RMS

BY RMC MOTORSPORT

"With the creation of the N5 our main goal was to develop a car that seemed to be an R5, with 4 wheel traction with razonable costs and at the same time being competitive in the traditional N5 places.

Our N5 vehicles don't need too much maintenance so they are the logical step if someone wants to enter in from the motorized two wheel world or in the forgotten N Group. Their little neediness of maintenance, their better characteristics and their bulky bodieworks make them ideal in terms of publicity and partnertship."

Roberto Méndez

ÍNDICE

In RMC we have been working so hard throughout this year in order to being able to introduce some upgrades in our vehicles that make them highly competitive. Thanks to these upgrades, our cars are more reliable than ever. At the same time, we have been researching in order to develop new upgrades for the future.

These upgrades let us obtain an increase in so much aspects of our cars such as their behaviour and technical specifications like the torque, that is up to 460 Nm. Moreover, we have maintained the power of our vehicles that is round 310 cV.

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The process of fabrication of our N5 vehicles starts in the **safety structure department.** There we make several and different steps in each car such as lightening of the stringers and the reinforcement of the weakest areas, welding and fixing the security structure, development of the wheel arch, transmission bridge, integration, fuel tank estructure development, etc.

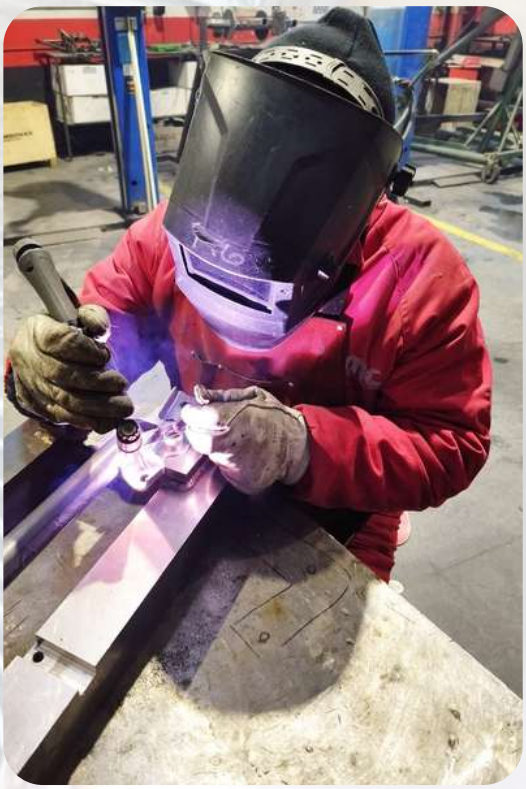
Our welding team has lots of experience in this sector. They develop their work in a thorough way, including the forge and forming processes of the N5 chasis.

Once the client has decided between the different bodies that make up the N5, it is entered into the RMC intallations to first clean it completely and cut the excess sheet metal.

The body is then ready to be inserted into the rigid welding supports in order to install the roll and adjust the geometric configurations that are the same for all N5s. The CrMb sheets and tubes belonging to the model desired by the client are bent or curved.

They are welded with great precision to the body of the N5, highlighting among the relevant modifications, the position of the top mounts, the transmission tunnel, the fuel tank cavity, etc.

The result is excellent. Providing a safe bodywork, respecting the dimensions to achieve a positive balance between robustness and set-up of the same.



In the fiber department not only external pieces like fenders, wings, bumpers or heel pads are developed, but also inner parts such as footrest, upholstered or door upholstery that are made in carbon fiber with a high degree of quality.

In order to develop these pieces our employees are specialized in the use of molds that are designed specifically for each piece. This can ensure a proper assembly without clearances between components and a unique design.

Carbon fiber is used in many parts of the N5, since it has always been reflected as a resistant material with absolute lightness. Part of the interior such as upholstery, center console and footrest are processed with this material, giving rise to excellent precision and detail.

Parts like the spoiler are made of fiberglass.

In the **bodywork and paint department** we combine the built pieces in fiber with the original bodywork of the car. As a result, we obtain the desired objectives in each N5. After that, we paint the car and finally we lacque it in order to obtain a lasting final product without imperfections.

The painting and lacquering process of the bodies that make up the N5 is carried out in the cabin. Once the fiber has been previously adapted to the bodywork, it is there, it is painted inside and outside.

Electrostatic paint stands out, a special paint that hardens with heat. Pieces such as crossmembers, arms, brake coolers are introduced... The high temperature achieves a more resistant finish and a very hard finish.

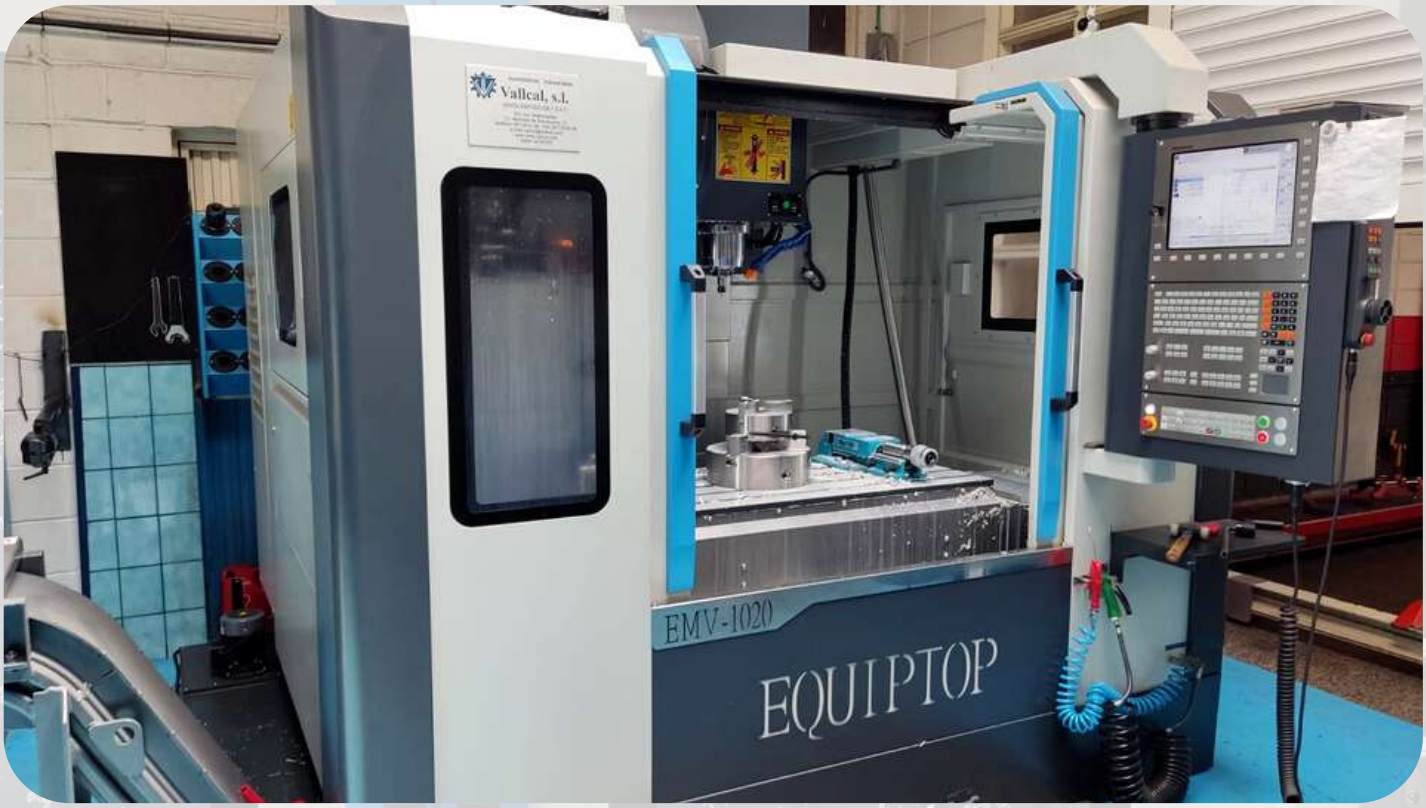
The flocking process is carried out, for example, to the dashboard. The fibers are applied directly to the desired size and composition on a base previously covered with adhesive, achieving a soft, elegant and velvety texture, in order to protect the fiber that makes up the dashboard made to measure for the N5.

Our facilities have a **machining departament** made up of various machines, highlighting a 4-axis CNC lathe, a machining center with a multi-tool revolver, a 5-axis CNC milling machine, a state-of-the-art laser cutter and a 175t folding machine. All of them allow internal engineering to be developed and generate less dependency when carrying out the manufacture of components, achieving an instant manufacturing service, always maintaining a high level of stock for all our parts.

In the machining area, the production of a wide variety of components is carried out, in different types of materials of the best quality.

The performance obtained in the machines that make up internal engineering allows most of the parts that make up the N5 to be developed and manufactured only at RMC facilities.

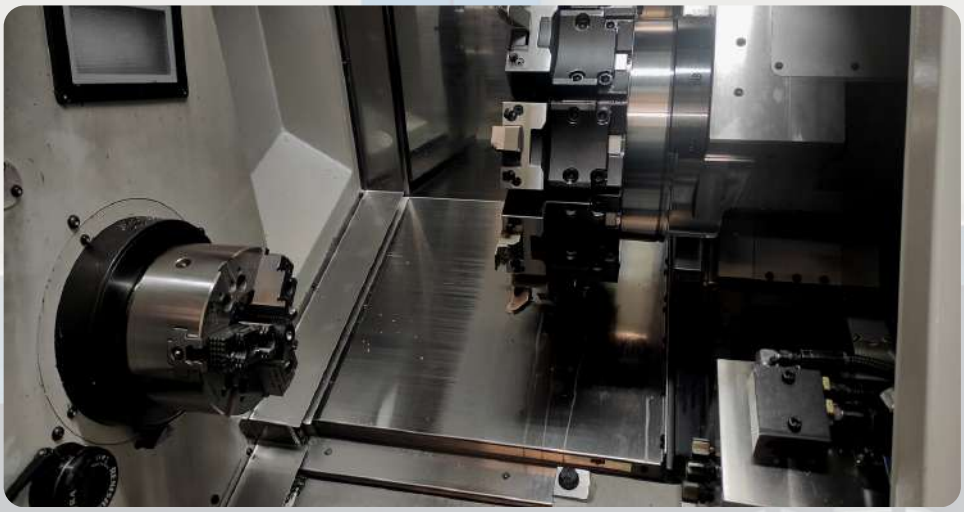
Machining center with 30 different tools revolver, do more easy to carry out high level difficult parts with a lot of precission.



Steering uprights are made from scratch starting from a high quality aluminum block, it is machined and the different processes are carried out until the desired final result is obtained.

The 5-axis CNC milling machine provides the most complex parts in a short period of time.

The 4-axis CNC lathe allows to make the parts generally of revolution with great speed and precision.



The production of steering uprights, bushings, driveshaft bars, tulips, steering connecting rods, brake cores, fast steering, mechanization in turbos, flanges... In addition to various processes subjected to mechanization machines, must be emphasized.

Once the machining process is finished, the necessary parts are subjected to heat or anti-corrosion treatments to increase their resistance and duration.

Another of the important sections that make up RMC is the laser cutting and folding department. Formed by a fiber laser with a cutting table of 3 x 1.5 meters. Which facilitates the making of precise cuts both of tubes made of Cr-molybdenum, and of carbon steel sheets up to 2 cm thick. Together with the folding machine, capable of exerting more than 150 tons of force, it allows the manufacture of an infinite number of parts for the N5.

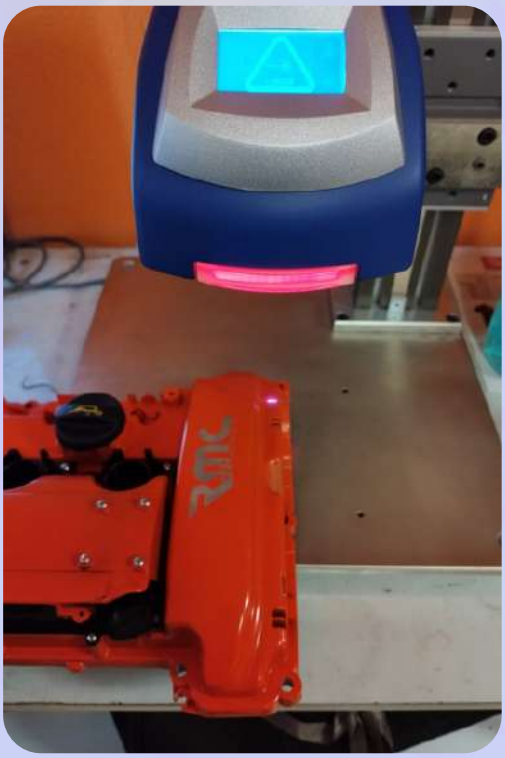
The fiber laser allows the oblique cutting of the tubes, it needs a great ease for the assembly of the bridges, security structures, exhaust pipes...

The folding machine is capable of bending very small sheets and with great detail, up to folding the resistant duralumin protections.

The RMC installations have one 3D print infraestructure. It helps us to create so many pieces such as air admission bells, using several materials such as carbon fiber or photosensitive resin.

We also have scanning technologies that allow us to make great advances in design and creativity. For this reason, we can improve not only in terms of geometry but also in the properties of so many pieces that are created in RMC.

Every marking of the pieces that are fabricated in RMC its personalized thanks to a fiber laser engraving machine that contributes with a wide range of tonalities



The **electrical department** of RMC. The N5 is made up of two main installations, the engine installation and the chassis installation. Thanks to the CAN line and the management of the 3 Motec control units, a simplified installation is achieved, without relays or fuses.

They are manufactured from cero with wire with differents sections and high quality Deutsch connectors. The cover that covers it and its great finish make it waterproof and exceptionally reliable against adversity.

In the **assembly facilities**, the vehicle is assembled and all the parts obtained in the previous manufacturing processes are checked to ensure optimal reliability in N5 rally car .

On line, work on N5 vehicles until they are finished. Thanks to the ease of assembly, it can be done in 5 days. After this process it will be tested to do good a set up.

In the **maintenance department** cars that suffer any type of damage during competitions or tests are repaired. Then they are prepared another time during the corresponding revisions in order to have them in the best conditions.

RMC has several **test zones** where we can assay our cars. What is more, these zones are for rent for every competition vehicle.

- Gravel track, which is made up of several layouts, reaching a stretch of 5 km, thus obtaining different combinations of curves to adjust an optimal vehicle set-up for the competition to be developed.

- We have a rent section located around 4.5 km from our headquarters, where we can carry out several tests with our cars. This section contains fasts and slow sectors, clean and dirty zones that in combination with several flush make this section thorough for our N5.

- We also have a karting circuit made up by several closed curves that in combination with the other zones let us upgrade the behaviour of the car in order to face every different situation.

- **Engine:** 1598 cc, Direct Injection. 16 valves
- **Power:** 310 CV
- **Torque:** 460 Nm
- **Electronics:** : Motec – ECU M142,C125 Screen, Chasis switchboard PDM with keypad, USB data acquisition
- **Box:** Sequential, 6 gear Samsonas
- **Suspension:** Exe-tc / Reiger / Samsonas (4 ways)
- **Car steering:** Hydraulic
- **Brakes:** AP Gravel / Tarmac: 305/ 355 mm
- **Rims:** Gravel 7”x15”, Tarmac: 8”x18”
- **Fuel tank:** Homologate FIA FT3, 95 liters
- **Chasis:** Original, modificated for the N5 with a security structure welded in FIA regulation.
- **Weight:** 1230 kg

***N5 models have same mechanical components by regulation .**

- **Toyota Yaris N5 2021**

- **Toyota Yaris N5 2019**

- **Renault Clio N5**

- **Nissan Micra N5**

- **Kia Rio N5**

- **Citroën C3 N5**

- **Peugeot 208 N5**

- **VW Polo N5**

- **Citroën DS3 N5**

- **Skoda Fabia N5**

- **Hyundai I20 N5**

- **Ford fiesta N5**

Next, the inner finish of our N5 vehicles is shown in detail. We are looking for the perfection. It is made up by several pieces in carbon fiber such as the footrest.

Moreover, our vehicles wear a high quality pedal box that allows faster responses to the pilot enquires.

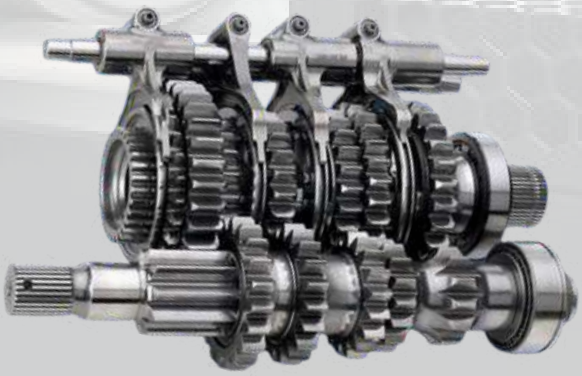
The inner structure it's made up by baquets which were specifically desgined for our N5 and wear a 5 point harness.

What is more, they wear an automatic fire extinction system with 3 inner and outer mouths.

Details of the console, fabricated in carbon fiber. It is located near the hand brake and the gear shift. There is also a communication system that allows the message exchange between the pilot and copilot.

The steering wheel includes some of the most importamt functions that are located in the console in order to help the pilot to use them in some cases.
There is a wide range of pharameters that can be personalized by the pilot thanks to the software that controls the ECU that is developed by MoTeC.

The N5 category is characterized by the fact that all the cars use the same mechanic parts, only changes the body with fiber kit, thus allowing a much purer competition. The engines, all the same, provide a power of 310 cV, with a total displacement of 1598 cc. In addition, it is a 4-cylinder in-line engine, 16v and they work by direct injection. These engines are modified and optimized for their performance in competition.



Our cars sequential gearboxes that are developed by the Lithuania brand Samsonas. The relationships have been designed specifically for the N5. They are made up by 6 different gears plus the reverse, their spur gears and crabots that maximize the performance of the engine.

The brake system for tarmac kit is made up by AP with 355 mm discs and 7075 T6 aluminium core by RMC. It's main advantage is linked with the fact that we can easily replace it with the dirt kit, using the same caliper.

The brake sytem with gravel kit of an N5 is made up by AP with 305 mm discs and with 7075 T6 aluminium core by RMC. It's only recquired the structure formed by the core and the disc. In addition, the caliper support is not required in order to complete the exchange from one tarmac system to a gravel one. It's done in an easy and fast way.

Refrigeration system from the front brakes. It absorbs air throughout a fireproof tube, bifurcating the flow into the inner part of the disc and the brake caliper.

The N5 wear a McPherson suspension system. It's made up by shock absorbers of 3-4 regulable ways. One option is to use 3 different brands, Reiger, Exe-Tc and Samsonas, all of them with an tarmac and gravel kit.

The 4 regulable ways are the fast and slow compression, the extension and the hydraulic stop.

Their variation get an optimization in the perforances of our cars, for each different surfaces and grips.

The great effort that was caried out by our engineering and mechanics team let RMC face the future of our company with more reliable and efficient N5 thanks to a wide range of upgrades that were implemented throughout this year.

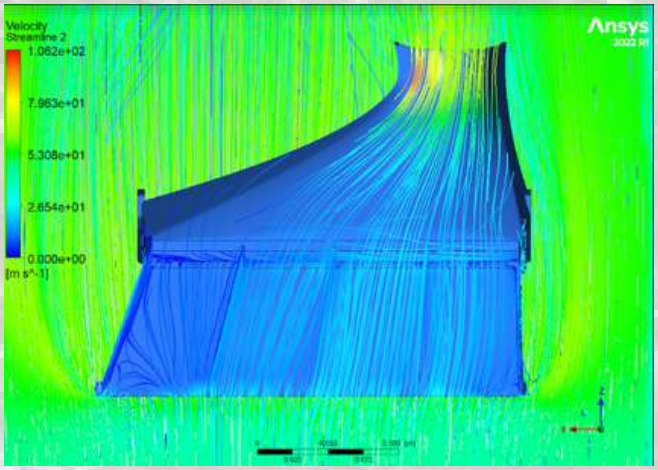
Engine

Intake circuit

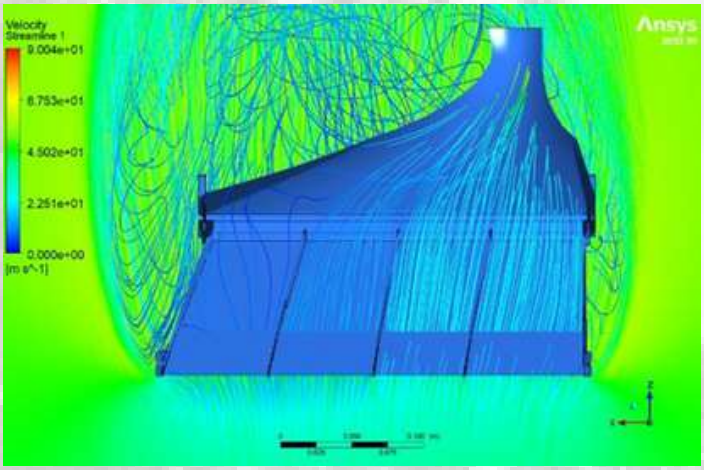
A more efficient intake circuit is compulsory if you want to make the air flow in an appropriate way inside the engine. For this reason, we have done several upgrades in order to increase the air flow, insidse the N5 regulations.

- **Turbo intake hood with flat filter for high performance**

An upgrade in the intake hood has been done using CFD analysis in the old hood in order to chech it's performance. Thanks to this study we have checked that the old hood produced turbulence in the sections that are located far from the hood exist. For this reason, we have done some upgrades in order to eliminate or reduce the effects of the turbulence. We have improved the air intake and so the performance.

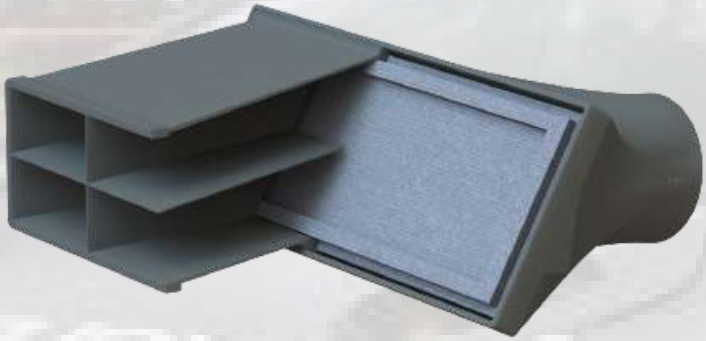


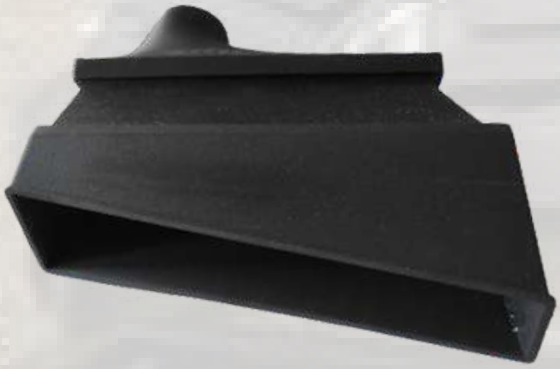
Upper original section



Fluid Study

We have done a design with a geometry that maximizes the air intake into the turbo entry with less loss.





It has been fabricated using a 3D print , in compose materials with high termic resistance carbon fiber

The particle filter is flat. However it has little inclination in order to maximize the laminar flow.

- **Turbo restrictor**

Restrictor has been redesigned. More efficient performance is acquired. This translates into a higher air intake speed, therefore the flow rate (m3/s) rises and the N5 engine always obtains, even at high RPM, the desired air for the mixture, avoiding flow saturation by restrictor.

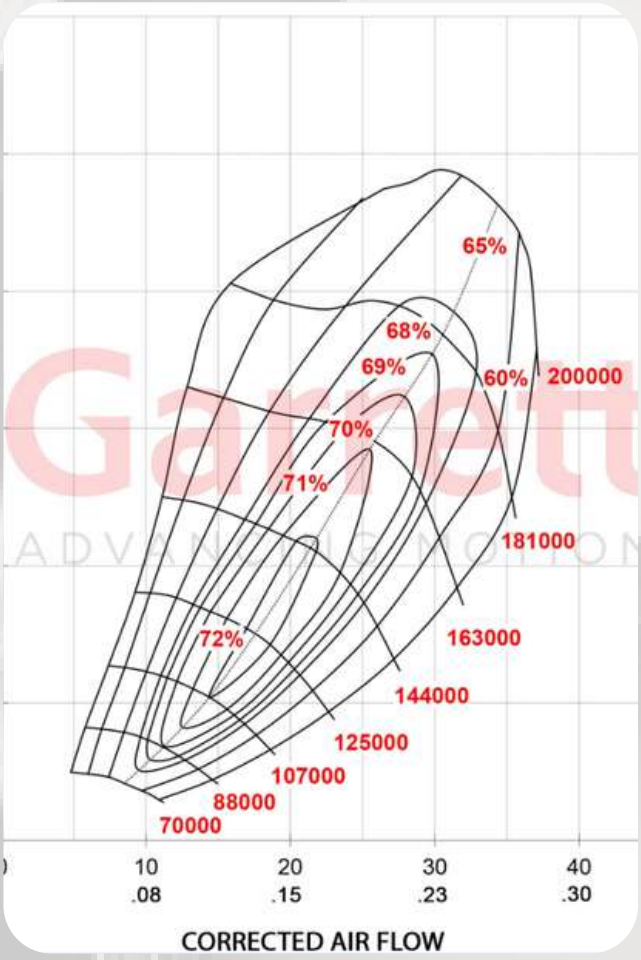
Comparation between the old and new restrictor.

New restrictor render.

- **Garret turbo with V-band**

The Garret turbo help us to obtain more power and efficiency in our cars, obtaining 310 cV in a continious way.

This Garrett turbo is especially characterized by its design focused on competition, it develops a high efficiency that translates into a flow almost without losses. Thanks to the shape of its blades, it delivers power at a low RPM rate, maintaining it up to high RPM. Its resistance to high temperatures without deformation of the materials, provides absolute reliability.

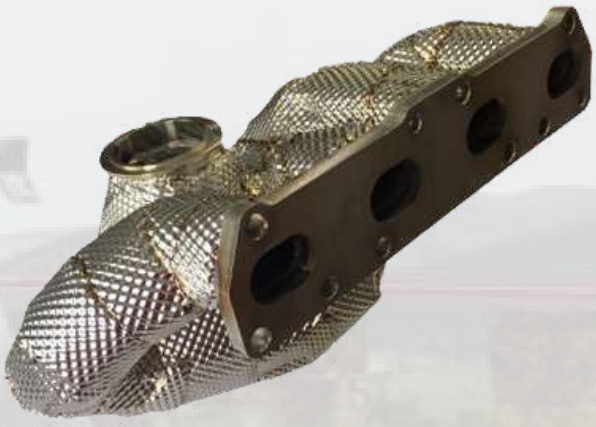


Exhaust System

An optimized exhaust system increases the capacity of our cars of evacuating the combustion gases. What is more, we have more efficient turbos.

- **Exhaust manifold**

It has been designed a brand new exhaust manifold that helps the engine in order to obtain a better adaptability to the V-Band. In addition, we get more a more efficent combustion process.

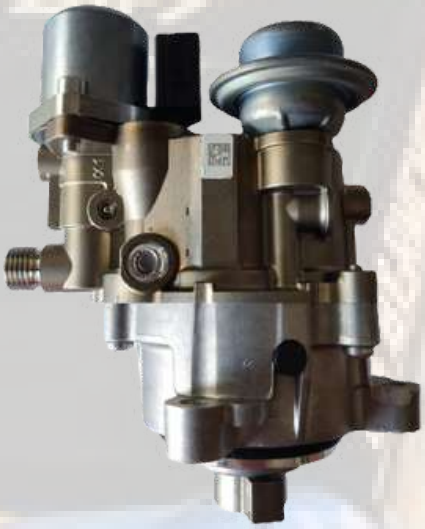


- **Exhaust manifold protection**

A brand new exhaust manifold protection has been included in the exhaust of our vehicles in order to have a better termic isolation into the rest of the components

Fuel injection system

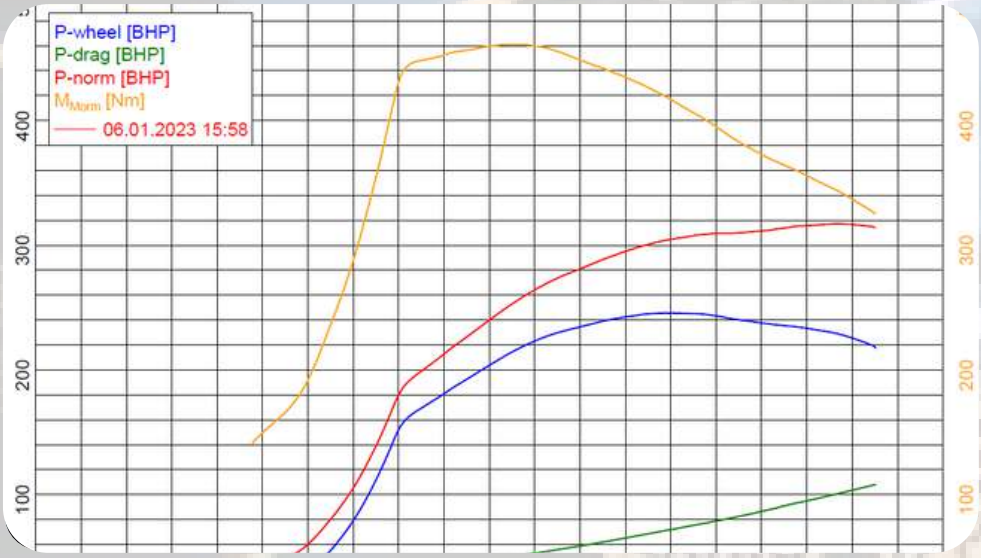
- **BMW high pressure fuel pump**



The new evolution of the fuel pump allows a considerable increase in pressure compared to the previous one, a greater input of fuel is achieved with much more power, reaching an increase of 150 bars more than the standard one. The performance is remarkable, but the most important is the reliability.

New electronical engine map

During 2022 we have been doing several tests in order to get more efficient engines. Thanks to our injection circuit and our new intake system, we can obtain a more lineal and lasting power curve. The new map allows us to obtain constant management without variating the power supply when timed kilometers are made.



- **High flow injectors**

Injectors with higher flow (ml/s) are installed. The injection angle is adequate for the design of the N5 piston, achieving a more atomized injection and thus a more homogeneous one, obtaining a powerful and stable response in the N5 engine.

Chassis

- **Kit king pin / Fast steering**

One of the objectives that has been achieved is linked with a faster steering. It transmits better competition feedback, similar to a Rally 2. The fast steering allows the N5 to have better reactions, achiving more speed and agressiveness

Aerodynamic Kit

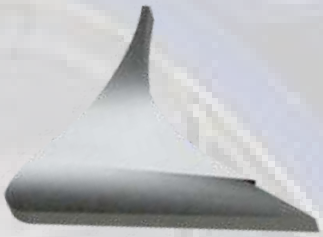
.We have done a research in order to develop an aerodynamic body kit that upgrades the efficiency of our vehicles in order to make them similar to an WRC, inside the rules of the N5 regulations. We have done the pieces that are shown here usign Ansys Fluent.

New rear wing spoiler, more efficient that reduces drag.

The side skirts avoids that the air flow that circulates through the N5 floor circulates into the outside, creating drag.

El splitter guides the air flow into the N5 floor.

Upper and lower dive planes. They optimize the air flow throughout the fender. In addition, they generate downforce.



The winglets generate aerodynamic force in an uniform way

The rear-view mirror helps to generate aerodyamic force and let the flow pass in a better way.

The final model of the N5 in which it can be obserbed how is the result with and without the body kit.

Sensors

- **Exhaust pipe temperature sensor**

The exhaust temperature sensor gives us information about the exhaust temperature at every time. We can obtain better refrigeration control, owing to the fact that it indicates when the N5 engine can be switched off without risks.

- **Módulo temperatura del escape:**

We have implemented an upgrade of the previous system in order to get more precision in the measurement of the data obtained.

- **Oil pressure and temperature sensor**

It's an element that is used to measure the temperature and the oil pressure. It transmits this information to another device or the ECU.

- **Brake force distribution front -rear sensor kit**

New front and rear break pressure information. It let our cars have better monitorization and brake in each axis. In addition, we can observe in the display the mechanical regulatation via the distribution wheel incorporated in the N5.