FAST & FURIOUS™

75

Build the Legendary DODGE CHARGER R/T



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FAST & FURIOUS

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United Kingdom
Published by De Agostini UK Ltd c/o Royds Withy King, 69 Carter Lane, London EC4V 5EQ

USA
Published by De Agostini Publishing USA, Inc. c/o Becker, Glynn, Muffly, Chassin & Hosinski LLP, 299 Park Avenue, New York, New York 10171

ISBN: 978-1-4439-5218-7
FFN75: 22 02 09

ISSN 2631-9799 (Print)
ISSN 2732-4583 (Online)

Picture credits: NBCUniversal Archive; FCA Archives; Shutterstock

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Printed in Poland

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FLIP CAR: AN UNSTOPPABLE DEVICE

The *Fast & Furious* franchise has given us the opportunity to see some of the most powerful vehicles of the last few decades, from the classic American muscle cars to the latest racing cars from Europe and Asia. But thanks to the inventiveness of the producers of the franchise we have also had the chance to see unique automobiles, like the Flip Car.

When, at the start of *Fast & Furious 6*, agent Luke Hobbs asks Dominic Toretto and his team to follow the trail of a group of mercenaries led by the former soldier Owen Shaw, he assures him that they will be facing cunning, well-prepared rivals. Dom has the chance to witness this in his first encounter with them, when the criminals are leaving Interpol's London HQ, where they have just committed a robbery. What surprises him the most is that, in their escape, the mercenaries do not use normal cars but some strange devices that enable them not only to slip away among the traffic at top speed but also to charge their pursuers head on. Given their curious structure, when they launch themselves frontally against other vehicles, they do not collide with them, but they toss their pursuers up in the air. This is how the fearsome Flip Car operates.

IN SEARCH OF THE PERFECT MACHINE

As on previous occasions, before starting to film *Fast & Furious 6*, director Justin Lin and vehicle coordinator Dennis McCarthy worked intensely, searching for the cars that the stars of the film were going to be driving. McCarthy, as usual, chose muscle cars, his favourites. For his part, the director was interested in introducing something unexpected and spectacular to the catalogue of vehicles in the franchise. His initial idea was quite clear: he wanted a car that could move at high speed through the city streets,

↑ The assault by Shaw's men on Interpol's offices in London becomes the official debut of this incredible vehicle.

Flip car: an unstoppable device

easily dodging the traffic. But there was one aspect in particular about the way the Flip Car would work that obsessed the director.

"Right from the start, the presence of the Flip Car in the movie was something that Justin Lin would not budge on," says Dennis McCarthy. "I remember he called me and told me that we should come up with a kind of vehicle that could collide head on with other cars and toss them into the air. It was a great idea! I immediately understood the kind of spectacular image that he had in mind, so I began to send him models. My favourite cars are all about the way they work, their performance. In the case of the Flip Car this was not the original intention. It is basically designed to function, and that was the fun part, but what it could do during a chase was what really interested the director."

THE HEART OF A FORMULA 1 CAR

The crew got down to work. In the following weeks different projects, increasingly refined and striking, began to see the light. Both McCarthy and Lin were getting more and more excited about this project. After a large number of prototypes, they finally produced the basic model of what would eventually become the Flip Car, a creation absolutely exclusive to the world of *Fast & Furious*.

The definitive version of the Flip Car was that of a very low vehicle weighing just over 1,600kg. It had three seats, a metal frame for bodywork and an angled front, which was what made it possible to flip other cars over the top of it. McCarthy and his crew worked for 10 weeks on the chassis of a Formula 1 racing car, equipped with a Chevrolet LS3 engine giving 500hp. Power assisted steering in all four wheels was included in the prototype so that it could achieve surprisingly maneuverability.

SAFETY GUARANTEED

Once the vehicle's definitive specifications had been established, work began on the special pieces needed for it. All in all, the final assembly of the original Flip Car took three weeks. Later, other additional cars had to be built to allow the movie's first and second units to work simultaneously on the streets of London.



The Flip Car was manufactured in a way similar to a conventional vehicle, as aspects essential in any car had to be taken into account: the performance and the look, and of course safety. Second unit director Spiro Razatos, stunt coordinator Andy Gill, and special effects supervisor Joss Williams had the job of testing all the models built to make sure that they complied fully with all the safety regulations. Before putting them in front of the cameras, various trials were carried out to ensure the personal safety of the people who were going to be driving these speedy machines.

NO SPECIAL EFFECTS

When Justin Lin and Joss Williams began planning the electrifying chase after the mercenaries emerged from Interpol HQ, they took it for granted that they would need to use the classic launch tubes and ramps that are normally used in the movies to launch a vehicle through the air and make it roll over spectacularly. But when the actual Flip Cars that McCarthy had designed went into action, they realised that they wouldn't need any special effects. The car's front was so precisely designed that it served as a launch platform.

Very fast and manoeuvrable, the Flip Car was almost impossible to stop when it was being pursued.



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Dennis McCarthy set about designing the Flip Car based on a Formula 1 shape. The front was steeply sloped so that it could flip oncoming cars over the top.

"We were massively surprised to find out that the Flip Car could actually flip the police cars with far greater precision than a conventional launch ramp," Razatos explains. "Surprisingly, it wasn't necessary to use stock footage in that sequence in *Fast & Furious 6*. What the audience sees is actually the Flip Car advancing head on towards the police cars. So two of our stunt drivers confronted one another, and everything was filmed just as it happened."

STARS AT FULL SPEED

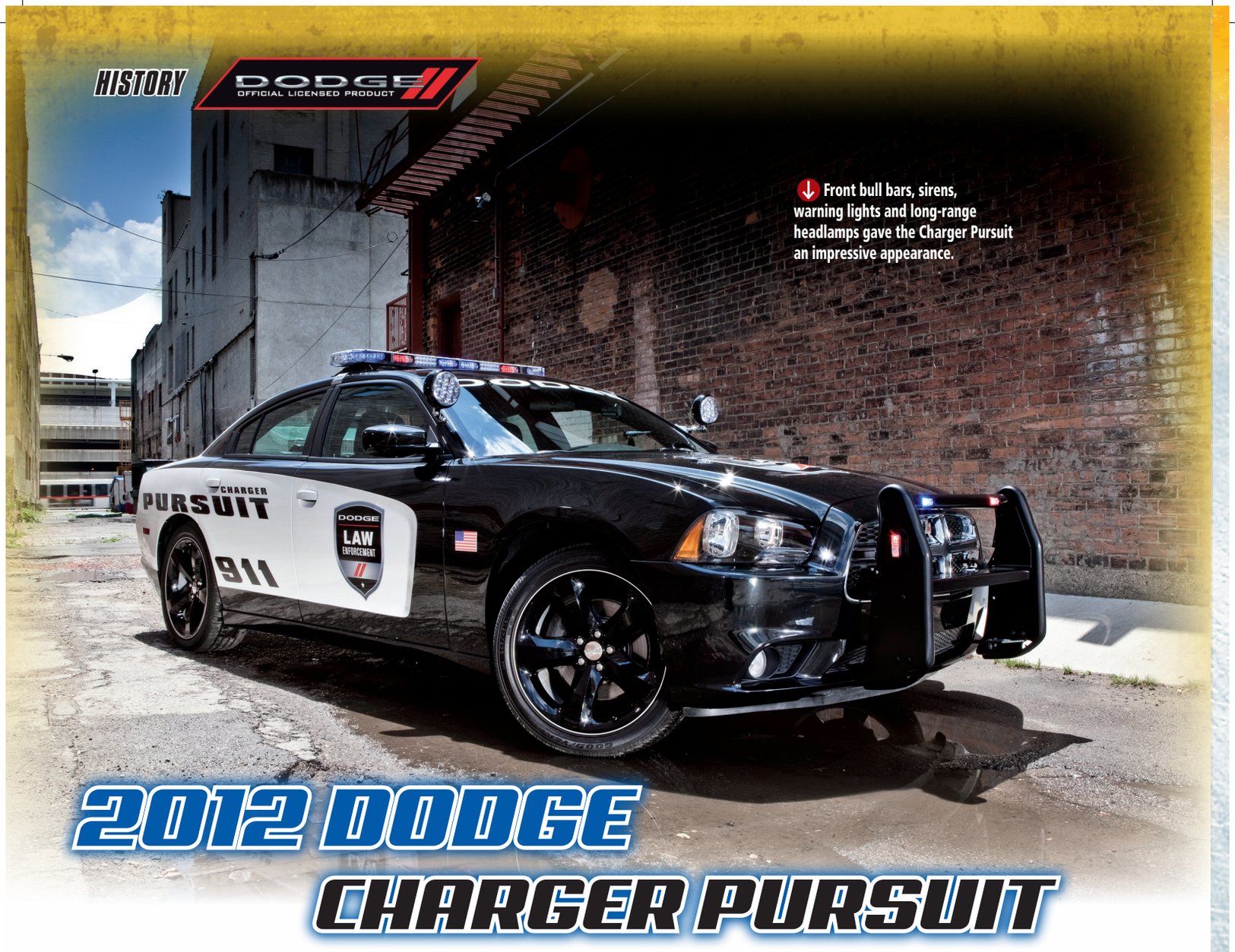
The machines created by McCarthy thus became the real stars of the shoot. Many of the leading actors in the film wanted to get behind the wheel of these unique devices, but only a few privileged people had the chance to do it. For example, the actor who plays Owen Shaw in the movie, was able to experience the extreme speed that the Flip Car reached, and he found it an incredible experience.

In any case, the chase demanded the presence of stunt drivers, like the British rally driver David Higgins or the action scene stunt performer Tilly Powell. Thanks to their skill, fans everywhere gave their unanimous approval of the participation of the Flip Cars in *Fast & Furious 6*.

JOSS WILLIAMS

The winner of an Oscar for his work in Martin Scorsese's film *Hugo* (2011), Joss Williams was one of the people responsible for the most prestigious special effects in Hollywood in the 1990s and the early years of this century. His career began in style, working as an assistant in the special effects department for *Indiana Jones and the Temple of Doom* (1984) and *Indiana Jones and the Last Crusade* (1989), directed by Steven Spielberg. His "training" was then completed in other legendary film franchises, like *Alien*, being part of *Aliens* (1986) and *Alien 3* (1992), or James Bond, for the films *View to a Kill* (1985) and *The Living Daylights* (1987). With this impressive basic apprenticeship, Joss Williams began his career as a special effects supervisor in the intense prison drama *In the Name of the Father* (1993). From then on, he found himself facing ever greater challenges, such as the filming of *Troy* (2004), *Charlie and the Chocolate Factory* (2005), and *The Bourne Ultimatum* (2007), all of them very demanding as regards the visual effects. After winning the Oscar and before his early death, Williams managed to see one of his biggest dreams come true: working on the *Fast & Furious* franchise, taking charge of the special effects for the sixth movie. The spectacular result served as an authentic tribute to a career full of light, imagination and magic.

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Front bull bars, sirens, warning lights and long-range headlamps gave the Charger Pursuit an impressive appearance.

2012 DODGE CHARGER PURSUIT

The Dodge brand has always offered special versions of its models designed for use by the police, which are sold suitably prepared. In 2012 it launched the impressive Pursuit version of its Dodge Charger sedan on the market, with everything needed to patrol the city streets and the highways of the USA.

That year the American manufacturer offered six different packs of accessories that could be incorporated in the Dodge Charger, equipped with the 5.7 litre V8 engine or with the 3.6 litre V6. The star was the fully equipped car on the base of the most powerful version, which gave 375hp and was no different to what anybody could buy, except in aspects like the reinforcement of the suspension (firmer shock absorbers, a self-leveling system, and thicker stabiliser bars), a change in the electronic control panel (making it possible to reach 243km/h), and the mounting of a supplementary battery to supply the electrical system and the interior devices.



In the interior, the police computer's central position made it possible to consult it from either of the two front seats.

Developed with the support of police officers, the car had the usual features (siren, emergency lights and exterior protection), but the most interesting novelties were on the inside. The computer and radio equipment, which could be operated by either the driver or the passenger, was set in the center of the console. This was the only way to prevent the computer and its connection from being damaged if either of the airbags was activated.

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INSTALLING THE IGNITION COIL

In this assembly session you will install the ignition coil in the engine housing and mount the left boot panel on the body.

PIECES FOR THIS STAGE

75A



75B



KP



SM



75A Left boot panel
75B Fuel hose

KP Screws 2 × 4 mm (x 2)*
SM Screws 2 × 4 × 5 mm (x 6)*

* Some of the parts are spares.

Editor's note: The parts shown here may differ slightly from the parts supplied with this issue. This does not affect the quality or the assembly instructions in any way.

ASSEMBLY AREA

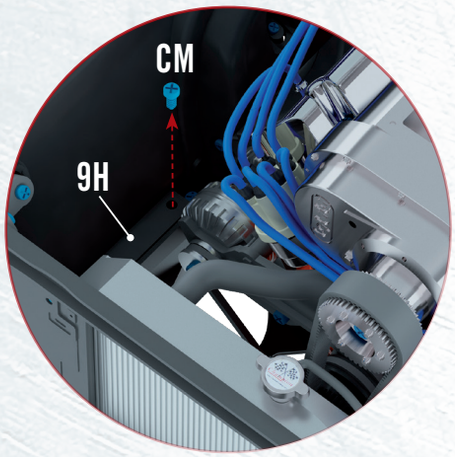


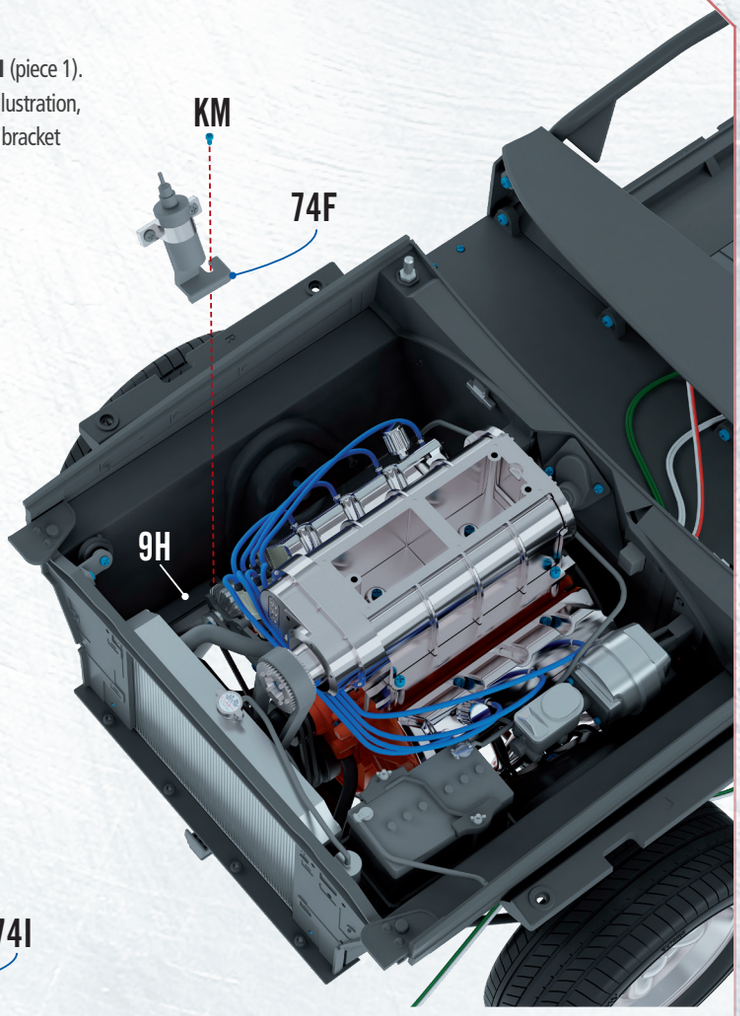
BOOT AND ENGINE HOUSING

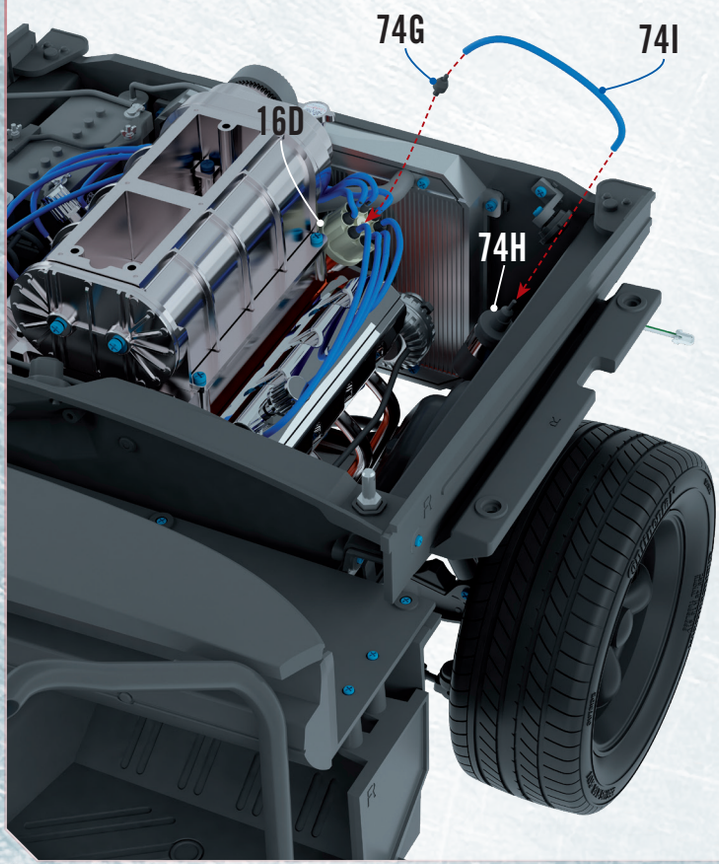
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Installing the ignition coil

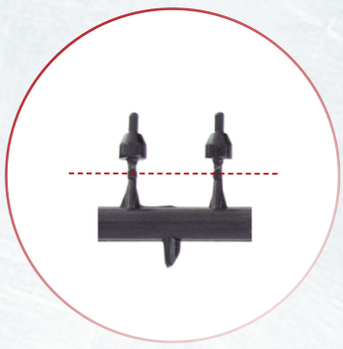
75.1 **LOCATE** the front right chassis beam cover plate **9H** (piece 1). Remove the **CM** screw on the right, as shown in the illustration, but do not remove the cover. Insert the pin on the coil bracket **74F** into the hole where the screw was and secure the pieces with a **KM** screw, provided with the previous assembly session. ▶



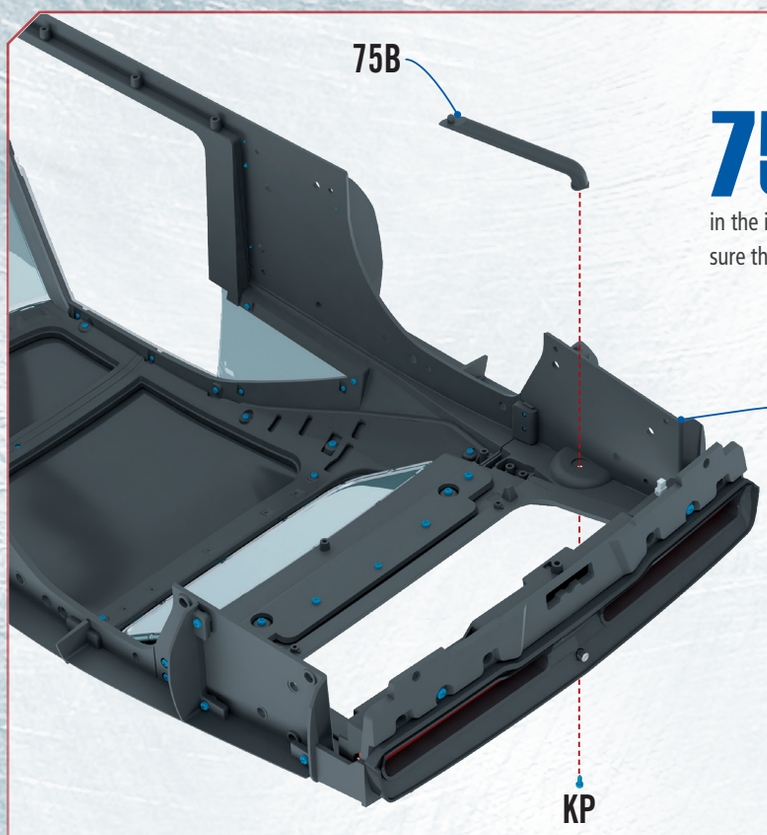




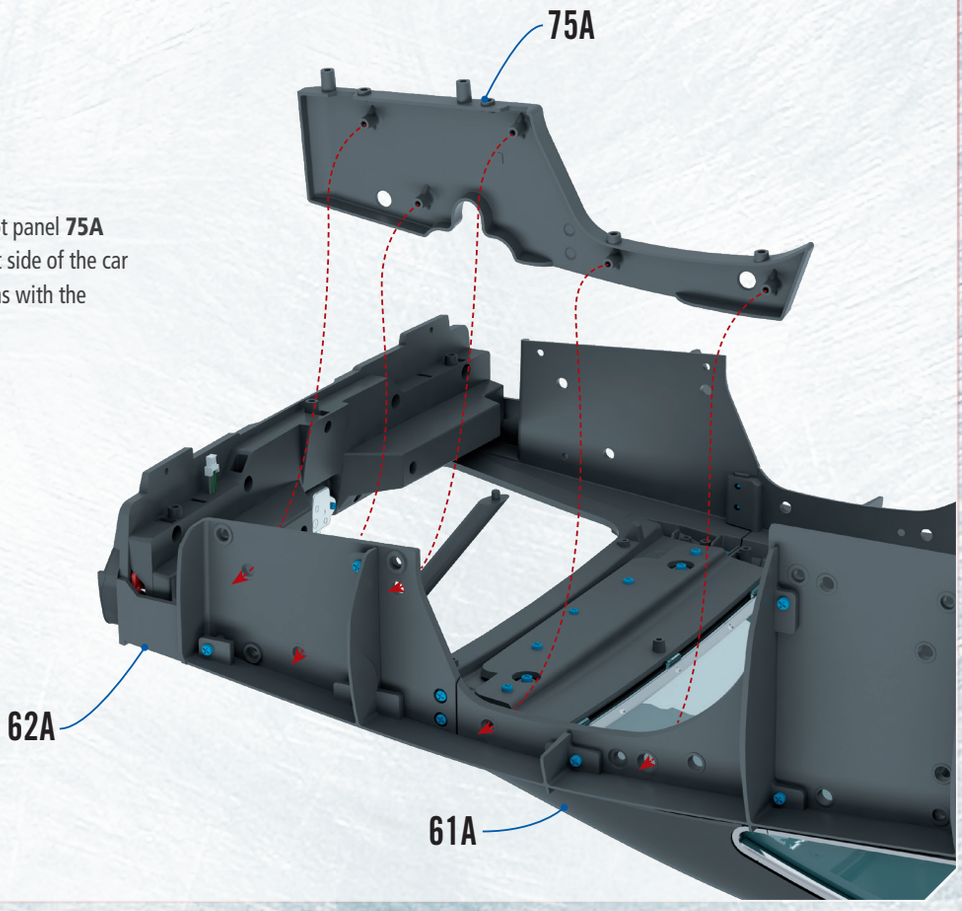
75.2 **GET** one of the high voltage terminals **74G** and insert it into the middle hole in the distributor cap **16D**. Connect the ends of the high voltage cable **74I** to the top pin on the ignition coil **74H** and the high voltage terminal **74G**. ◀



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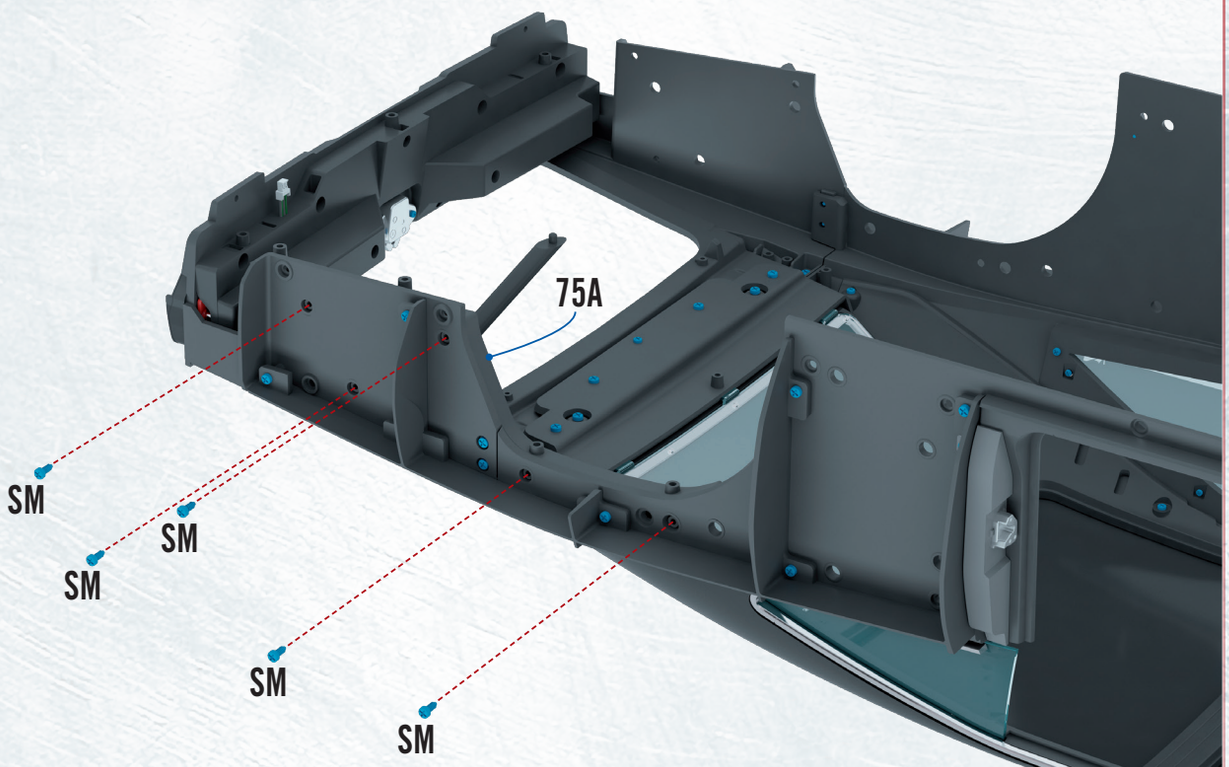
75.3 **GET** the car body and carefully turn it over. Insert the curved end of the fuel hose **75B** into the hole in the rear section of the car body **62A**, as indicated in the illustration. From above, secure it with a **KP** screw, making sure the piece faces the same way as that in the illustration. ◀



75.4 **ATTACH** the left boot panel **75A** to the inside of the left side of the car body. Align the five pins with the corresponding holes in the car body. ▶

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Installing the ignition coil



75.5 **USE** five **SM** screws to secure the left boot panel to the car body. ▲

RESULTS OF STAGE 75

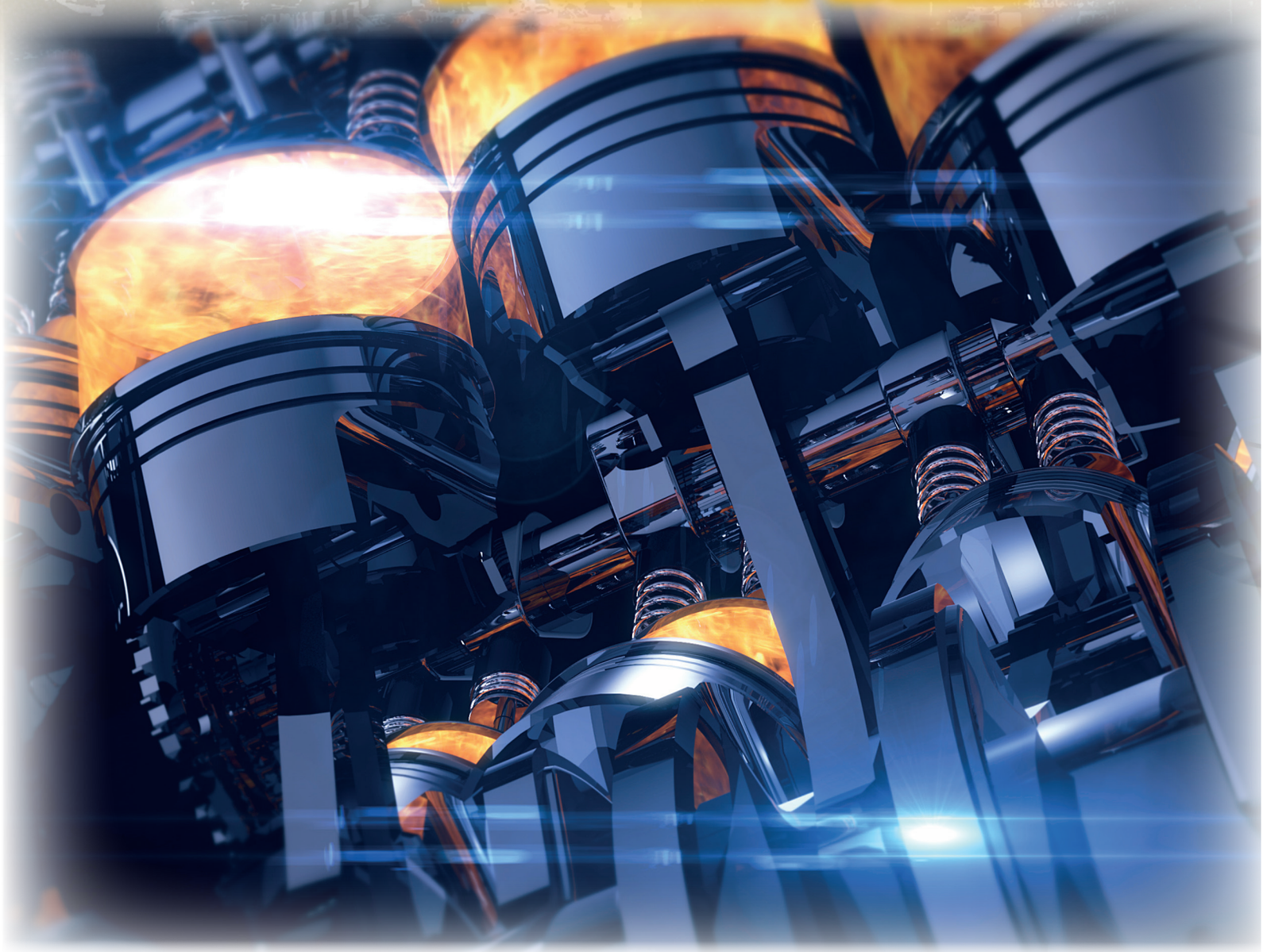




You have now connected the coil to the engine ignition system and attached the left boot panel to the car body.

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THE WORLD OF SPECIAL FUELS



Not all fuels are the same. If we included alternative fuels and racing mixtures, we could write whole books on the subject! In addition, we discuss the astonishing performance that nitromethane and nitrous oxide can provide!

These days, spark-ignition engines are not always fuelled with petrol. For example, in the USA, various championships are run using alcohol-based fuels. In Brazil and some other countries, ethanol obtained from biomass is used as fuel. There are also fuels such as LPG and methane, which are gaseous at room temperature and need to be transported in pressurised cylinders. In the past, special fuels (which have subsequently been banned) have been used in competition cars to provide astonishing performance. Within these same classes of fuels made from hydrocarbons, special formulations have been developed. These were

The metering of the fuel mixture must be as uniform as possible throughout the combustion chamber volume.

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very successful, particularly in the 1980s, in Formula 1 cars. However, the FIA later introduced very restrictive regulations. Fuels that, in some cases, can be up to 110 octanes are often used in the NASCAR championships in the USA. They are freely available on the market for use in competition and allow the big V8s to reach compression ratios in the order of 13:1 with cylinder bores greater than 103mm.

In the 1970s, lead-based additives were removed from commercial petrol, and "green" fuels replaced the "super" grade. In order to achieve enough power (95 Octane or more) and avoid engine "knock", several manufacturers relied on strong aromatic hydrocarbon additives, among them the highly poisonous *benzene*. The European Community then intervened, limiting the content of these hydrocarbons. The amount of oxygenated compounds (MTBE, alcohol) present in the different gasoline compounds is also strictly controlled. In addition to the use of the MTBE (Methyl Tertiary Butyl Ether) antiknock additive, higher octane levels are now achieved by making extensive use of chemical processes such as alkylation, isomerisation and polymerisation, which provide fuels that are practically free of contaminating aromatics.

THE IMPORTANCE OF OCTANES

Not all hydrocarbons are the same, and different fuels can be made up of different hydrocarbon mixtures. The most efficient as regards antiknock qualities, and therefore the compression ratio that can be used, are undoubtedly those that are defined as "aromatic". Unfortunately, they are also the most harmful. Among them, benzene was widely used in the past in racing fuels. Xylene and Cumene also enjoyed widespread popularity among specialists in the field due to their high octane



number in excess of 110. In the Formula 1 turbo era, Toluene dominated the field and still finds use in many special fuels. This is an aromatic hydrocarbon with a very high octane number, exceeding 115.

THE POWER OF ALCOHOL

The most important of the various alcohols that can be used in special fuels is, without doubt, methanol (or methyl alcohol). It is widely used where regulations allow it, and it forms the basis for mixtures used to power engines. This oxygenated compound has a very high octane number and a very high latent heat of vaporisation. This ensures excellent internal "cooling" of the motor. It can be produced industrially in various ways, for example, starting from coal. It allows the use of very high compression ratios and contributes to thermal efficiency and, therefore, performance. The energy content, i.e. the calorific value, is considerably lower than that of petrol, but the stoichiometric ratio of the mixture with air is only 6.4. This means that the same volume of fuel/air mixture contains more fuel. The result is that the thermal efficiency, i.e. the amount of energy supplied by the combustion of a given volume of the mixture, is very similar to that obtained with petrol, but with much higher attainable power. To make the most of the potential of this fuel, however, it is necessary to "adapt" the engine by increasing the compression ratio. The performance gains can be very considerable. However, the price that must be paid is much higher consumption, which means much less autonomy. Methanol is also extremely harmful, both on contact with the skin and by inhalation. It also attacks some metals and damages the sealing elements made of specific elastomers.

Another well-known alcohol used in fuels is ethanol (or ethyl alcohol). It can easily be obtained from plants of

In the world of Dragsters, nitromethane is the standard, allowing engines to reach over 12.000hp. Sometimes, because of the tendency of this fuel to explode, engines can be blown apart.





NOS came to the public's attention thanks to the clandestine races in the *Fast &Furious* film saga. However, during World War II, it was already being used in aeronautics to help accelerate aircraft off aircraft carriers and in American Drag races. NOS Cylinders are usually installed in the boot of the car.

different types that are fermented and then distilled. Therefore it has particular importance as an alternative fuel. In fact, in some countries, it is used instead of petrol to power the engines of road cars. For this fuel, the considerations already made for methanol generally apply. Generally, however, it is more expensive, and the increase in performance it provides is low. For these reasons, it is not of interest as a racing fuel. The stoichiometric dosage of the mixture with air is 9, and the latent heat of vaporisation is significantly lower than methanol. However, it is still five times that of petrol. Furthermore, ethyl alcohol is hygroscopic, i.e. it has a considerable affinity for water and tends to absorb it also from atmospheric humidity.

NITROMETHANE

Nitroparaffins are very interesting but also highly critical chemical compounds. Among them is nitromethane, which contains more than 50% oxygen by weight. The performance improvements it provides are outstanding. Already present in some special fuels developed in Germany at the end of the 1930s, it was used post-war for racing until the regulations prohibited it. Today it is mainly used to power Dragster engines. It is a corrosive compound, particularly for aluminium and magnesium. It is also somewhat unstable and has a marked tendency to detonate. If the percentage added to methanol increases, the compression ratio must be decreased and the ignition advance adjusted. Consumption is enormous - some dragsters burn more than one litre of nitromethane per second! Additionally, the mechanical stresses on the engine are enormous. By way of example, by adding 30% nitromethane to methanol, the potency increases by 25%. With 50%, the power increase is in the order of 40%!

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Nitrous oxide

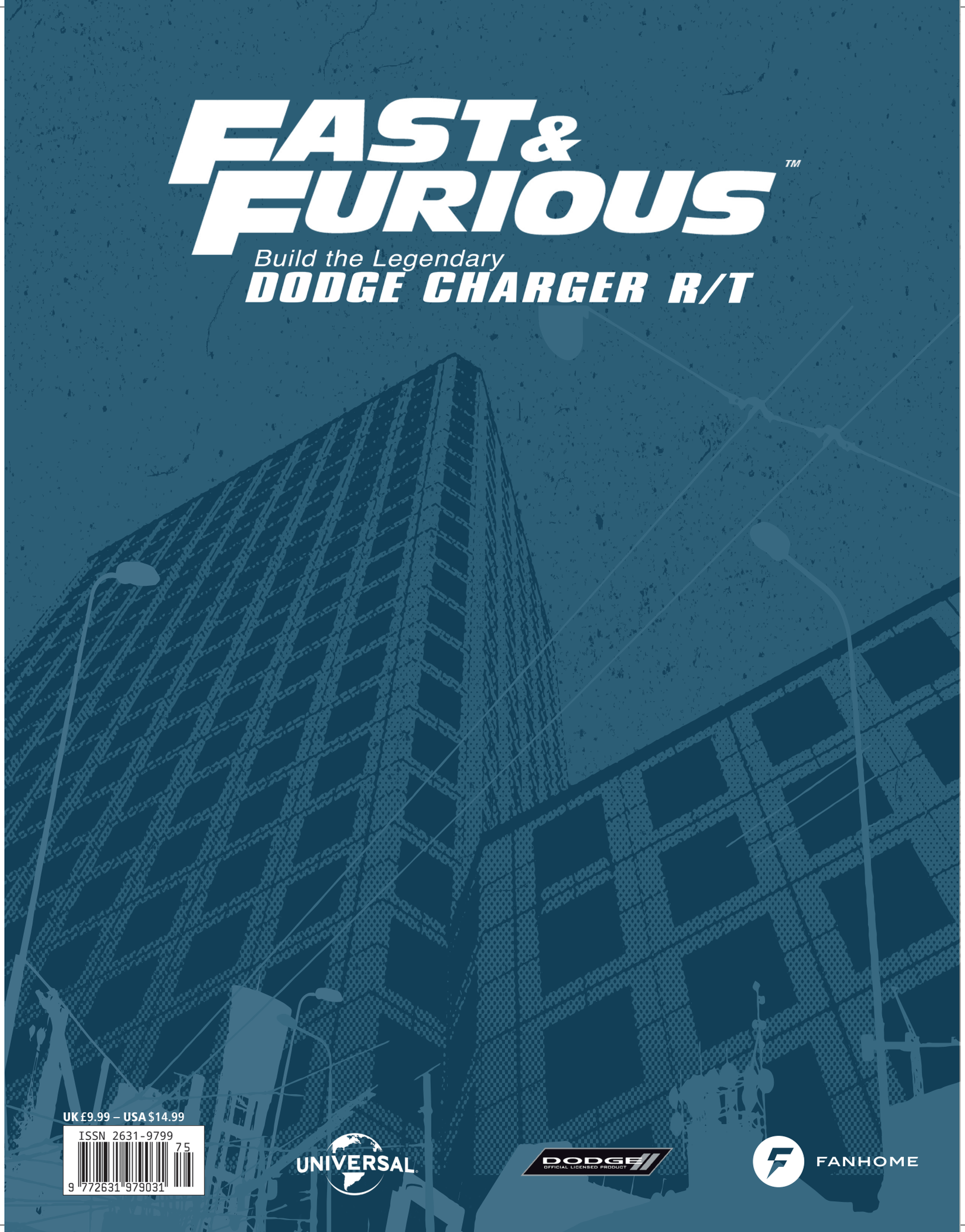
Although nitrous oxide (Fast & Furious's famous NOS) is not exactly a fuel, we feel it is right to devote a small amount of space to it in this article. In the past, especially during World War II, it was used to give combat aircraft engines extra power to take off from aircraft carriers. However, it was drag racing that increased its fame and popularity, first in America, then in Europe.

NOS, also known as "laughing gas", is a comburent - a substance that aids combustion. It is vapourised inside the combustion chamber, thus lowering the temperature inside the cylinder. This causes the air in the chamber to decrease in volume, making room for more air. As a result, the compression increases, detonation improves, and so does the performance of the engine. It is thanks to the protoxide molecule (which contains more oxygen that is released at the moment of combustion) that the engine can burn more fuel and temporarily have more horsepower available. We can usually quantify the power increase as between 30% and 40%. However, there is a limit to the time it can be used. The protoxide can only be released into the cylinders for a few seconds to avoid destroying the engine's mechanical parts.

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