How to take on 24 hours of braking at Le Mans

Guide to the differences between the LMP1, LMP2 and GTE Brembo brakes and related critical issues during the Le Mans 24 hours

There are just a few days left until the race of the year, the Le Mans 24 Hours. This year there will be about sixty cars on the starting grid, divided into 4 different categories. The top contenders will be primarily the prototypes, subdivided into LMP1 and LMP2. Just a bit lower performance, but by no means slow, are the Grand Touring Endurance (GTE) cars, sport replicas of the fastest street supercars in the world. They, in turn, are divided into GTE-Pro and GTE-Am.
These are very different cars from one another and they also differ in the Brembo braking systems used. Let's take a close-up look at the main differences.

Carbon discs for the prototypes and cast iron for the GTE
The two categories of prototypes (LMP1 and LMP2) have in common the material the brake discs are made of carbon. This is the material that best combines heat dissipation capacity and light weight.
One of the main differences between the discs used by the LMP1 and the LMP2 cars lies in the “mounting method” of the disc to the housing. Whereas the LMP2 cars use the less costly bushing drag system (used until a few years ago by the LMP1 cars), almost all of the LMP1 cars use the more costly “spline” dragging system. This is a system that has been adapted from Formula 1 that consists in the insertion of a titanium element (housing) that connects the braking surface to the hub. In previous years ventilation was severely limited in the intake capacity due to the blocking caused by the braking surface mounts, but with the introduction of the “spline”, a sort of sprocket gear, the internal part of the disc is now open to the air flow.
For the GT (GTE and GTE-pro) cars, on the other hand, the rules strictly prohibit the use of carbon brake discs, which is why for these cars Brembo supplies composite discs with a cast iron braking surface and aluminium housing. Here the teams can choose between several types of “slotting” on the Brembo braking surfaces to find the best compromise between the braking “bite” and disc and pad duration.
The diameter of the brake discs varies greatly both between the front and rear, and based on the choices the individual teams make.
In terms of Brembo disc dimensions, the differences between the 4 categories are significant.
Here they are in the table below.

	LMP1	LMP2	GTE-Pro	GTE-Am
Front disc diameter	320-370 mm	370 mm	380-390 mm	380-390 mm
Rear disc diameter	320-350 mm	345 mm	332-355 mm	332-355 mm
Disc thickness	30-32 mm	32 mm	35-32 mm	35-32 mm
Disc material	carbon	carbon	cast iron	cast iron
Mounting	“Spline”	“bushing”	“sprocket”	“sprocket”

The temperature "unknown" for the brake discs
On the other hand, there are different risks or problems that the prototypes and GT cars may face based on the different brake disc material.
For the carbon discs, the main unknown factor lies in the disc operating temperature that must never drop below 350°C, a possibility that is far from remote, especially on the long straight stretches and in adverse weather conditions. In this case, the problems connected with excessive cooling and "glazing" of the friction material can not only compromise braking efficiency, but can even cause excessive and early brake disc wear.

In order to handle these problems, Brembo provides the teams with a friction material for discs and pads characterised by extremely low wear and by more efficient thermal conductivity. This friction material guarantees optimum warm-up times, in other words, they quickly reach the most efficient operating temperature, and they have a wide range of use, both in terms of pressure and temperature, and a very linear friction response. These are all characteristics that provide the driver with perfect modulation of the braking system. The incredibly low wear also allows performance to stay unchanged and repeatable from start to finish.
The cast iron discs, on the other hand, do not require minimum operating temperatures and are therefore immediately effective even at low temperatures. Nevertheless, cast iron is a particularly sensitive material to thermal stress, so for the cast iron discs the greatest danger is the formation of cracks due to the continuous rise and fall of the disc temperatures in the straight stretches and the hard braking sections.

Different materials for the brake calipers
Another difference is the material used to make the Brembo brake calipers used by most of the cars on the starting grid.
They are all “monoblock”, which means that they are derived from a single block of material or a mould. Beyond the various geometries selected by each team the shape of the caliper housing is designed for in order to optimise the weight/stiffness ratio, the main differences between the various categories have to do primarily with the material used and the surface finish.
To the naked eye, the main difference has to do with the surface finish: the LMP1 prototype calipers are characterised by a surface finish with a nickel coating, whereas the LMP2 and GTE category calipers are characterised by an oxidised surface.
What is not visible to the naked eye, however, is the material used to make the calipers and which differs from the LMP1 and the LMP2/GTE cars. If Brembo supplies the LMP2 and GTE cars with lightweight aluminium alloy calipers, the LMP1 cars are more demanding and they use Brembo calipers made from a particular aluminium/lithium alloy, decidedly better than the aluminium calipers used by the LMP2 and GTE cars in terms of the weight/stiffness ratio.
Brembo will equip most of the cars in all the categories, seeking to repeat, if not improve on, the triple wins in recent years. Last year the winning cars in the LMP1, LMP2 and GTE-Am categories used Brembo braking systems, as was the case in 2014 for the LMP1, GTE-Pro and GTE-Am winners.