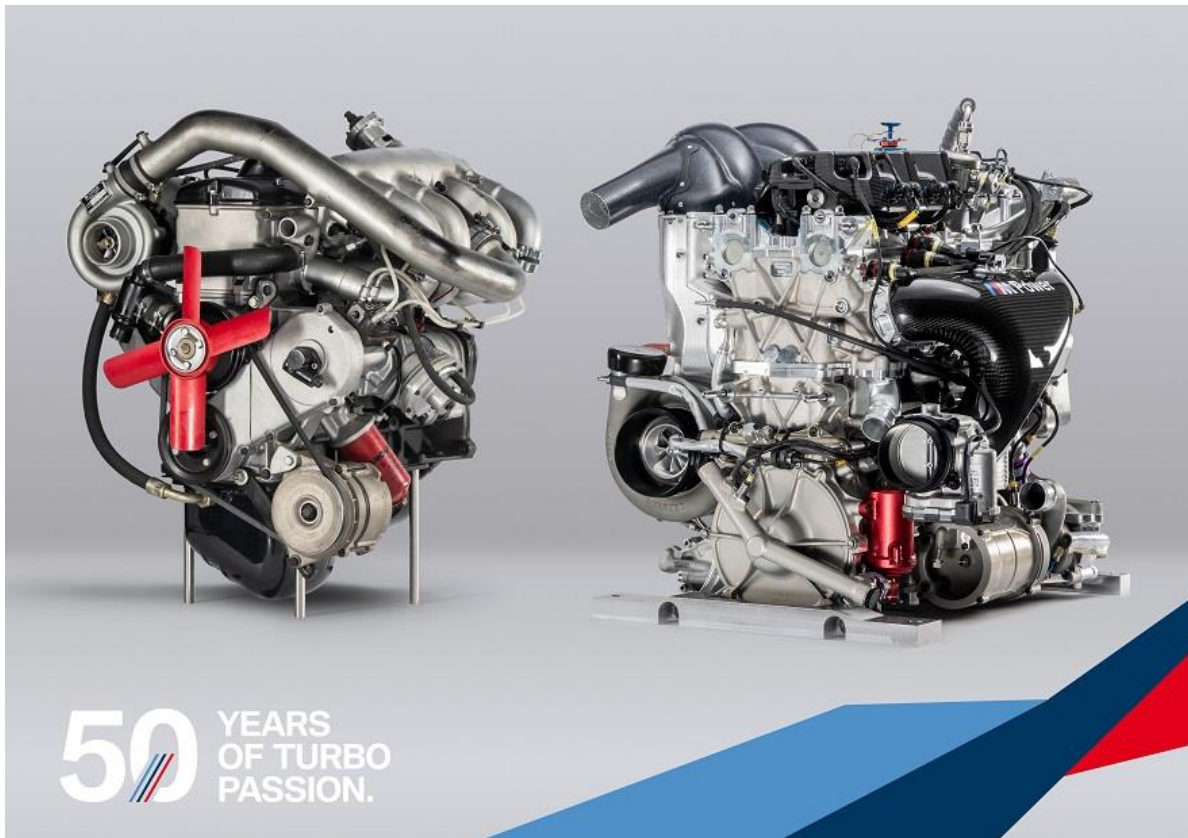


50 Years of the Turbo engine

By BMW Group

BMW Turbo Power is a success story in motorsport – and has been for 50 years. In 1969, BMW won the European Touring Car Championship with Dieter Quester (AUT) and the BMW 2002 TI, doing pioneering work and writing history in the process. The first BMW Turbo in motor racing – the M121 – provided the necessary drive. After many more BMW Turbo engines in the 50 years since then, the newly-developed Class 1 regulation-compliant BMW P48 engine will make its debut in the BMW M4 DTM when this season's DTM kicks off at Hockenheim (GER) at the start of May. Times may have changed, but the outstanding properties of the engine have remained the same.



Despite the 50 years that lie between them, the two high-performance engines have a number of similarities: both are straight, four-cylinder engines with a two-litre capacity and a turbo charger. In both the BMW M121 and the P48, the sensitive engine components must be protected by a heat shield from the heat emitted by the turbo charger. A mechanical injection pump supplies the engine with fuel in both cases.

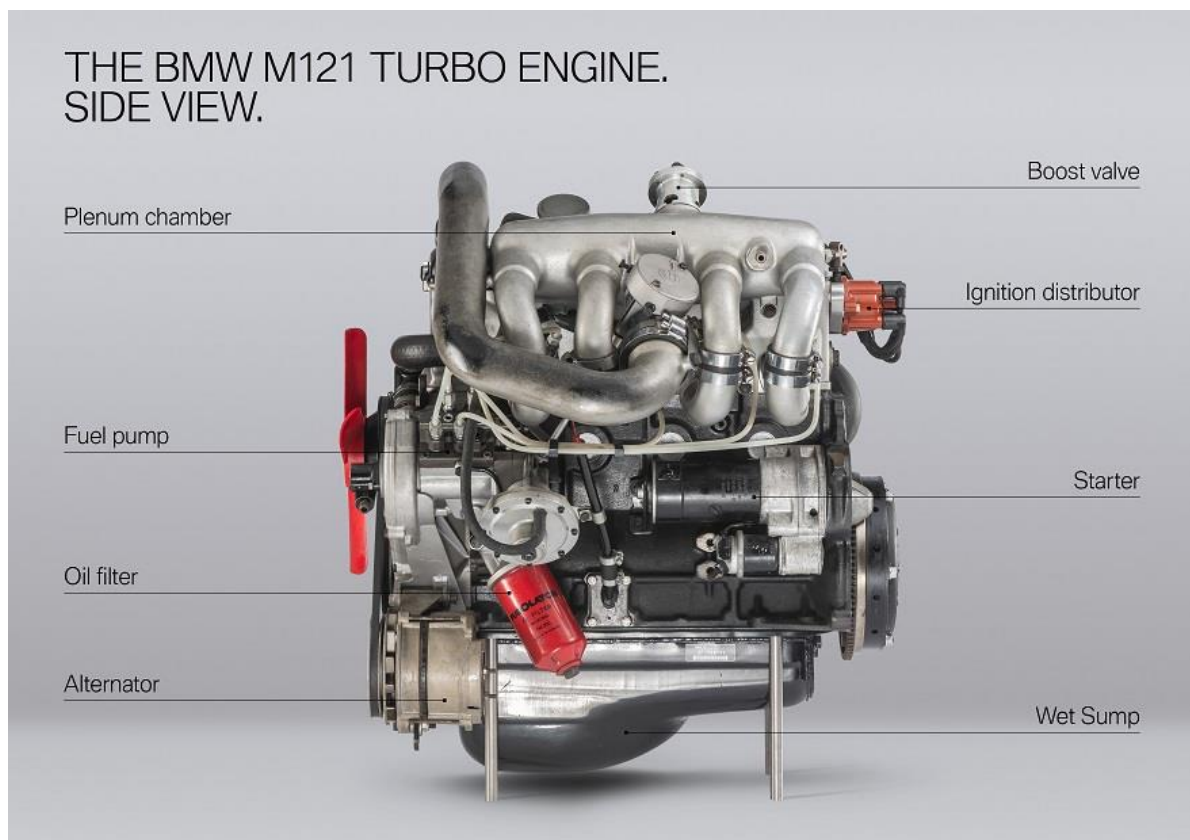
More than twice as much power with far less consumption and a much longer service life. The pressure with which the combustion air is supplied to the engine, can hardly be compared any more. With 0.98 bar of pressure, the first generation of turbo race engine achieved approx. 280 hp at 6,500 rpm. The exhaust fan was theoretically capable of developing a boost pressure of 1.76 bar. However, the pressure in the cylinder would have been so great, that the cylinder head would have lifted off. Nowadays, boost pressures of up to 2.5 bar are possible with more than 600 hp. The crankcase and cylinder head were manufactured in a special sand-casting procedure in the BMW Landshut foundry.

In the meantime, components like the ignition distributor, fan, wet sump and boost valve have since disappeared from the engine. There is no longer a direct charge air pipe, which supplies the engine with compressed air without any cooling. Instead, the P48 has a sophisticated dry sump system. The oil required for lubrication purposes within the engine is extracted immediately without any oil being lost through splashes. Another part of this system is the oil tank, which is directly attached to the engine. Efficient charge air cooling also allows for increased performance and efficiency.

Auxiliary units, like the starter and generator, are no longer on the engine, but are mounted on the transaxle gearbox behind the engine. Carbon-fibre-reinforced plastic has replaced the old aluminium weld-and-cast construction on the plenum chamber. Furthermore, the butterfly is now moved electrically and no longer by a mechanical throttle rod. Instead of an open ignition harness, the electrical wires in the P48 are housed in a protective, carbon cable tray.

One of the most efficient BMW race engines of all time.

One of the key aspects of the P48 is its exceptionally good consumption. As the regulations limit the permitted fuel flow, every fuel saving means better performance and was followed in detail. Compared to its predecessor, which itself was very efficient, the current engine has been made almost 10 percent more efficient. It is actually more than 50 percent more efficient than the M121 from 1969. This was achieved with the help of the high-pressure direct fuel injection, as found in BMW production engines, as well as a mixture preparation and combustion – tried and tested in many simulations and tests – which allows the engine to operate in so-called 'lean burn mode'.



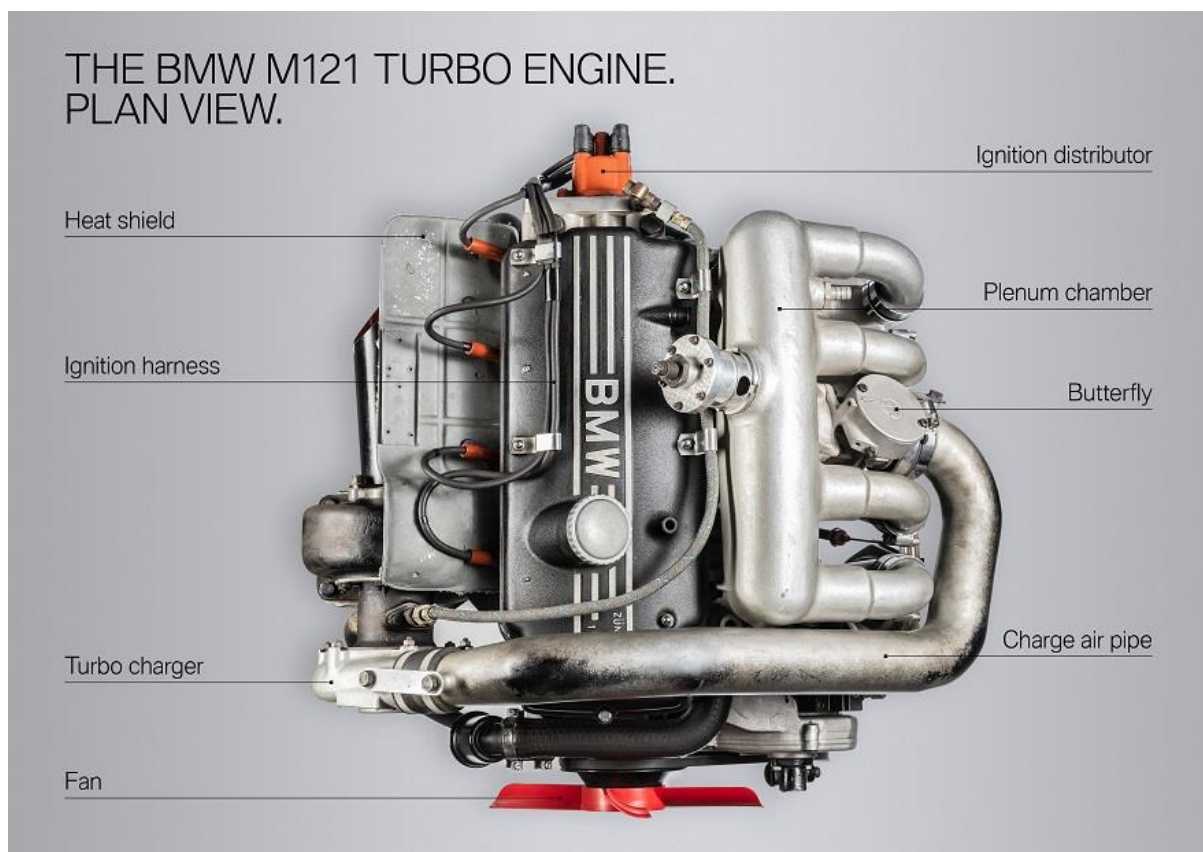
A consistent minimisation of friction losses, such as through the aforementioned oil system and the use of high temperature-resistant components that do not require cooling by the fuel, make the P48 one of the most efficient BMW race engines of this day and age.

BMW Turbo engines guarantee maximum sportiness.

Despite all this, the original 1969 turbo need by no means hide when it comes to performance. As the

developers of the BMW 2002 TI were not permitted to increase the displacement, the performance had to be increased elsewhere. The engine no longer aspirated its mixture itself. Instead, it was blown into the engine via the turbo charger. This transformed the BMW 2002 TI into a real sports car, with a top speed of 240 km/h. This was followed in 1973 by the first German car manufactured in production with a turbo charger: the BMW 2002 turbo.

The next chapter in the story of BMW Turbo in motorsport is now set to be written in the DTM. Above all, the Class 1 regulations herald a new technical era. The previous V8 engines have been replaced by more powerful, four-cylinder turbo engines. The sound of the new turbos is awesome, the performance nothing short of impressive. However, their most brilliant property is their efficiency. At 85 kilograms, the short engine in the new turbo power unit weighs little more than half of its predecessor. The lightweight model boasts impressive figures compared to the DTM engines used up to this point: half the displacement, more power, less consumption.



Facts and figures on the new BMW P48 engine.

Type: P48, R4 turbo engine with direct fuel injection
Capacity: 1,999 cc
Weight: 85 kg (basic weight, according to regulations)
Bore: between 86 and 90 mm
Engine speed: max. 9,500 rpm
Power output: over 600 hp
Service life: over 6,000 km (per season)
Fuel mass flow restrictor: mandatory 95 kg/h,
100 kg/h with push-to-pass activated

- Cylinder block and cylinder head made from cast aluminium in the BMW foundry in Landshut
- Steel crankshaft

- Four valves per cylinder, operated via rocker arm
- Steel camshafts, operated via gears
- High-pressure, direct injection, as with BMW production engines with 350 bar
- Dry sump

Despite the significant increase in power of about 100 hp, the unit is designed for reliability and durability, and lasts roughly 6,000 kilometres. 1.5 engines may be used per car over the course of the season. The Push-to-Pass system, new in 2019, provides an extra 5 kg/h of fuel for a duration of five seconds, resulting in an increase in power of roughly 30 hp.

The turbo charger in the P48 supplies the engine with 400 litres of air per second – 3,500 times as much as a human breathes. The pistons accelerate from zero to 100 km/h in less than a thousandth of a second – 1,200 times faster than a lunar rocket. The water pump shifts roughly 18,000 litres per hour. This is fast enough to fill a bath tub in roughly 20 seconds. 1,005 drawings were made for the final assembly of the engine, which consists of roughly 2,000 individual parts. Laid next to each other, they would cover the floor of a 250 sqm apartment.

A new era in touring car racing is dawning with the BMW P48 and the Class 1 regulations – just as it did with the engine's forefather from 1969. The turbo is ready for ignition – today, as it was 50 years ago.

