over a part of the global giant, Altran.

He's been in charge of the German-Austrian-Czech part of the Altran company — an important technology and engineering player — for a few weeks now. We asked Werner Ferreira da Silva about the story behind the recent acquisition of the Swell company, about his plans, goals, and visions for the future of the automotive industry.

Being a well-established international company, Altran is nevertheless quite new to the Czech audience, even though it's been here for a few years now. Can you briefly introduce it? What is its main focus, its expertise, and its experience?

With over 30,000 talented women and men, Altran is the world leader in technology consulting, engineering and

VÝZKUM VÝVOJ AUTOMOTIVE

Interview

R&D services. For more than 30 years, Altran's been helping and accompanying clients all over the world, from the automotive, aerospace, and electronics industries, to the life sciences, telecoms, media, and financial services to innovate their business and bring novel products and services sectors, successfully to market. Throughout, we help them build a competitive advantage. We already have quite a history in Czechia, however, with the acquisition of Swell we gained a larger footprint.

You worked in Altran a couple of years ago, and now you're back and in charge. What made you come back? Can you see a difference in how the company looks today?
Altran's always been a special place for me, for two reasons. On the one hand, the group has a fantastic spirit in terms of innovation and the potential to turn it into reality. On the other hand, Altran has a splendid team of engineers and researchers that are simply a pleasure to work with. Additionally, it's an honour to work for the world's largest company in the field.

What's the story behind Altran expanding to other countries — to Germany and lately to Czechia? Altran bought Swell, a local automotive developer. What was the reason for that?
As outlined in our strategy Altran2020.ignition, we believe that the engineering services market will grow and will become more global. The main drivers of our strategy, which is founded on engaged people in our team, are added value, industrialised global share, operational excellence and geographical expansion. With Swell, we've found an ideal opportunity to support several of our strategic objectives at the same time. Beside the technical excellence of Swell helping us to expand our global portfolio, we could strengthen our local footprint significantly to serve our Czech clients better.

What are your plans with Swell? What do you seek to achieve through this acquisition? Will Swell become a part of Altran or will it remain a stand-alone member of the group?
Swell has a proven track record of technical excellence for automotive engineering and testing. We want to develop those skills further and make them available to international clients. To deliver large projects such as vehicle development efficiently to our clients, integration and collaboration within Altran are key. Swell is already integrated well into the Altran family, so it's natural that it will soon also be integrated from the perspective of branding.

Swell has always been strongly focused on automotive development. Do you plan to keep this focus? Or will you try to extend its range to other fields that Altran is active in?
We believe that Swell's focus on automotive was a decisive factor in achieving competence and growing the business. With Altran's strong footprint in industries such as aerospace and rail, there's no reason that Swell's engineering and testing capabilities couldn't be of interest to customers in those domains.

Are there any plans to connect the German, Austrian and Czech parts of the group more tightly? What are their common goals? And what do you perceive to be the particular strengths of each local office?
At Altran we strongly believe in the concept of local presence and global delivery. The overarching goal is to offer our clients the best services at optimum prices. Our clients in the automotive sector develop worldwide and expect the same from their suppliers. So, we plan to work on better integration and collaboration within the very closely linked markets of Germany, Austria and Czechia – without sacrificing local competence and close relations with our customers.

You've been in charge of Altran Germany, which includes the Austrian and Czech parts too, for quite a short while. Nevertheless, what are your visions, plans, and goals? Will you bring new people, new juice, and new spirit? What will you change? Where do you want to place your focus?
Although I do know Altran well and I can proudly call myself an 'industry veteran', it's immensely important for me to listen carefully to staff and clients for the first couple of weeks to understand their needs and wishes. Based on this feedback, we'll hone our strategy. Generally, I'd like to see Altran in the Top 3 companies in the region of Germany, Austria, and Czechia.

Where do you feel the automotive industry's been heading recently? And what do you think it will look like in the near future, and a couple of decades from now?
The automotive industry is facing some really significant challenges. New forms of mobility will be sustainable, connected, autonomous, and shared. Through the dramatic advancements in technology, industry giants suddenly see competition coming from much smaller companies, and also from entirely different industries. Industry giants begin to adapt and redesign their ecosystems according to a partnership model. This is where I see the future of Altran: helping traditional industry players to master this transformation, and in supporting mobility providers to develop new products and services in partnership. There's never been a more exciting time to be in the industry! ■

INDUSTRY GIANTS SUDDENLY SEE COMPETITION COMING FROM MUCH SMALLER COMPANIES, AND ALSO FROM ENTIRELY DIFFERENT INDUSTRIES.

Technology

SHAKEN, NOT STIRRED

Yes, it is a shaker, but not just any shaker. This one is used to test the vibration of, for example, automotive parts.

The machine, sometimes referred to as a vibration table, is properly called an 'electrodynamic vibration test system' and is used to simulate vibration of various types in laboratory conditions. It is often called a 'shaker' in testers' jargon. One of these "toys" was recently purchased by the Swell testing laboratory. The Head of the Testing and Simulations Department, Jaromír Kejval, told us about the brand-new shaker, its advantages, and his first experience using it.

Three tests in one axis

"A typical shaker is a single-axis system that generates vibration in one axis. The reality is, of course, different: there is spatial vibration in cars, in all three axes at the same time. Today, there are triple-axis shakers being produced, but these are rather expensive and, in our facility, not used for real testing that much. So, we usually have to make do with one axis – we simplify the test in our lab and apply vibration to the tested part successively from each of the three spatial axes," says the experienced tester. He explains that this is because twenty three years ago, when the individual specifications were created, only single-axis equipment existed. That is why standards are built on this basis.

It works like a speaker

The principle of a shaker can be explained with a speaker, which you surely have several of home or in your car. A speaker consists of a fixed coil (sometimes only a permanent magnet) with a movable coil inserted. On top of the movable coil, there's a membrane that shakes and creates vibration, which we then experience as sound.

A shaker has a vibration table instead of the membrane, on which test samples are placed – sometimes it is also called an armature, which is usually made

HOW ARE TEST SPECIFICATIONS CREATED?

Just as climate chambers simulate a real environment, i.e. temperature and humidity, in a laboratory, shakers simulate the vibration load acting on various parts and components. In order to determine real load in operation, we need accelerometers. Testers in automotive usually use small units of about 1 × 1 × 1 cm. These are screwed on or glued to an engine, gearbox, exhaust, and so on, and during field drive tests, they measure the vibration acting on the given part. The data is then used to create testing specifications, which define what load the specific parts from the given area of the car should be required to withstand. These vibration loads are later simulated in a laboratory separately – in individual vibration directions.

of magnesium alloy to be strong and light at the same time (it has up to one third less density than aluminium alloys). The armature is connected to a coil, which is relatively tightly inserted into the larger fixed coil of the machine.

Constant current flowing through the larger coil generates a strong magnetic field. Controlled flow of alternating current through the smaller movable coil then creates movement, similar to that in a speaker – and after connecting a voltage generator, 50 Hz for example, the armature starts to move up and down at this frequency – and now we have a vibration test. The higher the current used, the bigger the stroke of the vibration.

The difference is that while a speaker only produces movement (i.e. sound) without any feedback control, the shaker is controlled using a closed feedback loop: it monitors acceleration deflection and senses an accelerometer fixed on the armature, through which the control system adjusts the behaviour of the entire machine according to individual requirements.

WHEN LIQUID IS INSIDE

Vibration tests present one particular difficulty. As already stated, spatial vibration in a laboratory is composed successively of all three axes. In the case of small parts, where the Earth's gravitational field is irrelevant, parts can be gradually rotated on the machine to compile all vibration as a result.

But with larger parts, such as a washer fluid reservoir or a cooler, this is no longer possible, because even if we turned the part to the required axis, the fluid inside remains horizontal – i.e. incorrectly oriented towards the reservoir. Then we need to use horizontal vibration. That is why shakers vibrating along a vertical axis are equipped with a so-called sliding table.

It is usually a large magnesium plate on a heavy granite mat, with a thin oil film between them. This film serves as a bearing. Thanks to the sliding table, it is possible to implement this horizontal vibration (the z axis is then implemented directly, vertically; the x and y axes on the sliding table – the part just rotates about the vertical axis by ninety degrees).

Two tables are an advantage

As already mentioned, the Swell testing laboratory purchased a new shaker, which complements a variety of existing machines. It is model ES-50LS3 produced by the Chinese manufacturer DongLing.

"Our new shaker has two sliding tables, measuring 50 × 50 and 90 × 90 centimetres. This allows for wider use of the machine, both for smaller parts requiring high acceleration amplitudes and large and heavy parts with low acceleration. In addition, we can perform tests on one table and prepare another sample on the second one at the same time, which saves time," Kejval says.

Swell serves a wide range of customers who require testing of small as well as large parts. The former, such as sensors, are small and light, but also unluckily placed directly on the engine or gearbox, where acceleration easily reaches tens of Gs. – that is why a small sliding table is required, to make it even possible to transmit power to the part. On the other hand, large parts, such as bumpers, need a large sliding table to even fit on the machine, but with lower acceleration, as it is a sprung item, and if it was vibrated to 50 Gs, it would fall apart in a moment.

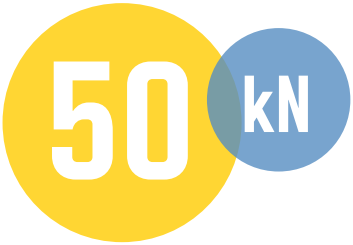
Another strength of the new shaker is in its mechanical stroke discipline. "All our current machines work with a maximum stroke of two inches; about five centimetres. This range is insufficient at low frequencies. That is why we purchased this machine with a stroke of three inches, roughly 7.5 centimetres," Kejval says.

A pig in a poke? Certainly not

According to Kejval, the purchase was a bold move for the Chinese manufacturer. It is, after all, a technologically very demanding machine. "But it was not a leap in the dark: the brand already has a long-standing presence in Italy, so it already has some reputation in the European market. However, practical experience can only be evaluated after several years of operation, let's say after a few thousand hours," he says.

To conclude, he adds one related piece of news and also an ambition for the future. "With a machine this big, we want to test big parts, of course. And because a shaker does not make sense without a climate chamber – they're an inseparable pair – we also purchased a larger climate chamber. Compared to our current chambers with a volume of 1.2 m^3, the new one is one cubic metre larger and the usable ground plan dimensions are about 1.4 × 1.4 metres. This allows us to test parts such as door panels, front-end or four headlamps at once. To extend our capabilities, we are planning to test vibration also on large parts, such as an entire bumper or dashboard. However, that requires a chamber with a volume of about ten cubic metres and another shaker with a large attaching surface for vertical as well as horizontal vibration. For now, we have to wait, learn to use this new machine and leave that prospect as another investment milestone," the head of the testing laboratory concludes. ■

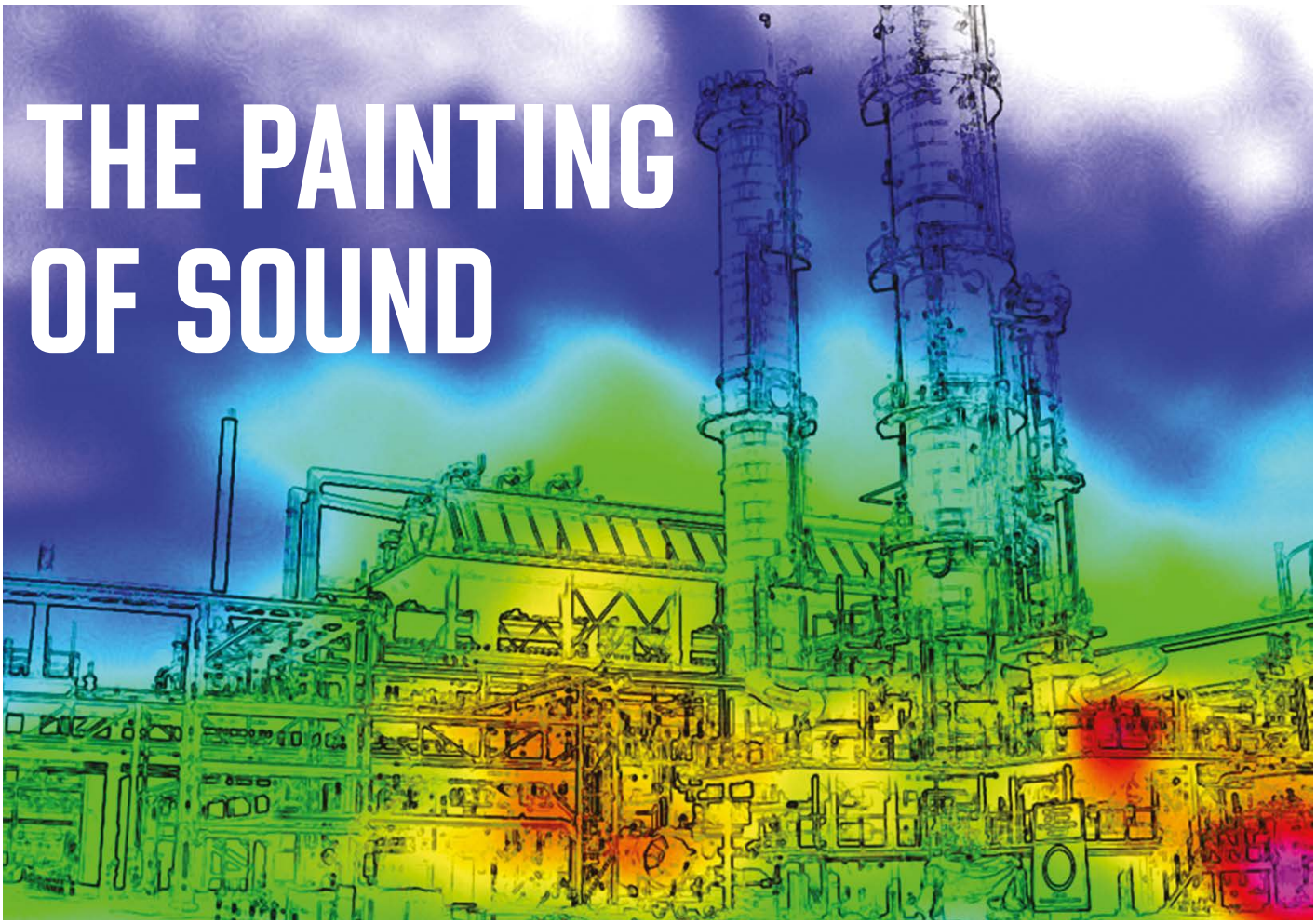
BOTH SIZE AND PERFORMANCE ARE IMPORTANT



Shakers, like any other device, are limited by several parameters. The first is a different force vector, which is actually the mechanical power of the shaker expressed in newtons [N]. "Our smallest ones have a power of 1 to 3 kN, they don't have a sliding table and are like babies with a weight of about 100 kilograms," Kejval laughs, "but we don't get much acceleration from these, and if we do, it's only with lightweight test samples. We also have to count the armature and all jigs. They are mainly used for modal analyses of small parts. Then we have three larger machines, with a power of 22 to 35 kN, always with a single sliding table. The new machine is even stronger – 50 kN – which gives us somewhat larger coverage during tests." The second important parameter is the size of the armature and the sliding table, i.e. simply the size of the work area on which the sample can be placed. It is restrictive, because if the sample is larger than the armature, it's not easy to attach it properly and, at the same time, place the dynamic centre of gravity of the entire tested system into the armature axis. If we fail to do this, inertial effects create side tilting movements that can destroy the armature. Apart from that, undesirable resonance is generated in locations that are not supported by the armature.

Technology

THE PAINTING OF SOUND



Do you live near a railway station, above a busy street or by a noisy manufacturing company? Noise can often be a major nuisance. The acoustic camera, a device with a seemingly contradictory name, is able to make sound visible.

You've certainly heard about temperature maps. Infrared thermography records the temperature of an object or area - from blue to green and yellow to red, showing the temperature distribution map from the coldest to the hottest.

Sound can be depicted in a similar manner. That's what the acoustic camera is used for. A very interesting device, it is now also being used by the Swell development laboratory.

Lots of microphones

The acoustic camera consists of a large number of microphones – usually from about 30 to 120, which are variously arranged in a space. At the centre of

MONITORING OF COMBUSTION AND NOISE OF TIRE

Of course, we are most interested in the automotive industry. As well as using acoustic cameras for interior noise measurement, the combustion cycle in the engine, for example, can be monitored: the moment of ignition or the release of exhaust fumes from the cylinder can be displayed. Another use is, for example, to monitor how tire noise arises from different types of surfaces and at different speeds. For example, thanks to the acoustic camera, engineers have found that rolling noise from the wheels exceeds engine noise at speeds above 30 km/h.

this microphone field is a high resolution video camera that optically records the scene, which allows the result of an acoustic calculation, that is, an acoustic map, to be projected onto the recording.

In addition, the unit includes a converter that picks up signals from individual microphones and converts them into a format that the computer and software will be able to handle. A variety of different algorithms are used for the deployment and utilisation of the acoustic camera.

How it works

The acoustic camera is simply set up in front of the measured device and turned on, and usually within a short period of time both the sound from the many microphones and the video from the video camera are recorded. The advantage, of course, apart from the possibility of capturing and depicting different levels of noise, is also the ability to analyse mobile sources as well as create a time recording of sounds for very fast processes. For a whole range of measurements, not only the level of noise but also how it changes in time and space is essential.

There may, of course, be several measurements, and the resulting data can then be averaged, grouped or otherwise analysed. The core of the analysis is the appropriate selection and evaluation of time and frequency domains. It is therefore a matter of selecting the measured signals in time domains that are of interest to the customer, as well as selecting the desired frequencies. Then the source distance to the acoustic camera is set, and the appropriate algorithm is selected.

It is not able to handle deep tones

Once all the calculations have been completed, individual sound pressure levels, i.e. the noise level, can be displayed in the video from the video camera. It can then be observed how the noise scene changes over time and in individual areas.

The acoustic camera is not suitable for capturing deep tones, meaning low frequencies. Depending on the size of the microphone field and the analysis of the algorithm used, the device can distinguish frequencies from about 400 hertz. The acoustic camera will not survive even where the measured signal blends with the acoustic background or when there are no dominant frequencies in the measured signal and their levels are close to background level.

Interiors and engines are measured in the test room

Acoustic cameras can be used, for example, when monitoring noise in an open environment, such as mapping noise from wind turbines, to assess the effect of differently shaped 'propeller blades'.

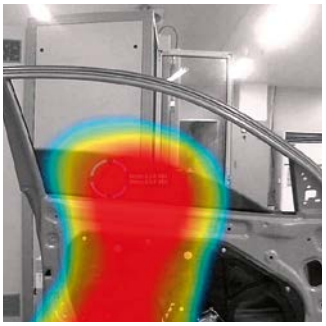
They are of course used in industry, transport and services where the proper function of various devices is associated with a particular aural accompaniment whose change may indicate a malfunction. They can also be used to detect acoustically weak spots on the facades of buildings.

Jaromir Kejval, Head of the Testing and Simulation Department, adds some practical observations and experience directly from the testing room: "This innovative test facility also greatly facilitates and accelerates the work of our customers and ourselves when it's not clear where the cause of the unwanted sounds is located. Due to ever-increasing comfort requirements, especially in interiors (in practice, this area is called NVH - Noise, Vibration, Harshness), it is also increasingly important in the perception of users," he explains.

"This type of device is another positive step towards a better understanding and explanation for non-professionals as well in the field of acoustics. The graphic output and clear visualization of noise sources are often positively evaluated by customers. Sometimes the search for the sources and causes of noise can be a bit like detective work, but that makes it even more interesting to us; and now we have another strong helper in the lab, thanks to the acoustic camera," Kejval concludes. ■

POSITION, VOLTAGE, ENGINE SPEED

In addition, you can attach recordings from a variety of other sensors to the sound recording. For example, they can record the angle of rotation in the space, the voltage and current level, or the engine speed. Which is precisely the case that it used at Swell the most. They use the acoustic camera for the noise analysis of the tested components.



Acoustic cameras mapping noise from wind turbines, to assess the effect of differently shaped 'propeller blades' on noise.

Technology

TESTING: RE-ACCREDITED

One hundred and fifty-one. That is the number of accredited tests that Swell performed so far. Without difficulty, it maintained its already conquered territories and added a number of new ones, for example, those related to the emissions of plastics in interiors.

The Swell testing laboratory is in full swing adding sets of new accreditations. Two stages took place this year in Podkrkonoší, the first in February and the second in June.

Quality Manager Martin Hobza does not hide his pleasure at the successfully increasing number of new tests: "Accreditations play an increasingly important role at our development testing laboratory. The number of test procedures is constantly increasing and their accreditation is increasingly being monitored by customers. Today we have 151 accredited standards." That is a very solid number, especially compared to the past. Swell entered accreditation in 2009, when it had 31 accredited standards within seven test procedures.

And what was the result of this year's first re-accreditation? "We have defended 26 test procedures and added five new procedures, which include 34 new standards. I am very glad that we managed to pass without remarks even for test fields that are entirely new to us, such as tests of chemical resistance. We also accredited other automotive standards for General Motors, Renault/PSA or Volvo. In addition, we managed to get accreditations for Chinese and American standards," Hobza says.

Other additions to the portfolio of the Swell testing laboratory include the first accreditations of TL standards for Volkswagen, accreditation of the "splash water test", which uses Arizona dust mixed in water, or all ingress protection tests.

The second series of re-accreditations took place in Hořice in June: the Swell testing laboratory added tests related mainly to interior parts.

"Through this, we followed up on the big re-accreditation in February. In February, there was a complete replacement of the group of professional evaluators of the Czech Accreditation Institute and all our tests were re-evaluated. After several months, we requested further expansion of the scope of provided tests with a new field – tests that characterize the emission behaviour of materials," Hobza describes.

Emission tests, like many other tests, differ from one manufacturer to another. "Our facility predominantly tests parts produced by Volkswagen, but we also accredited standards of other car manufacturers, such as General Motors, Renault, Daimler, Volvo, Jaguar Cars and Land Rover. By extending this accreditation, we added five new test procedures containing eighteen standards to the existing scope. In total, we now offer 151 accredited tests," Hobza says and adds one more thing that the Swell testing laboratory plans for the future: "It is a flexible accreditation scope, with a degree of freedom within parameters, and with the possibility of updating all types of accredited standards. We plan to implement flexibility at the end of spring next year."■

FOR BETTER AIR IN THE CAB

In the automotive industry, it is naturally mostly about the emissivity of interior parts, which are primarily made of plastics and textile materials. This is covered by tests that determine the emissions of organic substances (total carbon), formaldehyde content, or the condensible constituents (the so-called fogging test). There is also an odour intensity test. "It is therefore a test of the behaviour of materials, which are rapidly perceived by the car passengers in the interior or which can affect human health. Apart from interior parts, these also include the components that bring air into the cab," Hobza says.

Technology

Do you know how to test the burning rate of various car parts, or what a chemical resistance test entails? We asked Jakub Hak from the Swell testing laboratory.

We test operating chemicals, such as fuels, most often.

WE IGNITE, EXTINGUISH, EVALUATE

Most tests aim to verify a property of the tested part or material and compare the result with the requirement of a standard. For this purpose, the facility performs chemical resistance tests, determines the burning rate or evaluates changes of colour, gloss or overall appearance after being exposed to heat, light, etc. Through national, international or internal standards, all car manufacturers specify requirements for the suppliers of individual parts, which have to be met by the part in order to be used for car production. Even though requirements for tests usually vary as per the standards of manufacturers like VW, PSA or GM, they are all intertwined in principle. For example, when determining chemical resistance, everyone is mostly interested in how the substance acts on the surface of the material: whether it becomes damaged, fragile, faded, if the gloss changes, if the substance leaves a stain on the surface or causes paint swelling.

The group led by Jakub Hak deals with tests of the chemical resistance of interior and exterior parts. “Mostly we test operating chemicals. By that I mean, for example, fuel, such as commercial petrols, standardized petrols according to various standards, mixtures of petrols with different ratios of ethanol or methanol, and also diesel fuel and again its mixtures with a bio-component. Other liquids mostly include engine, gear and other oils, brake fluids, coolants or washer fluids,” Hak describes.

According to the technicians’ experience, brake fluids are very aggressive compared to other fluids. For example, brake fluids can cause blistering or softening of the paint of painted parts. “The same problem is with the E10 fuel, which is petrol with 10 % of ethanol. It is interesting that the fuel causes these problems only in this concentration, other ratios do not lead to paint damage or staining,” Hak reveals.

The purpose of these tests is therefore to determine if contact with chemical substances causes staining, paint cracking or other damage on the tested part, paint or surface treatment.

Bird droppings

The location of parts on the car naturally makes a difference. If, for example, the part is from the engine compartment, it is also tested at increased temperatures to simulate real operation as much as possible.

Tests are basically limited to the most frequent cases – it is not the case that car manufacturers “protect” themselves by ordering tests that are very unlikely to happen in real life. “It is truly mostly about the operating substances, the most dangerous of which is usually sulphuric acid, i.e. the battery electrolyte. But it is true that the chances of spilling in the car are probably minimal here,” Hak says.

Interesting are substitutes of other things, such as bird droppings. “That is a very frequent test. Each manufacturer has its own prescription to simulate the excrement. It is made either from pancreatin, i.e. pig pancreas, or, according to a different standard, from gum arabic. The substance is then applied to a painted part, heated, burned, removed and the paint reaction is determined.”

THE TESTED SUBSTANCES OFTEN INCLUDE GLASS CLEANERS, SUNSCREENS OR HAND CREAMS.

Sunscreen from Volkswagen

Standards also determine combinations of the substance and location in the car. “Depending on where the part

is located in the car, a set of substances to be tested is assigned. Typically, that means petrol on the body, but not on the dashboard, because it is not expected to get there."

Inside, for example, we test Coca-Cola and coffee or glass cleaners. We often test sunscreens or hand creams. "Volkswagen, for example, and other car manufacturers even have standardized creams that we purchase directly from the recommended manufacturer. BMW is strict about using their own maintenance products," Hak says and continues describing different manufacturers: "Tests vary by car manufacturer, each one deals with it a little differently. For example, we had a Japanese manufacturer here, which requested to replace Coca-Cola with a sweet drink specific to the Japanese market. We actually had it delivered from there."

Drip, pour, immerse

What happens when the test fails? "It happens sometimes – the surface becomes cloudy, there is a stain or the surface swells. It is a sign that the chemical reacts with the surface finish of the part, such as the paint. Then we usually do a second round, where the same part, let's say after correction, is tested again."

Jakub Hak also describes the specific test procedure: "We start with small amounts – drop tests. We apply small drops on the sample, leave them to act for half an hour to one day, according to the assignment. The substance is then removed and the consequences are determined, as I described. In the case of larger quantities, the substance is poured, splashed or sprayed on the test parts – some car manufacturers even request whole parts to be submerged in the liquid for a certain time at a certain temperature.

This is also done on electrical parts – we submerge connector sets in various chemicals and determine whether it affected their functionality." Sometimes a part is heated to the maximum operating temperature, to which it can be exposed during normal operation in a finished car.

Substances are often applied using a cloth, so the surface is basically rubbed. This is used for detergents, such as industrial alcohol, benzine, etc. Even here, everything is governed by standards – the cloth is soaked and a defined number of standardized moves is performed with a friction finger on the surface of the tested part. We watch if the surface rubs off, if the paint soaks in the cloth, if the liquid dissolves the part surface, if there are traces of the part on the cloth, and so on.

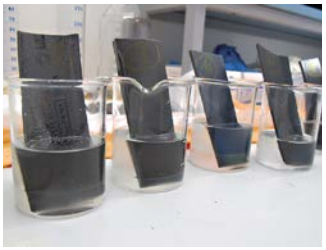
If you have ever travelled with small passengers, you might ask the practical question: is chocolate and such tested? "It would be interesting, but we have not come across such a request yet," laughs Hak.

Burn slowly, burn well

Other tests that are targeted in Hořice are related to fire: flammability tests determine the burning rate of parts. "It is one of the requirements for interior parts, which have a specified maximum burning rate (usually 100 mm/min), and part manufacturers are obliged to declare that their products comply with this limit, because the lowest burning rate means greater safety for people inside if there is a fire," Hak says.

These tests are performed using a special device, into which a place cut from the finished part is inserted, ignited and allowed to burn for a specified time. We then measure the time and burned distance.

To conclude, there is one more group of tests offered by Swell: emission characteristics. These tests essentially determine the emission of chemical substances from interior materials or parts. The most common are hydrocarbons. "We examine emissions of condensible substances, so-called fogging, where we measure the weight of substances released from the part and condensed on an aluminium foil under certain conditions. Using gas chromatography, we are able to detect released organic substances in micrograms per gram of sample; it is basically a trace analysis. Spectrophotometrically, we determine the formaldehyde content. The last of these four tests is the odour test, where we actually smell and detect the odour produced after heating and evaluate it according to a scale in a standard," Hak says, concluding our conversation. ■



DO YOU SWEAT? EVEN THAT GETS ATTENTION

Another interesting substance tested at Swell is human sweat. It typically concerns interior parts – a sweaty person sits in the car, brushes against the armrest and so on. Tests are performed on substitute human sweat with an acidic as well as alkaline base. "Acidic sweat is usually based on acetic acid, a very dilute solution, about one volume percent. The alkaline version is based on ammonia and sodium chloride. It's not all about the composition, pH is important. We prepare and mix the solutions ourselves, always according to some standard," Hak explains.

THE SAME, ONLY DIFFERENT?

If the customer does not wish otherwise, staff usually choose the most popular and widely used brands, such as Sonax, Castrol, Shell, etc. How do you deal with the fact that many products have a different composition for Western and Eastern markets, i.e. Coca-Cola here is not the same as Coca-Cola in Germany?
"We are not concerned with this and purchase all these global products in the Czech Republic," Hak says.
Are any brands stricter?
"I wouldn't say that. For example, premium brands have a wider variety of substances, but as far as strictness or criteria are concerned, there is no difference."