

**DISCOVERING
BREMBO
SOLUTIONS**

THE FIRST 60 YEARS OF HISTORY...



A GLOBAL SPECIALIST IN BRAKING TECHNOLOGY



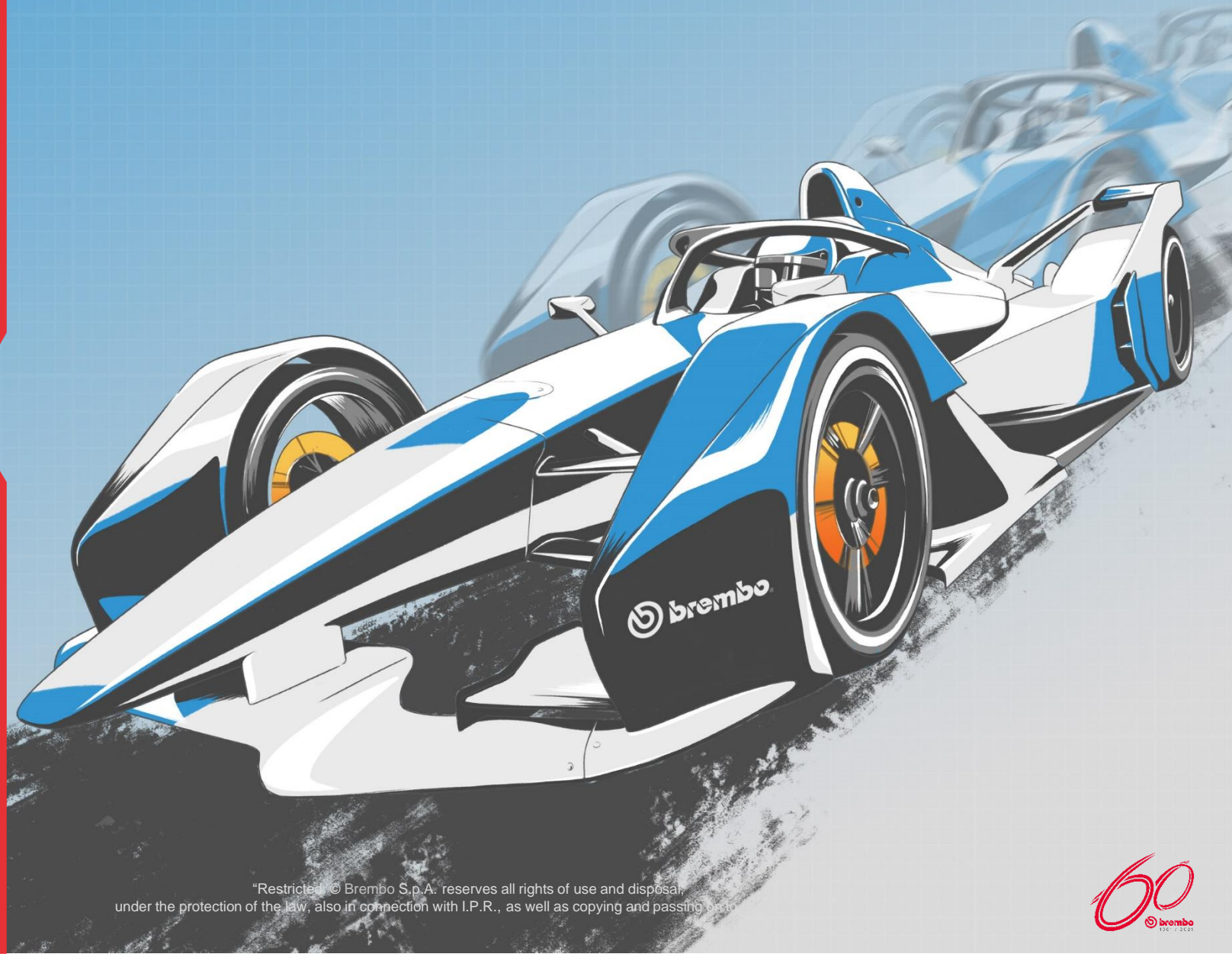
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GLOBAL PRESENCE



TRACK-TESTED TECHNOLOGY



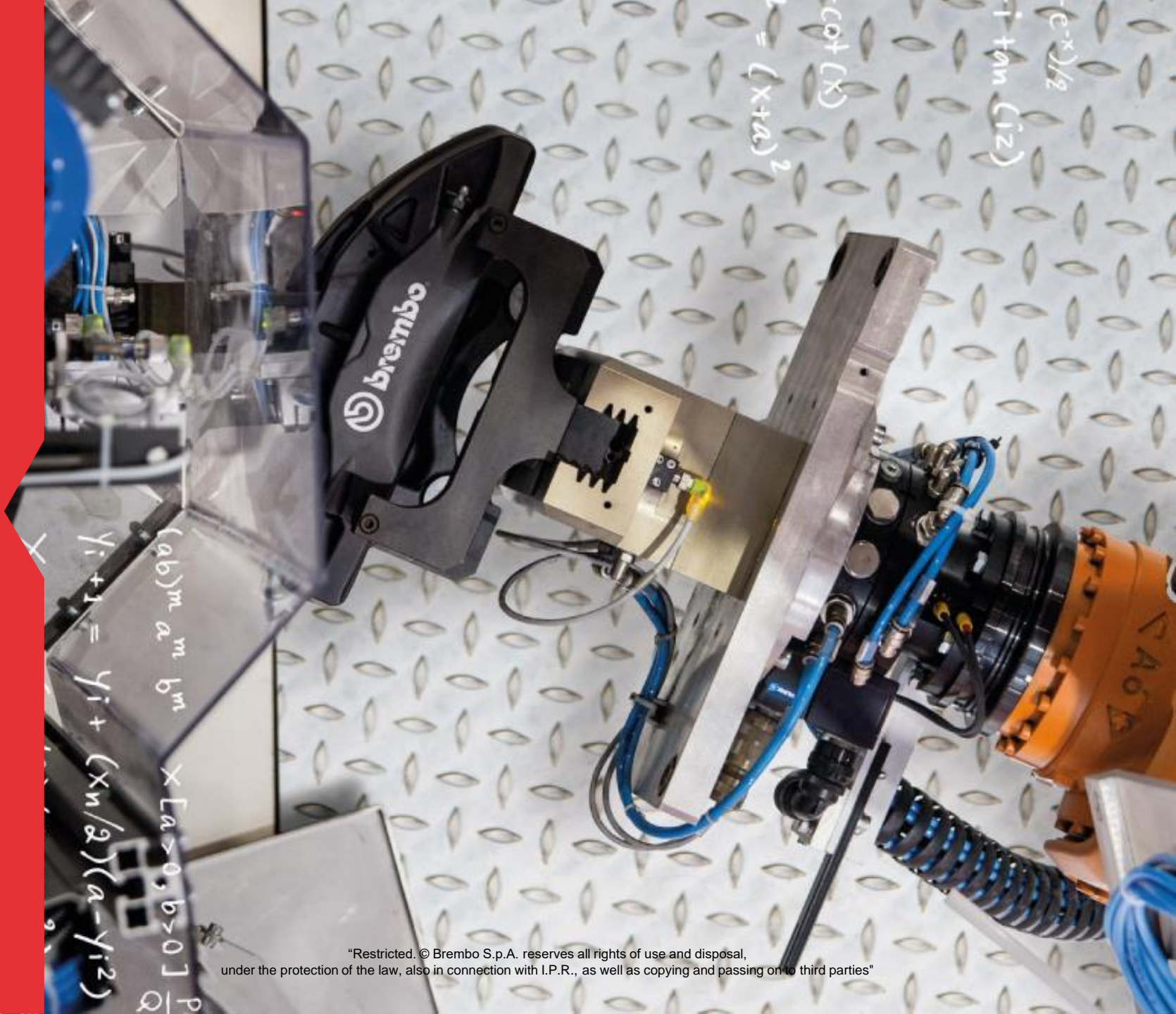
ALWAYS COMPETING

500

World titles won in 46
years.



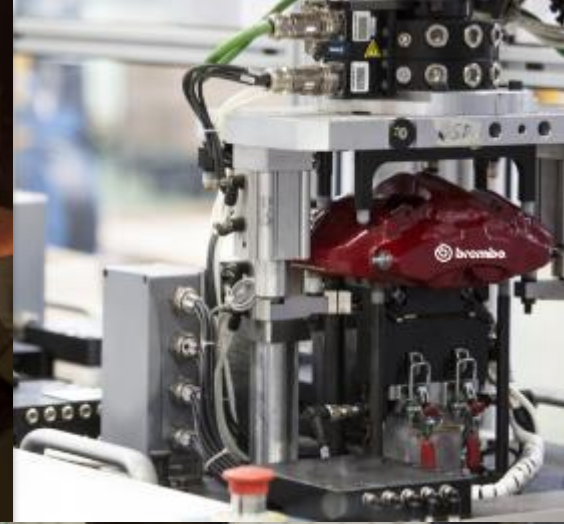
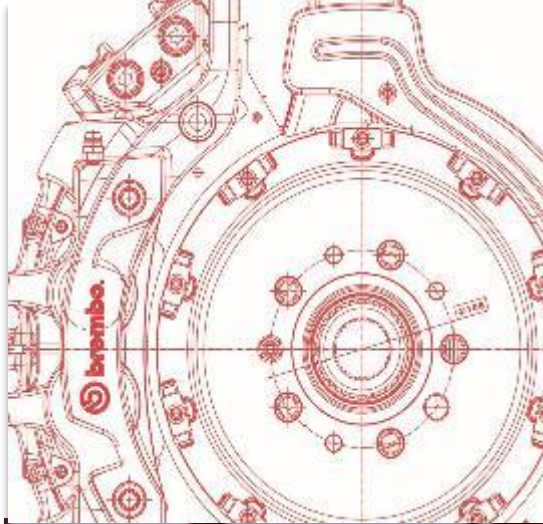
EVERYTHING UNDER CONTROL



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ALWAYS RAISING THE BAR

- ▶ Research & design
- ▶ Casting
- ▶ Processing & assembly



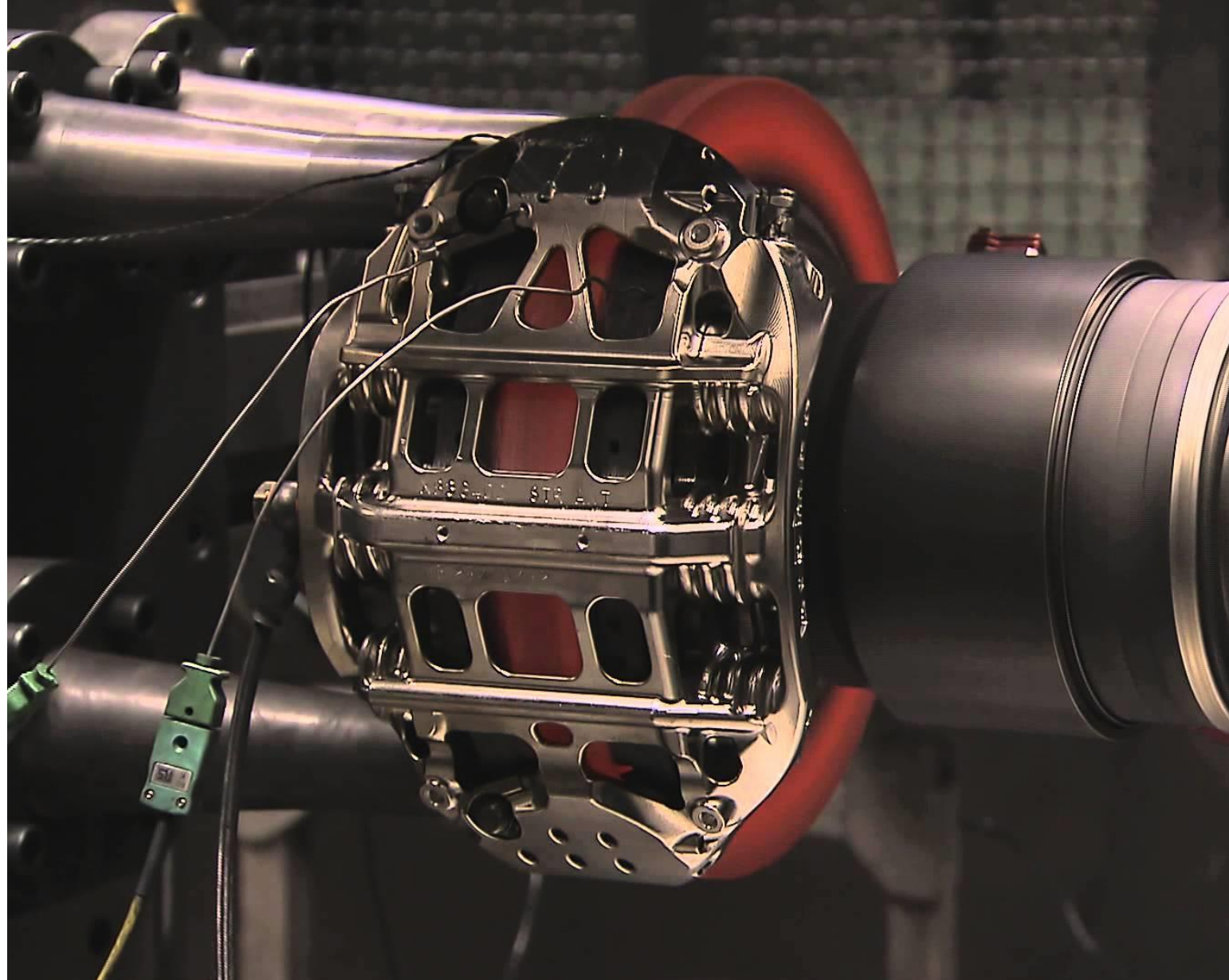
**A MILLION
KILOMETRES
FOR PERFECT
BRAKING**

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CHAMPIONS OF SAFETY

550,000

Dedicated testing
hours

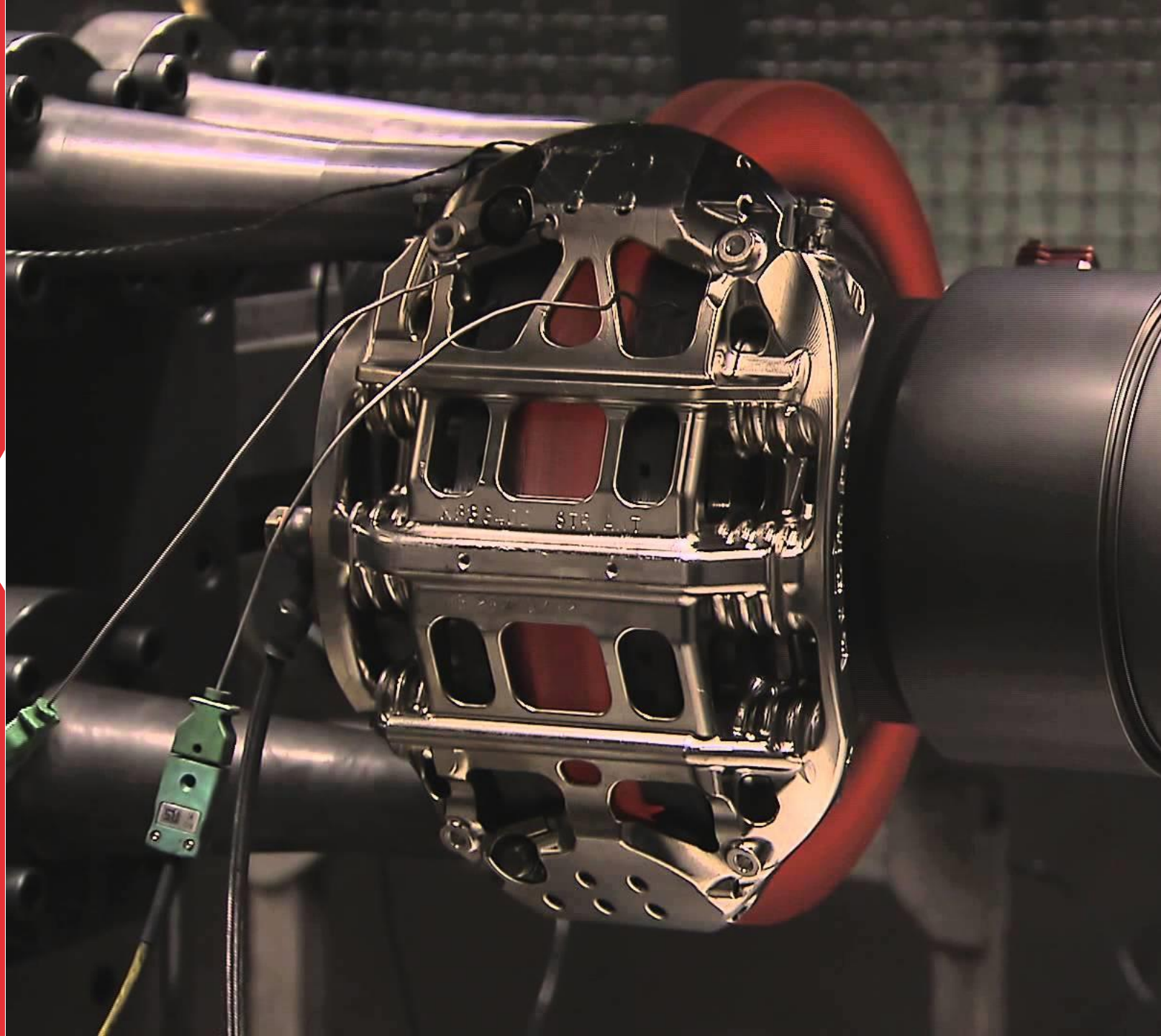


**EVERY CAR
DESERVES
BREMBO**



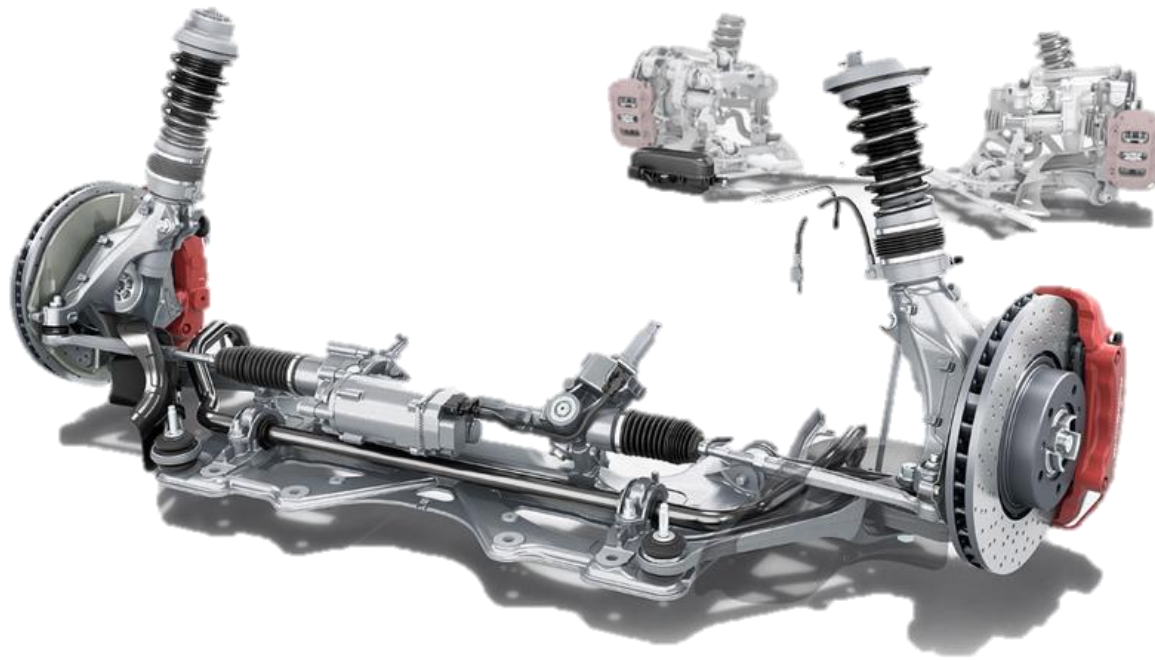
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THE FORMULA FOR PERFECT BRAKING



BRAKE SYSTEM: SAFETY COMPONENTS

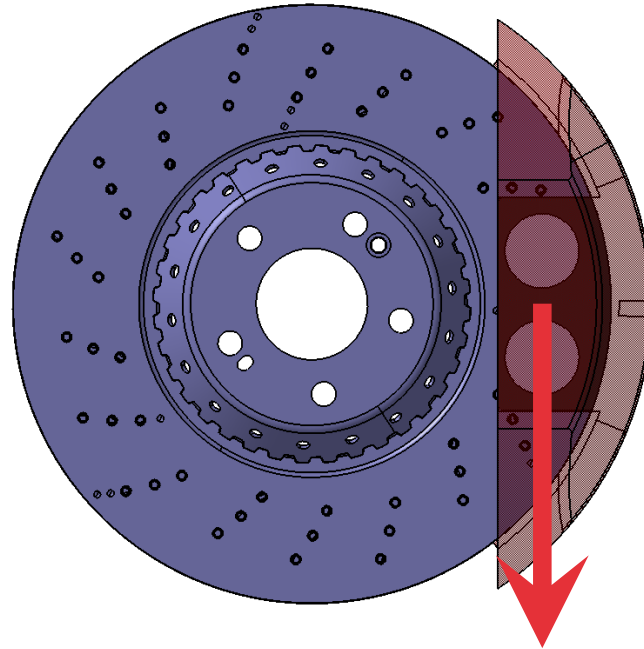
All the devices used to prevent an accident or to control the car in critical situations are intended for **active safety components of a car**.



- Brakes
- Tires
- Shock absorbers
- Lights
- Steering
- Wipers
- ABS and similar
- ESP and similar
- Obstacle detection systems

BRAKE SYSTEM: PERFORMANCE

Brakes are the most important safety component of the car. Their performance is determined by some basic parameters that are:



Braking Torque (C)

- **P** = Brake Fluid Pressure
- **S** = Brake Cylinder Surface
- **n** = Number of Cylinders
- **R** = $\frac{1}{2}$ disc diameter
- **μ** = friction coefficient disc / pads

$$C = P \times S \times n \times R \times \mu$$

Therefore the performance of a braking system depends on the **type of disc and its dimensions, the friction coefficient of the pads, the type of caliper and the pressure in the braking system.**

NVH PREVENTATIVE MEASURE IN DESIGN



NVH: WHAT IS IT?

Noise, Vibration and Harshness: these attributes define the lack of comfort in the braking system - in other terms, in the system consisting of the disc, pad and caliper.

In certain cases, the suspension components and shock absorbers can also influence the comfort of the system.

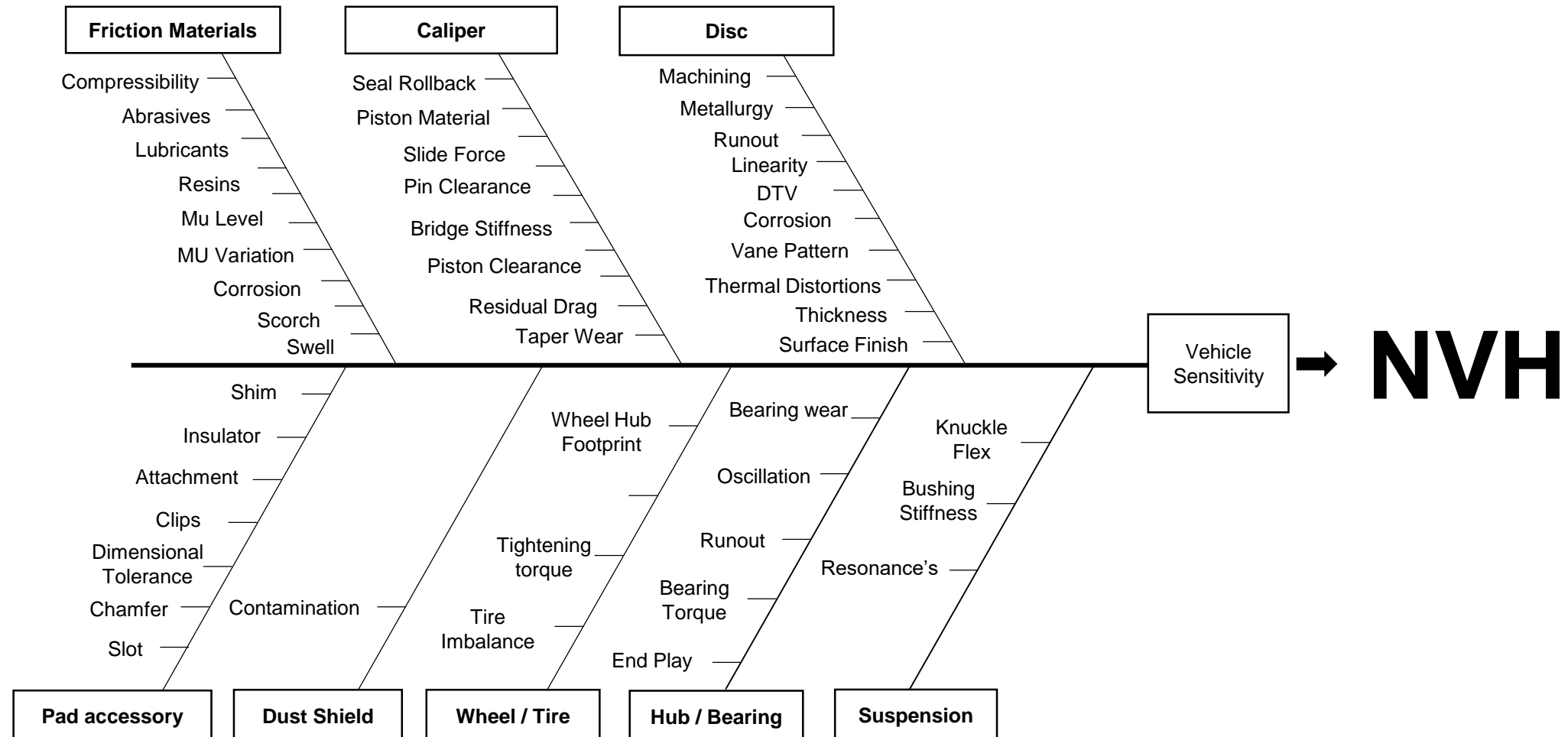
Inadequate comfort is expressed in terms of the following three factors:

- Noise (squeal, squeak, moan)
- Vibration (hot and cold Judder)
- Harshness (freight train noise)

These phenomena occur in the following conditions:

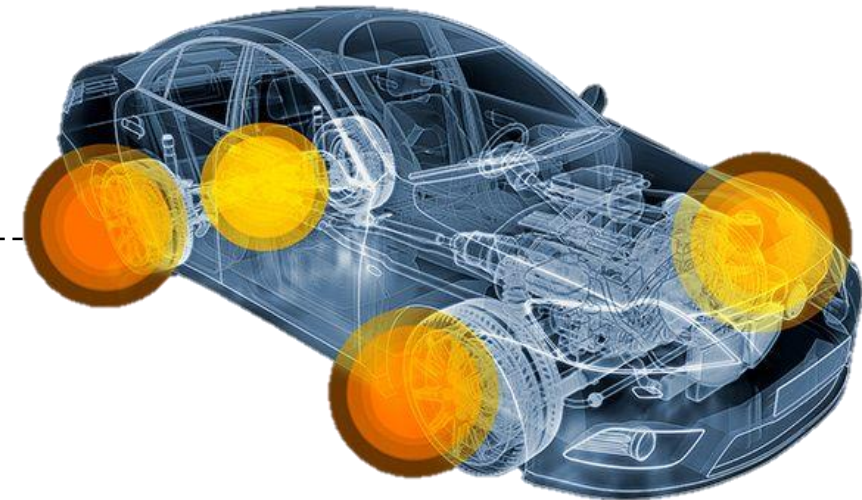
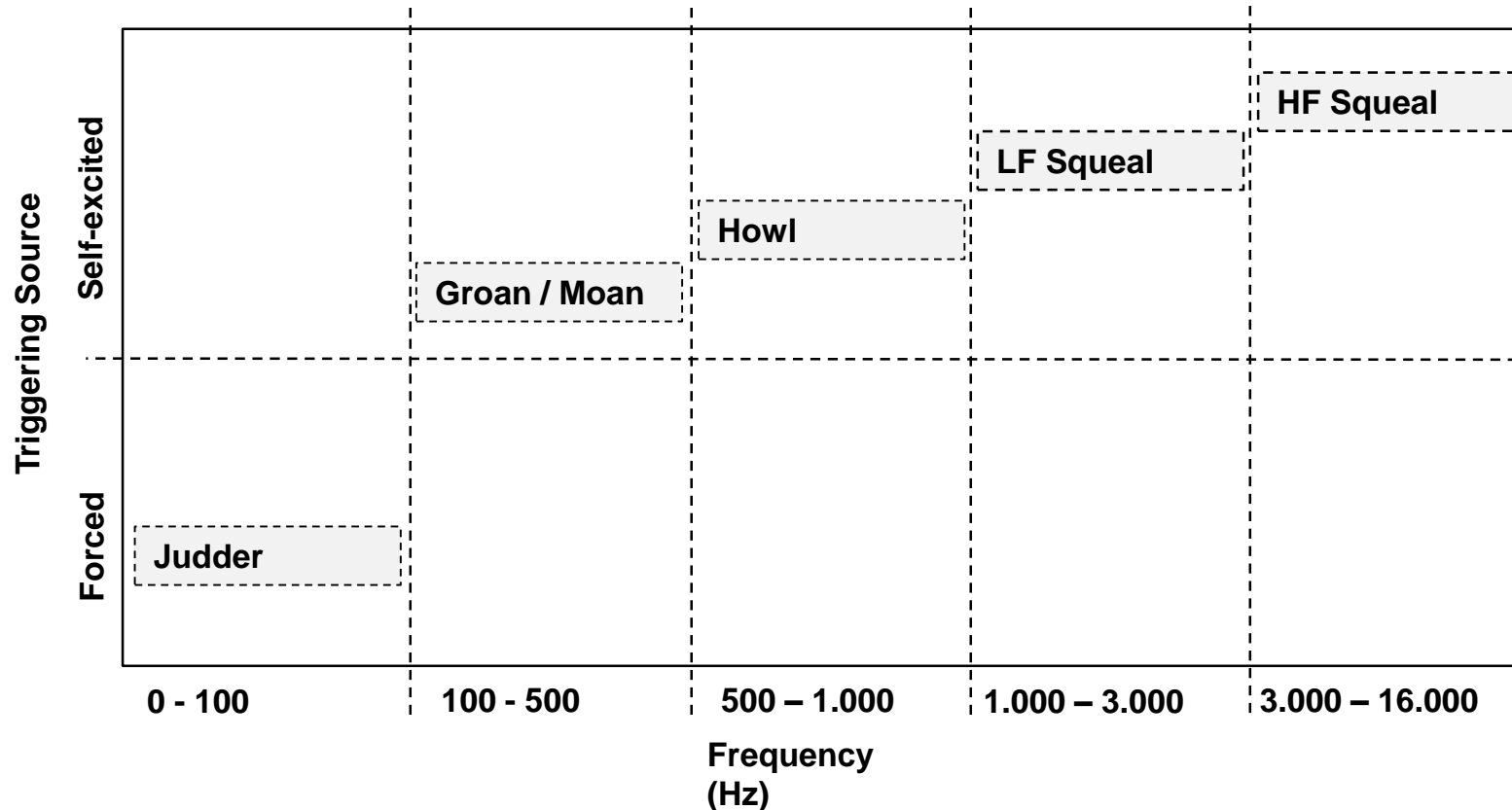
- When braking (in the majority of cases)
- In off-brake conditions (in rare cases), where there is undesirable contact between the pad and disc. This occurs especially when steering due to excess deformation of the strut/bearing/wheel hub assembly.

NVH: IMPACT OF THE COMPONENTS



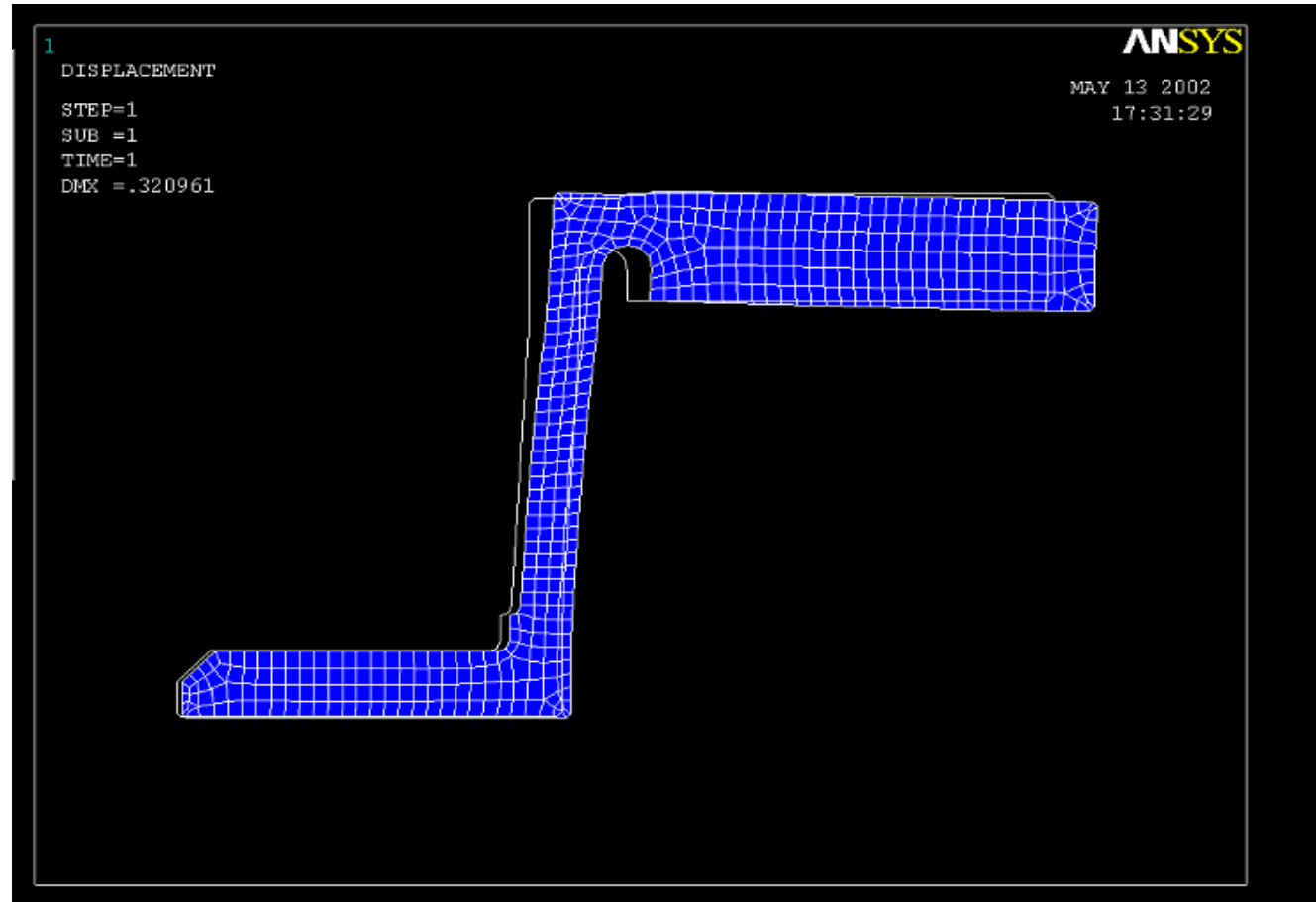
NVH: FREQUENCY RANGE

- Many phenomena with different origin and evidence, in different frequency ranges
- Acoustic impact is often the critical outcome for Customer
- The most complex and unpleasant phenomenon is *squeal*



VIBRATION: DEFORMATION AND JUDDER

- The judder is a vibration with a frequency dependent on the speed of the disc rotation.
- The origin is a thermoelastic deformation on the disc
- There are two main vibrations groups; cold judder and hot judder



NOISES: LF/HF SQUEAL

- **Type:** Low Frequency Squeal

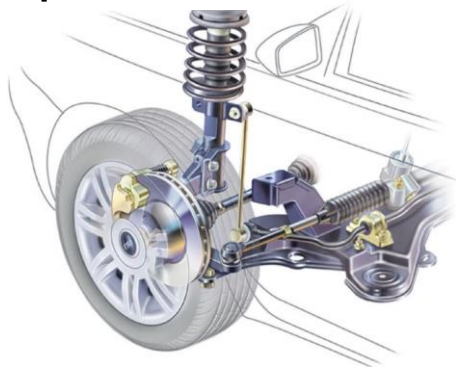
- **Cause:** LF squeal (1 ~ 4 kHz)

- ✓ Discs and pads
- ✓ Caliper and bracket
- ✓ Knuckle
- ✓ Suspension

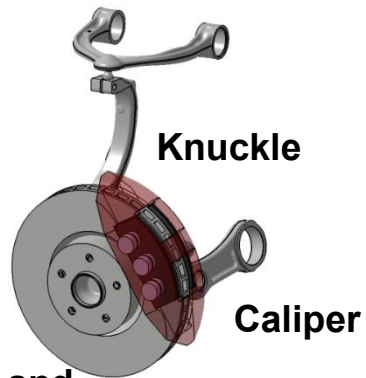
- **Characteristic:**

- ✓ Speed = 0 ~ 10 km/h
- ✓ Pressure = 5 ~ 30 bar
- ✓ Temperature = 0 ~ 300°C
- ✓ Frequency = 1.000 ~ 4.000 Hz

Suspension



Disc and Pad



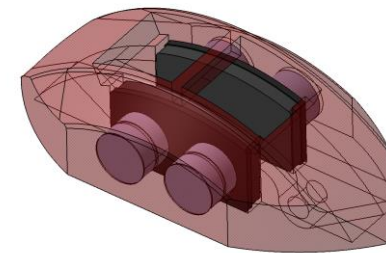
- **Type:** High Frequency Squeal

- **Cause:** HF squeal (4 ~ 16 kHz)

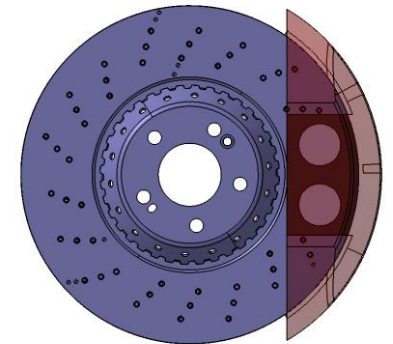
- ✓ Discs and pads
- ✓ Caliper and bracket

- **Characteristic:**

- ✓ Speed = 0 ~ 10 km/h
- ✓ Pressure = 5 ~ 30 bar
- ✓ Temperature = 0 ~ 300°C
- ✓ Frequency = 4.000 ~ 16.000 Hz



Caliper



Disc and Pad

NVH – PREVENTIVE MEASURE DISCS: MATERIAL AND SHAPE

Material:

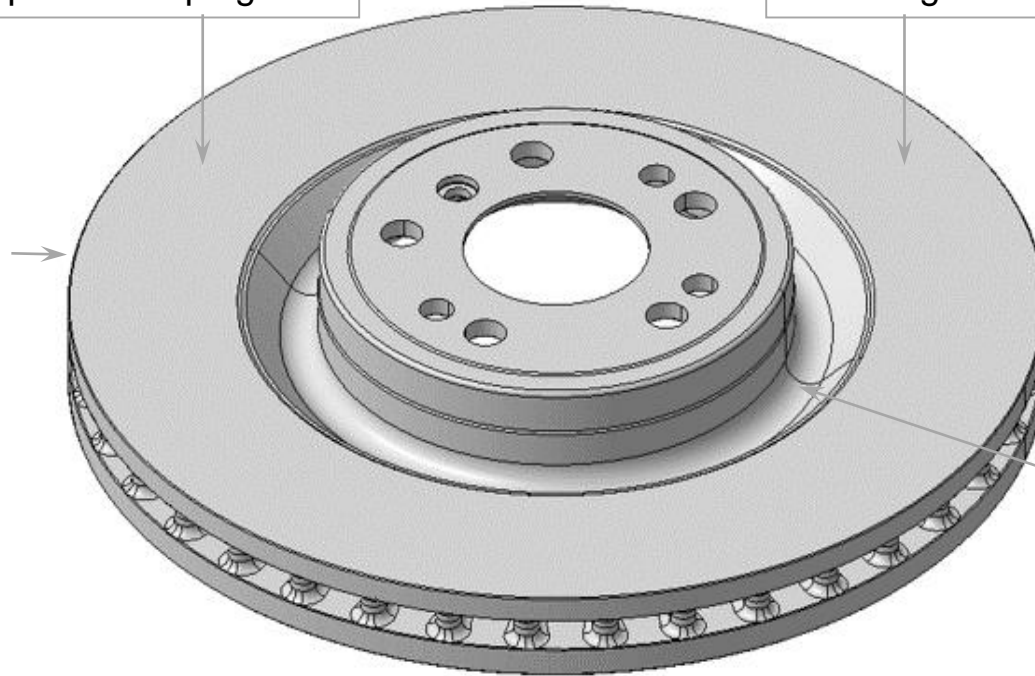
- High Carbon cast iron has a different elasticity of the standard one and can improve damping

Roughness

- Rotor finish also affects noise. The smoother and flatter the surface, the less the possibility of pad vibration during the contact with the braking surface

Run-Out / DTV

- The thickness variation and high run-out during the rotation can cause vibration and noises



Hat connection

- Different type of connection can influence the elastic deformation of the braking surface

NVH – PREVENTIVE MEASURE

DISCS: MATERIAL AND SHAPE


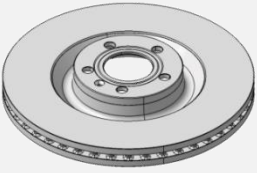
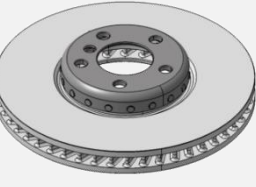
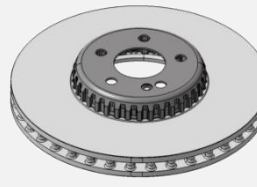
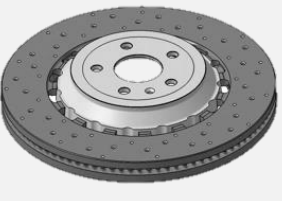
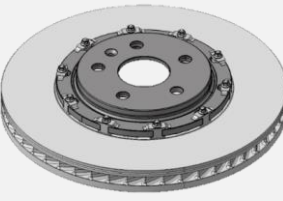



Ventilation

- Type of disc (solid or vented), type of ventilation, number, type and thickness of the ribs can influence the frequency of vibration

NVH – PREVENTIVE MEASURE

DISCS: MATERIAL AND SHAPE

INTEGRAL STANDARD	INTEGRAL HIGH CARBON	COMPOSITE ALUMINUM	COMPOSITE STEEL	FLOATING DUAL CAST	FLOATING MECHANICAL	FLOATING CERAMIC
						
<ul style="list-style-type: none"> • Low Carbon • Standard connection 	<ul style="list-style-type: none"> • High carbon • Brembo connection 	<ul style="list-style-type: none"> • High carbon • Aluminium Hub • Mechanical join 	<ul style="list-style-type: none"> • High Carbon • Steel Hub • Mechanical join 	<ul style="list-style-type: none"> • High Carbon • Aluminium Hub • Floating join 	<ul style="list-style-type: none"> • High Carbon • Aluminium Hub • Floating join 	<ul style="list-style-type: none"> • Carbo-Ceramic • Aluminium Hub • Floating join
<ul style="list-style-type: none"> • Cost 	<ul style="list-style-type: none"> • Noise reduction • Less temperature 	<ul style="list-style-type: none"> • Nose reduction • Less temperature • Weight reduction 	<ul style="list-style-type: none"> • Noise reduction • Less temperature • Weight reduction 	<ul style="list-style-type: none"> • Noise reduction • Less temperature • Weight reduction • No deformation 	<ul style="list-style-type: none"> • Noise reduction • Less temperature • Weight reduction • No deformation 	<ul style="list-style-type: none"> • Noise reduction • Less temperature • Weight reduction • No deformation • High friction

NVH – PREVENTATIVE MEASURE SUPPLYING THE COMPLETE SOLUTION

All discs are checked and, if necessary, balanced automatically during production

- Any imbalance can produce undesirable vibration.
 - Not all discs need correction.

Fastener screw's purpose is to set the disc in the right position (hub-centered), making braking system maintenance easier.

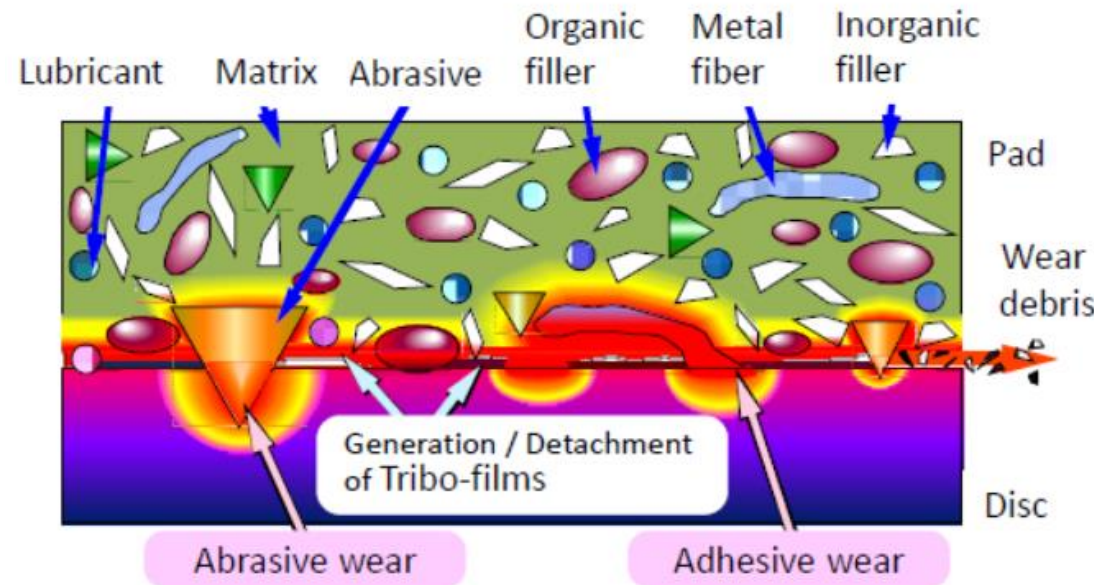


NVH – PREVENTIVE MEASURE

PADS: MATERIAL AND UNDERLAYER

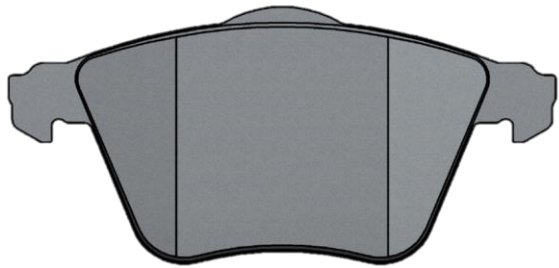
When developing or choosing a pad material, more than 20 properties are considered. Everything from density, melting point, strength (tensile, compressive, and shear), machinability, environmental impact, squeal probability, etc. should be considered.

In relation to the noise problems that most important properties are: **component mix, friction coefficient, compressibility, underlayer and backing plate**

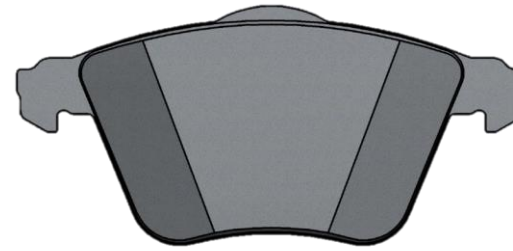


NVH – PREVENTIVE MEASURE PADS: CHAMFER

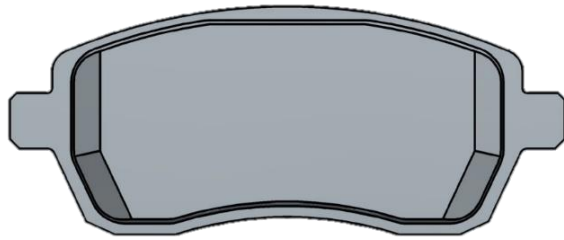
The design of the pads also influences their ability to suppress noise.



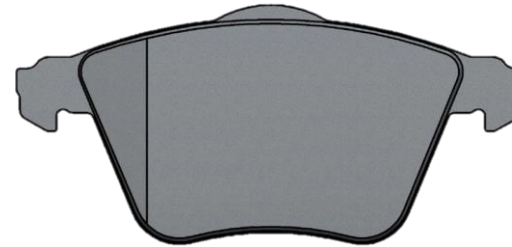
Straight chamfer



Radial chamfer



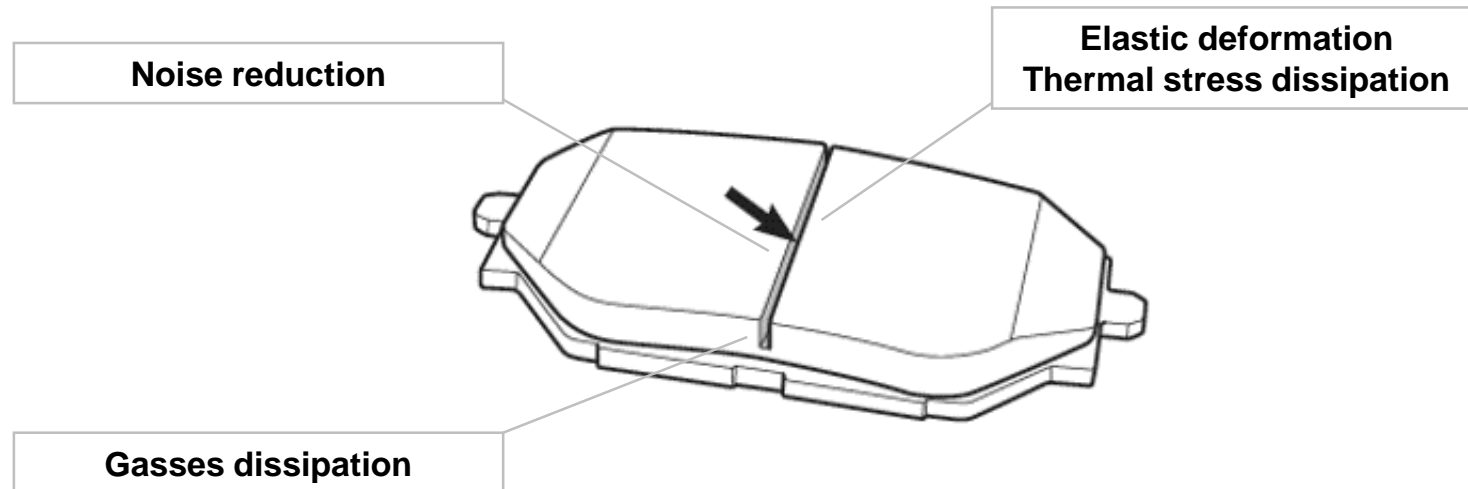
Diamond chamfer



Single chamfer

NVH – PREVENTIVE MEASURE PADS: SLOT

Why brake pad manufacturers use slots:



NVH – PREVENTIVE MEASURE PADS: PISTON INTERFACE

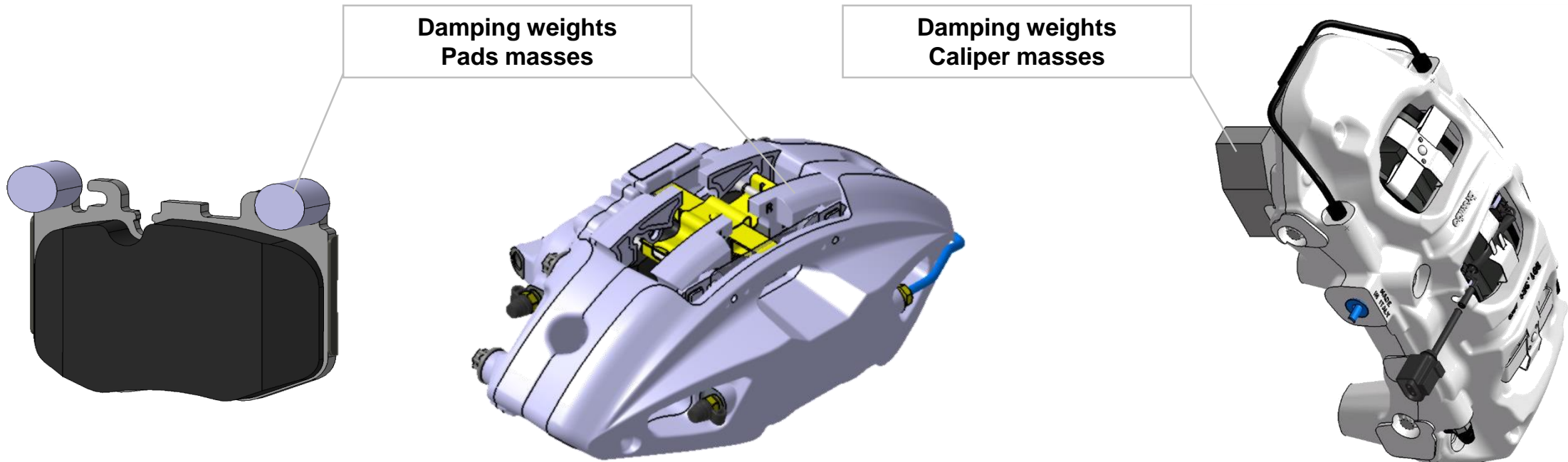
Brake pads / piston interface:

- Shim (single or multilayer made by metal and rubber)
- Rubber coating
- Double sticky layer
- Piston clip
- Brake lubricant



NVH – PREVENTIVE MEASURE PADS & CALIPER: DAMPING WEIGHTS

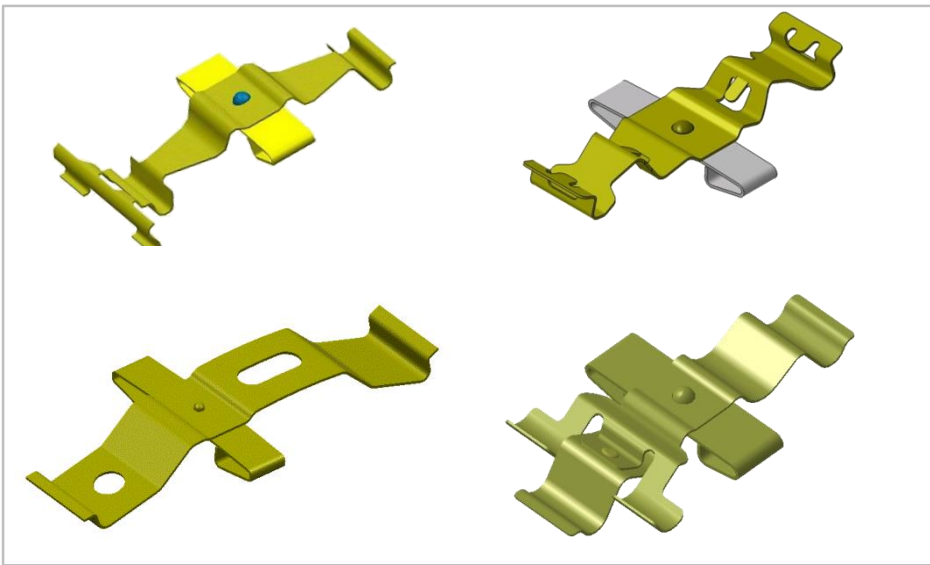
To minimize brake noises in the 1.5kHz – 2.5kHz range.



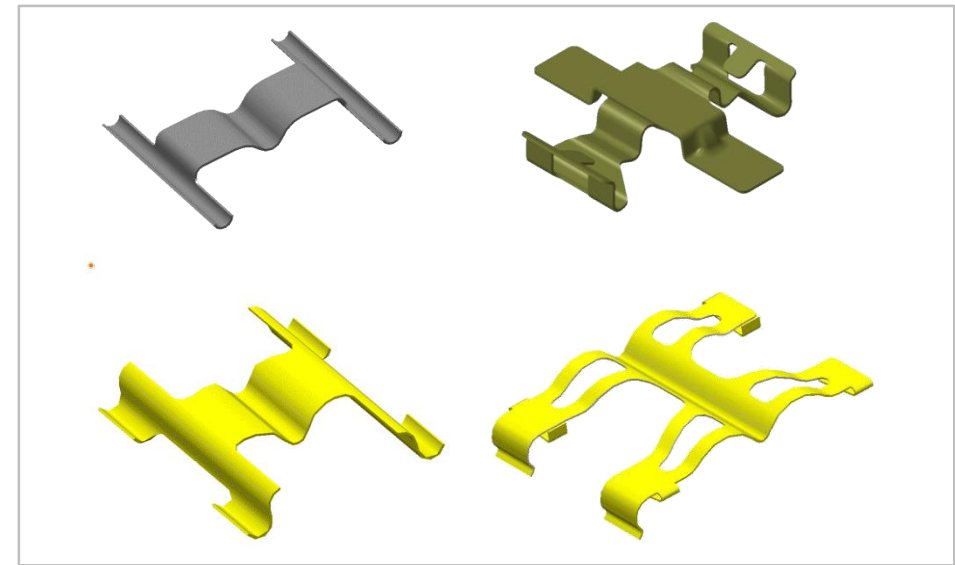
NVH – PREVENTIVE MEASURE PADS: SPRING

These springs can also be classed according to the number of their component pieces.

2 piece riveted spring



Single-piece spring



The riveted spring is normally made of stainless steel while the single piece is made with steel for the springs, with an anti-corrosion coating, or stainless steel.

NVH – PREVENTIVE MEASURE SUPPLYING THE COMPLETE SOLUTION

OE
reference



Competitor
1



Competitor
2



Competitor
3



MAINTENANCE KEY POINTS



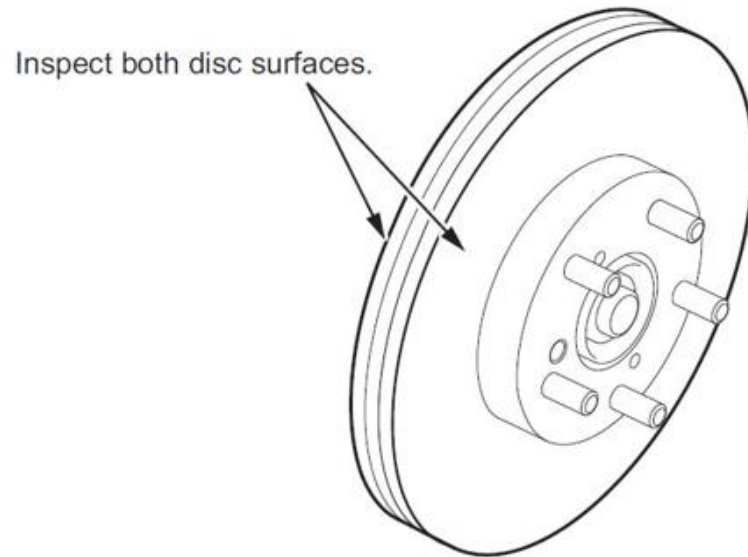
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KEY POINTS DISCS INSPECTION

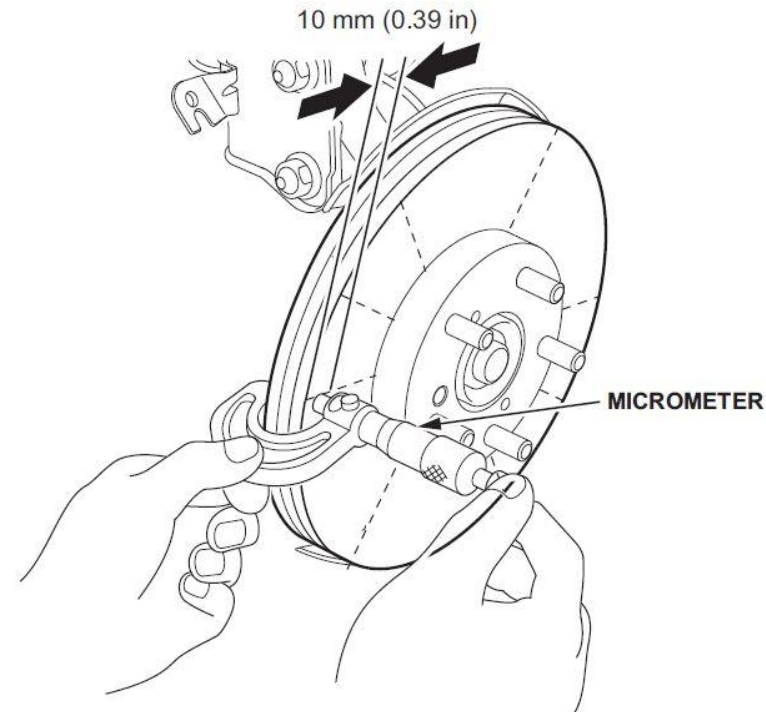
ALWAYS evaluate rotor condition and thickness

- Minimum thickness is generally marked on the rim of the braking surface or on the hub surface
- Replace if needed. Brembo do not recommend turning or grounding the braking surface



WHY?

- If rotors are below minimum thickness, they will not be able to dissipate heat correctly.



KEY POINTS

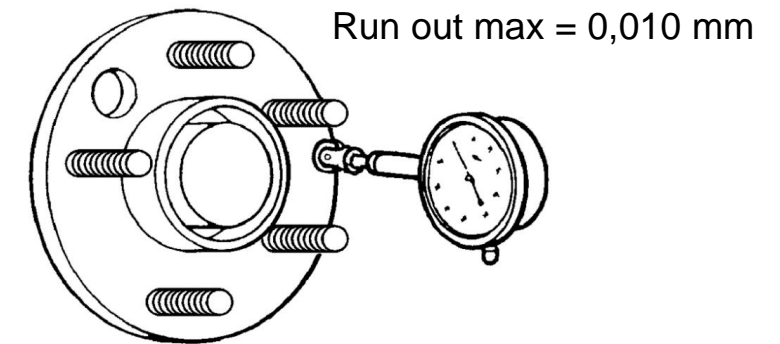
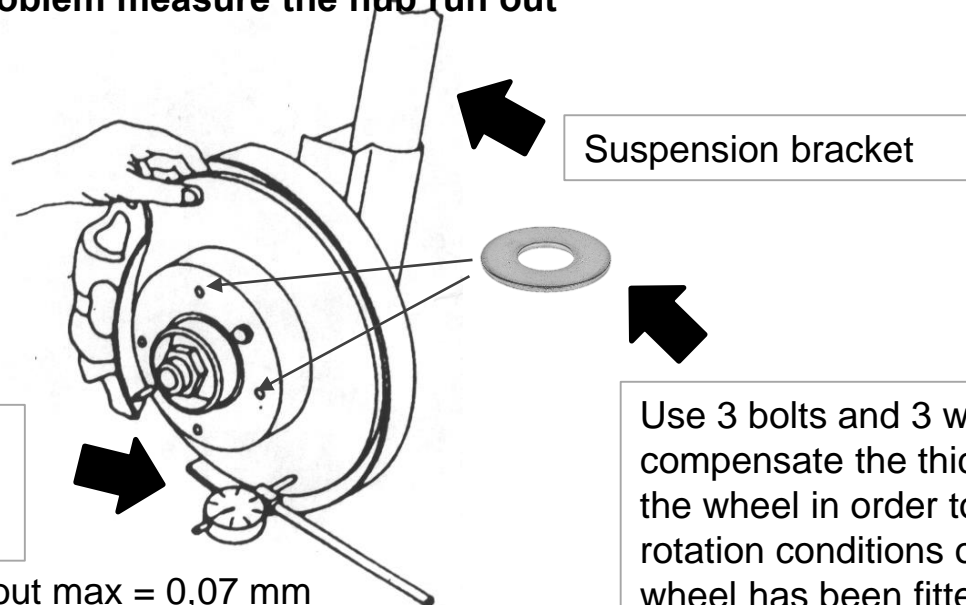
RUN-OUT CHECK

ALWAYS measure rotor before and after a brake job

- Use the specific tool to check the disc run-out
- Run out cannot exceed 0,07 mm when the disc is fitted
- Tighten the disc using the wheel screws and washers to simulate the thickness of the wheel
- In case of problem measure the hub run out

WHY?

- Run out variation can cause vibration in the brake system
- If rotors have excessive run-out there may be poor brake feel and stopping performance.



KEY POINTS HUB CLEANING

ALWAYS clean the hub before new disc installation

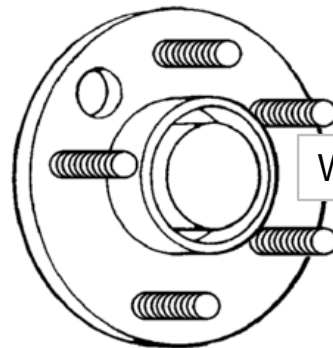
- Clean the surface of the wheel hub. Eliminate rust and other deposit with a metal brush

WHY?

- The wheel hub may have rusted
- The presence of rust or dirt can influence the disc Run-out.

Which hub cleaner?

- ✓ Metallic brush
- ✓ Hub Cleaning Tool (kind to metal)
- ✓ Specific brake cleaner



Wheel Hub

KEY POINTS

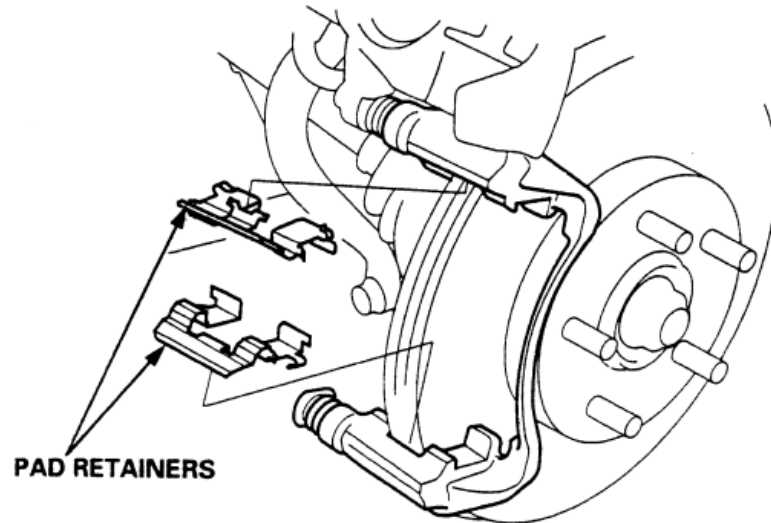
CLIPS / BRACKETS INSPECTION

ALWAYS inspect and clean pad wear clips, and support brackets

- Replace clips if needed

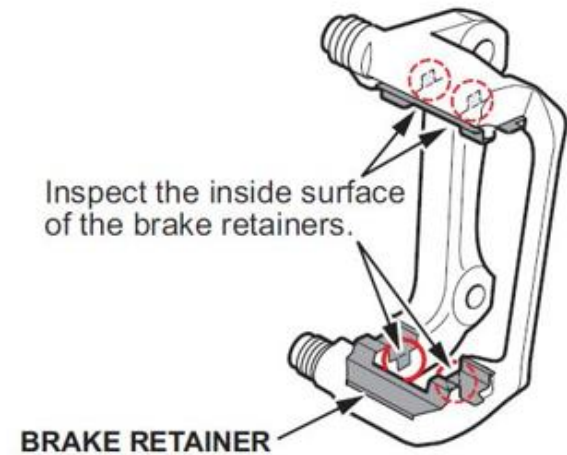
WHY?

- To ensure a smooth in/out operation when the brakes are applied



Which carrier cleaner?

- ✓ Metallic brush
- ✓ Caliper File (kind to metal)
- ✓ Specific brake cleaner



KEY POINTS

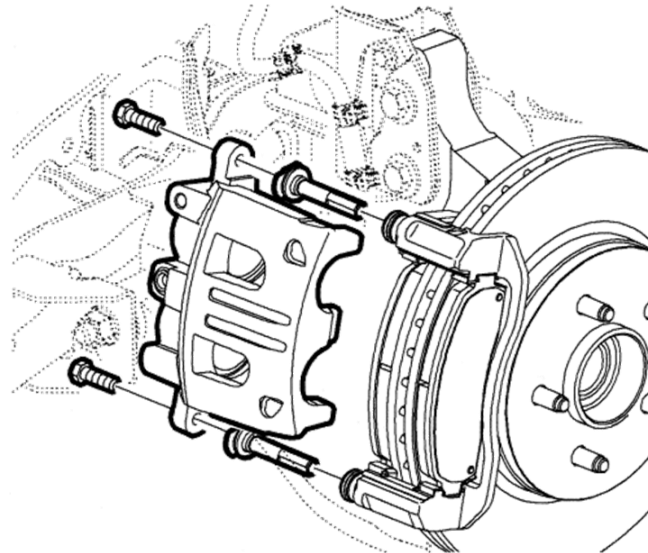
SEALS AND SLIDING ELEMENTS

ALWAYS clean and lubricate caliper slide pins, pin boots and external piston seal

- Check pistons, seals, boots and sliding elements on the caliper to ensure that they are free from damage and corrosion and able to slide
- Use specific grease suitable for each component
- Replace if needed

WHY?

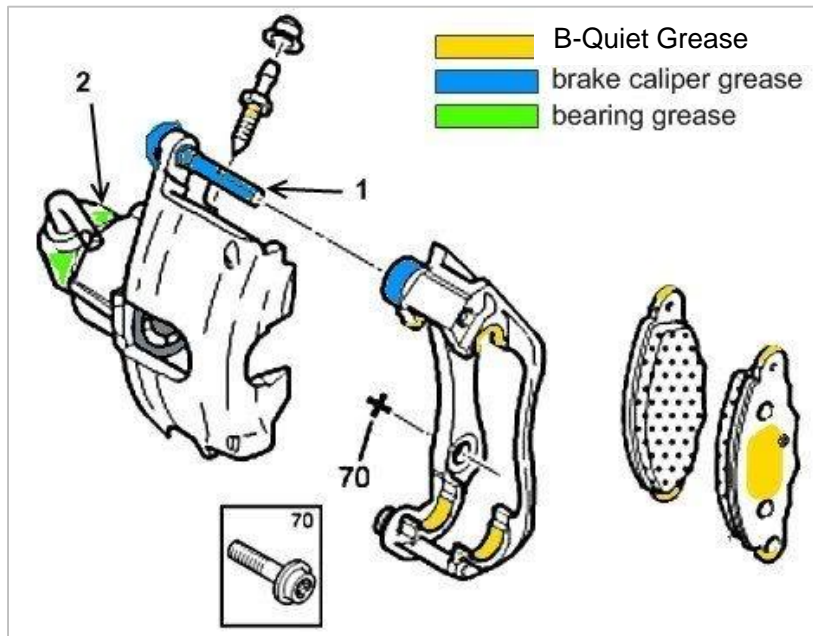
- Using wrong grease could result in premature rubber and seal failure, causing uneven caliper pressure or leaks.
- Cracked or torn rubber components can allow moisture to enter assemblies, potentially creating rust, preventing smooth operation while braking.



KEY POINTS LUBRICANT

TAKE CARE: RUBBER COMPATIBILITY (BLUE AREAS)

- Rubber parts of brake caliper (seal, boots, dust boot) are manufactured using EPDM
- EPDM is special rubber compound brake fluid compatible
- EPDM could be damaged using products that are not compatible, like mineral oil, not compatible lubricant and cleaner



BRAKE LUBES (YELLOW AREAS)

Another way to dampen noise-producing vibrations is to apply a high-temperature brake lubricant to the backs of the pads, and the points where the pads contact the caliper.

- **The lubricant must be heat-resistant** so it won't melt and run off the pads, and it must be durable so it will provide long-lasting protection.
- **Never use ordinary chassis grease** or silicone brake grease for this purpose.
- Also, do **not allow the lubricant to come into contact with the fronts of the pads**

KEY POINTS

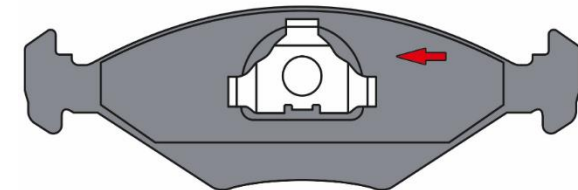
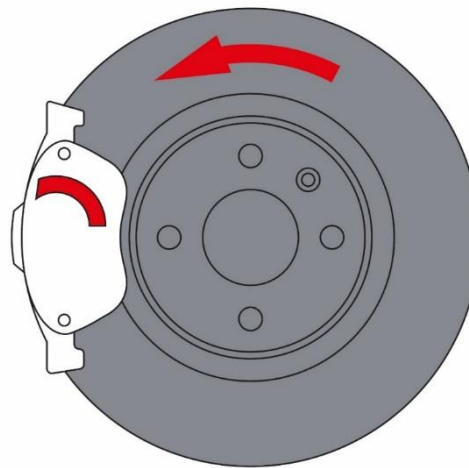
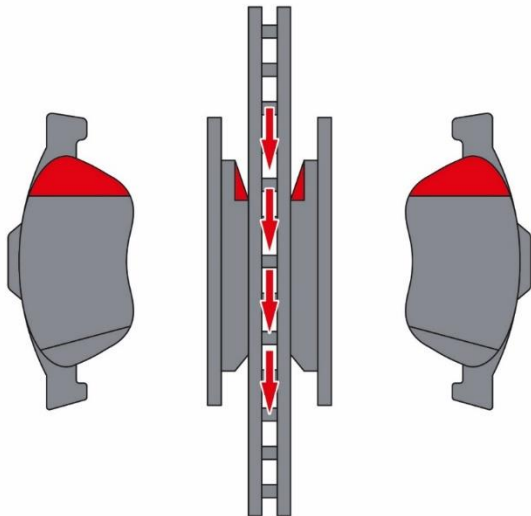
DIRECTIONAL PADS

ALWAYS check if the pads is a directional pad

- Length of electric wear indicator
- Asymmetric clip
- Different chamfer
- Shim features “Half moon” cut-outs

WHY?

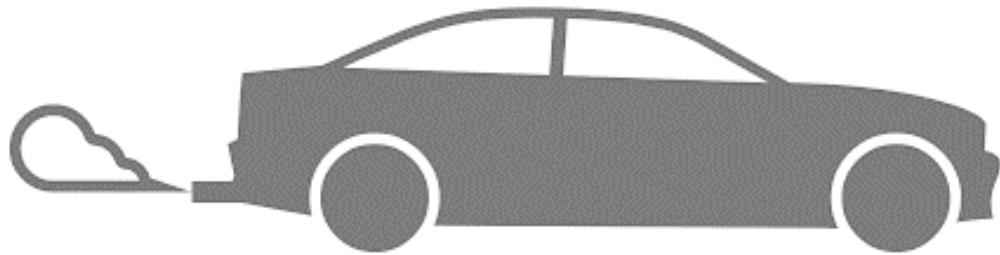
- Fitting the brake pads on the wrong side leads to noise, increased wear and possibly reduced brake performance
- Electric WI. The fitting location is determined by the length of the indicator
- Clip –asymmetric identified by the markings
- Shim with cut-outs. These enable you to displace the pressure point from the piston



KEY POINTS AT THE END – RUNNING IN

ALWAYS the mechanic has to carry out a test on the road and suggest to the driver a running in period of 300 km to be sure there are no vibrations or noises and that the brake system works properly.

- During that period short and smooth braking will be carried out to allow the correct alignment between pads and discs surfaces
- Type of stop: low brake pressure, low deceleration, low temperature, low speed (e.g. normal stop at traffic light)



Road test

WHY?

- The braking system is responsible for the active safety of the vehicle.
Its malfunction can compromise people's safety
- **During** the running-in period it is important to allow the correct alignment between the surface of the disc and pads



Running in of 300 km

BREMBO PROVIDING SOLUTIONS



WHAT ABOUT THE BREMBO PRODUCTS PACKAGING?

Stronger and more resistant than before



QR code for easy access to fitting instructions

Brembo employees, conveying the pride and awareness common to the members of a Group that makes quality and innovation its strong points

- Brembo is OE supplier of brake discs and pads and braking system
- Brembo is environmental friendly
- We are in contact with the world
- Product description in 14 languages



AUTO*i*NFORM

HEAR IT · SEE IT · TOUCH IT **LIVE**

in association with



OESAA Members

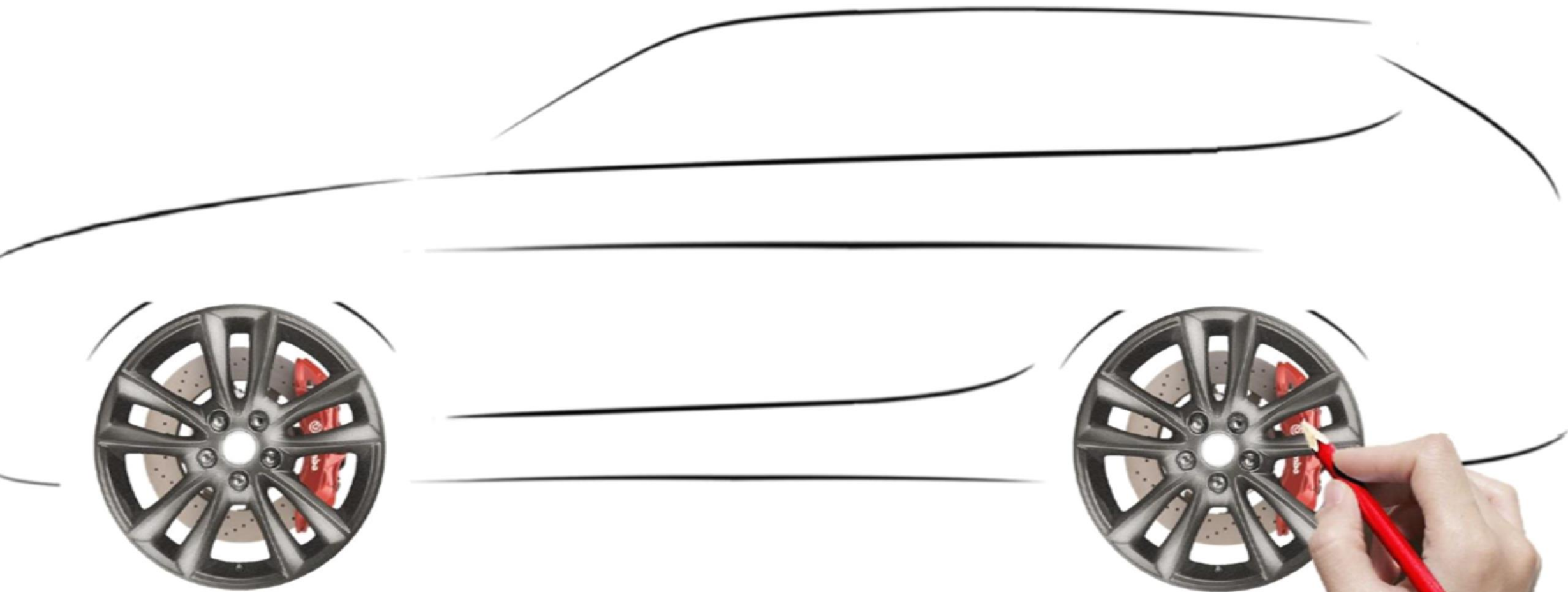


**WE ARE SUPER EXCITED
TO ANNOUNCNE THAT THE
AUTOINFORM LIVE
SHOW IS BACK!!**

Wolverhampton November 6th and 7th 2021.

Autoinform Live is an automotive technical training weekend hosted at the GTG training academy in Wolverhampton. Autoinform & OESAA have brought over 15 industry experts together delivering technical training on the very latest mechanical & diagnostic technology.

Great for aspiring Technicians, Mechanics and business owners to keep up to date with the very latest industry info. future proof your business and attend our training this year!



**THANK YOU
FOR YOUR ATTENTION**

*«Anyone can do simple things
but only a few can handle difficult ones.
We have to do the difficult ones.»*

Emilio Bombassei
Founder

