NOISE TESTING
EFFICIENT SOLUTIONS
FOR PREVENTING BRAKE NOISE.
THE CHALLENGE: ELIMINATING NOISE

Tyres screech. The driver slams against the seat belt. The smell of rubber fills the air. When a vehicle brakes at high speed, bringing more than 1½ Tonnes of total weight to a sudden halt, enormous forces are released. These forces cause components to vibrate, which in turn creates brake noise – ranging from a barely audible 10 db, to upwards of 120 db, or the equivalent of a jet aircraft firing its engines.

As world leading brake friction manufacturers, we apply all of our technical know-how to address the underlying causes of brake noise, and to develop solutions that ensure quiet and comfortable operation under all conditions.

Nowadays most cars are fitted with disc brakes and pads which, as dry friction, automatically generate vibrations. In the low-frequency range, these vibrations translate into humming, groaning or grinding sounds. At higher frequencies, people refer to squeaking or the sound of wire-brushing. The frequency and noise is influenced by a range of factors: the level of contact between pads and other material, the contact speed, temperature and applied pressure, the duration of the braking application, and the type of components involved, as well as their vibration and dampening behaviour. In addition, there are external influences beyond the manufacturer’s influence, such as air temperature, humidity and other environmental factors.

All parts of the brake and car body are involved in the noise build-up, right down to the rubber brackets on the chassis, and even the wheels and tyres. Depending on the design, size and properties of each part, the effect is different each time. While the brake disc acts like a loudspeaker to transmit the noise to the environment.
### NOISE TEST DYNAMOMETER

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. speed, velocity</td>
<td>ca. 240 km/h</td>
</tr>
<tr>
<td>AC output</td>
<td>-20 °C to +50 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>15 – 85%</td>
</tr>
<tr>
<td>Rated output (power)</td>
<td>200 kW/h</td>
</tr>
<tr>
<td>Air stream</td>
<td>2,400 m³/h</td>
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</table>
THE CAUSES:
LOCALISE AND UNDERSTAND

At TMD Friction we have been investing heavily in research and development for over 135 years. Our technical knowledge and expertise is used to influence vehicle development from a very early stage – helping to ensure that the ideal braking solution is ‘designed-in’.

We test materials for strength, friction level, natural oscillation and dampening properties. Our brake pads are constantly optimised for shape, formulation and strength. And we apply a range of secondary measures such as bevelling, adding grooves, or an intermediate layer in order to eliminate any residual disruptive Noise.

When it comes to installation, using an adhesive foil or spring clips can help the brake pad remain in the correct position in the caliper whilst shims and grease can help to change the frequency of vibrations in the brake system. In very noise sensitive brake systems we combine different measures to achieve the best results.

E.g. Q+ dampening shim
MEASURES: TESTING SOLUTIONS

Using our state-of-the-art dyno, we are able to accurately measure the performance of different solutions. In an example test, we performed 1,912 braking procedures – using brake pads with and without dampening plates. On the procedures without dampening shims, we recorded 180 incidences of disruptive noises above 100 decibels – that’s the same as the noise generated by a jackhammer. We also recorded 230 results above 95 decibels – or the equivalent of a lorry driving past. In fact, the overall score for procedures without dampening plates was just 2 out of 10 (with 0 being the worst, 10 the best.)

▶ Our results show enormous differences.
Tests carried out using a Textar pad with a dampening shim showed dramatically better results. A noise level of 70 decibels (roughly the same as a typewriter) was reached only four times.

And all louder noises were eliminated entirely — leading to an overall score of 9 out of 10.

To compare:

- The starting of a jet plane = 140 dB(A)
- Pain threshold = 130 dB(A)
- Propeller plane = 120 dB(A)
- Rock concert = 110 dB(A)
- Jackhammer = 100 dB(A)
- Passing lorry = 90 dB(A)
- Vacuum cleaner, traffic siren = 80 dB(A)
- Typewriter = 70 dB(A)
- Loud conversation = 60 dB(A)
- Normal conversation = 50 dB(A)
- Whispering = 30 dB(A)
- The ticking of a clock = 20 dB(A)
- Rustling of leaves = 10 dB(A)

Ideally a brake pad would consist only of friction material and a backing plate. However, in almost all cases, secondary measures are required to optimize comfort.

- Underlayer
- Dampening shim
- Dampening foil / dampening lacquer
- Chamfer
- Slot
- Additional measures
THE RESULTS:
NOISE NEUTRALISED

The graph compares the test results for Textar with well-known competitors. All have equipped
their backing plates with dampening shims, but with very different results. With Textar, all noise over
70 decibels was successfully neutralised. In contrast, the worst-performing competitor produced
seven results of noise over 100 decibels. Two other competitors exceeded 95 decibels. And one
competitor had more than 30 recordings of over 80 decibels, or the noise of a vacuum cleaner.
These are noise levels which would certainly affect the comfort levels for the driver.

With Textar, all noise over 70 decibels was successfully neutralised.

This noise test was performed on a dynanometer. The procedure was in accordance with the Society
of Automotive Engineers SAE J2521 standard. The test was performed on an FN3 54-25/14 brake with
a rotor diameter of 312 x 25 mm, and was implemented in a Volkswagen Passat (B7).
As a global leader in brake friction solutions, we are trusted by the biggest brands in the automotive and industrial sector to deliver effective, reliable and safe braking applications.

TMD Friction is the preferred supplier for the global leading car brands and commercial vehicle manufacturers, and we are also one of the leaders in the rail sector. Our pioneering products are also chosen to provide effective, safe braking for some of the world’s most prestigious racing series, such as The Le Mans 24 hours.

Yesterday. Today. Tomorrow.

Over a hundred years in the business have seen us grow and prosper, becoming the world’s leading supplier of brake friction. Our continued success is based on providing technical excellence, consistent quality and constant innovation through intensive R&D investment.

Tomorrow’s solutions developed today.

Developing and refining products to improve performance for quieter, smoother, more efficient and environmentally responsible braking is a continuous process. We invest more than €25 million each year to ensure we not only meet the demands of today, but pioneer the technology that will be needed for tomorrow.