FAST & FURIOUS™

80

Build the Legendary DODGE CHARGER R/T



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FAST & FURIOUS

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THE BATTLE OF THE ANTONOV

The director Justin Lin wanted to end the sixth *Fast & Furious* movie in style. For this, he prepared one of the most incredible sequences seen up to then in an action movie. The main ingredients: cars racing at top speed, legendary battles, and a huge aeroplane.

After playing cat and mouse during the entire movie, the final clash between Toretto and Shaw in *Fast & Furious 6* had to be the biggest. Director Justin Lin and screenwriter Chris Morgan imagined an explosive finale: both sides, Dom's team and Shaw's mercenaries, would finally come face to face. But they would do so in a thrilling chase on the runway of an airbase.

"There's an aeroplane, cars everywhere … someone thought: 'What would be the most fun thing to film?' And then it was filmed, which is crazy. It's a very bold scene," says actress Jordana Brewster, who plays Mia Toretto.

Not only do Owen Shaw and his men intend to escape the scene in a military cargo transporter, but they're going to take Mia with them. For this reason, Dominic Toretto and Luke Hobbs join forces to stop them at all costs, in their cars, chasing a plane that is about to take off.

THE FOURTH LARGEST AEROPLANE IN THE WORLD

Justin Lin always said to his crew that to work in the *Fast & Furious* franchise you had to think big. Therefore, when the preparations for the final sequence in the sixth film began, he asked to be able to have one of the biggest aeroplanes in the world: the Antonov An-124 Ruslan, an unbelievable plane, 69 meters long, with a wingspan of 73 meters, and capable of transporting cargo weighing 150 tons.

It took more than eight weeks to film the sequence in October 2012, and the work was spilt between two different places. These were the RAF airbase in Hertfordshire, England, where the chase was filmed on the run-

Considered to be the fourth largest plane in the world, The Antonov An-124 Ruslan became the main protagonist of the explosive finale of *Fast & Furious 6*.

The battle of the Antonov

way, and Longcross studios, where the special effects crew, headed by Joss Williams, recreated different parts of the inside of the plane. In charge of a crew that eventually numbered 137 people, at all times Williams followed the instructions of Justin Lin, who continued to demand that even the most extreme action scene had to be as realistic as possible.

Given that working with a real Antonov was virtually impossible, because of its size, and the need for dozens of cars to be circling it at high speed, the people in charge of the movie decided to recreate some parts of the plane at scale, both the outside and the inside. For this, Williams worked side by side with the production designer Jan Roelfs and the construction manager John Maher.

"It was a massive challenge," says Roelfs, "but I really like this franchise because it is made for the more working-class parts of the social spectrum, whereas the James Bond movies always focus on the elegant and glamorous side of life."

MOBILE LIGHTING

Roelfs and Maher were tasked with creating completely separate and functional exterior parts of the aircraft, from aeroplane tyres six feet tall or the rear cargo loading ramp, to a skeletal frame representing the entire length of the plane's wing. They were only able to work with the frame because the wing covering would be added digitally in post-production by David Vickey, special effects supervisor at Double Negative.

Since the entire scene takes place at night, the photography crew led by Stephen F. Windon had to create a mobile lighting system, attached to a truck, in order to be able to work while moving along the entire length of the runway. It was not the only thing they had to invent. On one of the sets representing the inside of the plane it was necessary to devise an intelligent system on the roof to provide different lighting configurations to film the multiple fights taking place.

WITH ACCESS TO VEHICLES

Of course, to be able to film this scene the stunt performers were equally essential, both those with the task of driving the vehicles and those who had to perform amazing acrobatics. In one of them, the stuntman acting as agent Luke Hobbs's double had to jump from a vehicle traveling at high speed on to the Antonov's landing gear. To film this incredible scene, John Maher and his crew built a replica of the landing gear that weighed nearly 40 tons and had to be towed by a truck.

Another part of the Antonov that had to be recreated by the film crew was the plane's rear loading ramp, which

To film the frenetic final scene, several replicas of various parts of the plane were built, which made the job easier for the actors and technicians.



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JAN ROELFS

Born in Amsterdam in 1957, Jan Roelfs is an artist who has created wonderful settings for intimist films and major blockbusters alike. In his early days, this production designer's career was closely linked to that of art-house film director Peter Greenaway, who he worked with on films like *Drowning by Numbers* (1988), *The Cook, the Thief, His Wife & Her Lover* (1989), and *Prospero's Books* (1991). But it was a project unconnected with Greenaway – Sally Potter's biographical drama *Orlando* (1992) – that earned Roelfs his first Oscar nomination. Later, he would once again be in the running for the golden statuette thanks to his magnificent work on the futurist movie *Gattaca* (1997). After that Roelfs began working on Hollywood blockbusters, such as *Alexander the Great* (2004), *The Hunting Party* (2007), *47 Ronin* (2013) and *Ghost in the Shell* (2017). He also had the opportunity to be part of the sixth movie in the *Fast & Furious* franchise, returning later for the ninth.

had to allow vehicles to drive on or off the moving plane – in actual fact a hydraulic platform set at a height of more than 30 meters – so the drivers had to demonstrate their acrobatic skills.

A LOT OF ACTION IN A SMALL SPACE

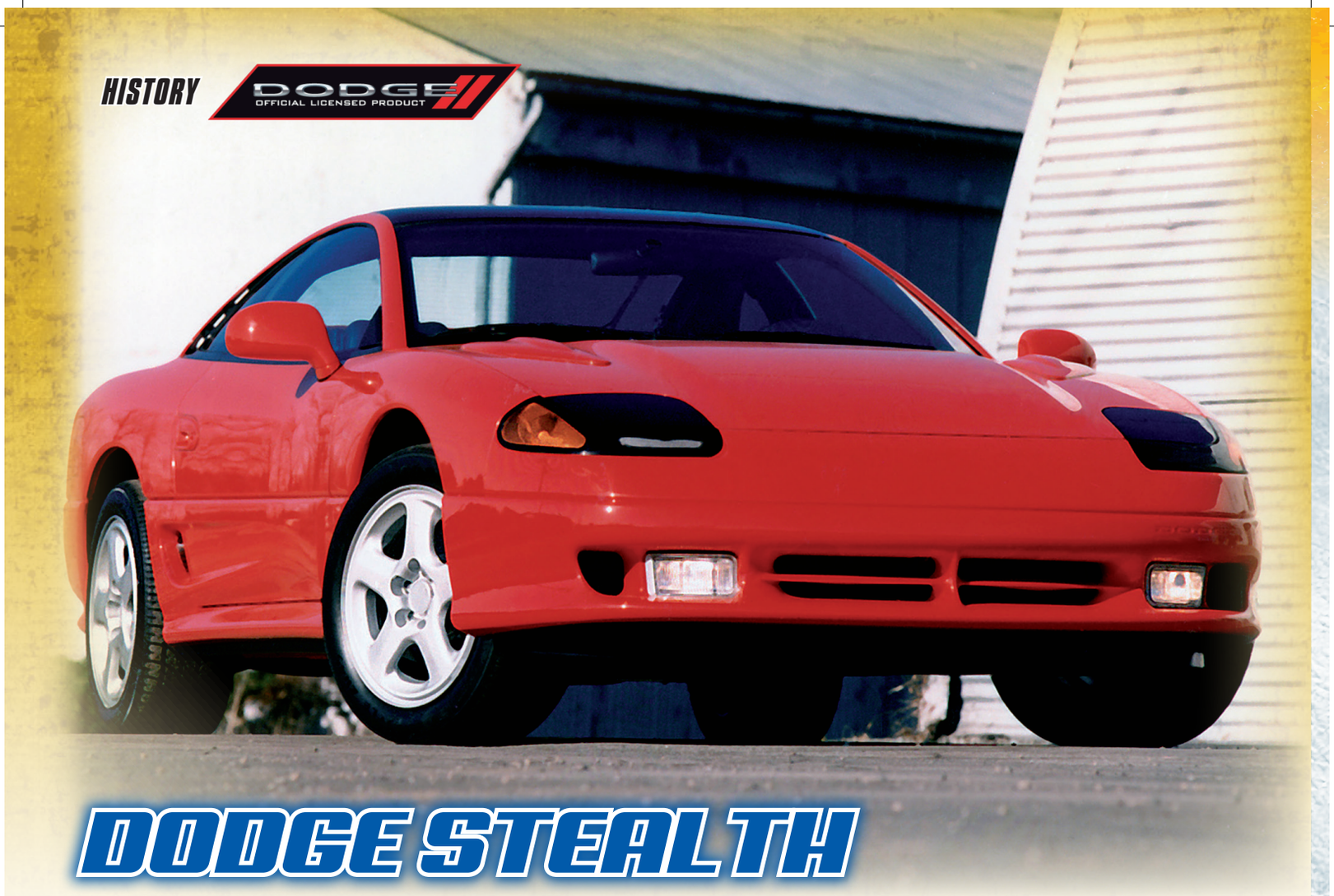
Just filming the interiors of the plane took two weeks. The sets were mechanised so that they would resemble those of a real Antonov. Despite being quite a large space, the work in the studio demanded close collaboration between all the technicians and actors involved in the scene. Bearing in mind that on the set, as well as the cameras necessary for filming, there had to be enough room for the bulky cargo boxes and three cars – the Charger, the Alfa Romeo and the Flip Car – it was difficult to move freely. On account of all this the fight coordinator, Olivier Schneider, was left with no option but to adapt the narrow passageways to be able to choreograph some really demanding fights. The nine actors that were taking part in the scene gave it their all to obtain an awesome result.

In any case, when they had finished filming what many ended up calling the "battle of the Antonov", nobody was too sure about the results. Except for Justin Lin, that is, who as usual had the entire movie in his head even before filming began. Together with his team of editors and the people in charge of the digital effects, who rounded off what had been filmed, the director put the pieces back together to produce a long, electrifying chase in which the audience has to simultaneously keep track of about 20 fights taking place inside the plane and outside it – a true tour de force that served to provide the finishing touch for what undoubtedly became one of the most incredible movies in the franchise.



After having been kidnapped and forcibly taken to the plane in which Shaw and his gang planned to escape, Mia Toretto uses her wits to escape to safety.

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DODGE STEALTH

Developed by Mitsubishi and manufactured by that brand in Japan, the Dodge Stealth was a high-performance sports car that the Dodge brand sold, with its own bodywork design, on the American market. The most powerful version, the Dodge Stealth R/T Turbo, had a V6 engine giving 320hp and four-wheel drive.

The R/T Turbo version of the Dodge Stealth was a high-performance car thanks to its Twin-Turbo V6 engine giving 320hp.



An advertisement for the car with a quote from the American specialist magazine *Road & Track*, in which the model's acceleration was highlighted.

In 1970 when the Chrysler Corporation acquired 15% of Mitsubishi, these two industrial giants began a long period of collaboration that continued even after the Japanese brand repurchased its share package in 1993. This meant that many of the Japanese firm's models were sold under the Dodge and Plymouth brands in the USA. The most spectacular one was the Dodge Stealth, the version for the American and Canadian markets of the first-generation Mitsubishi 300 GT. Unlike other Mitsubishi models sold by the American company, the Dodge Stealth had its own distinct bodywork, created by the Dodge brand's design department.

The Dodge Stealth was launched in 1991 in four versions, the more modest of which were front-wheel drive coupes giving barely 164hp. But the Dodge Stealth R/T Turbo was a pure sports car, brim full of technology. Its engine was the same 3 litre V6, but with a cylinder head with four valves per cylinder and, above all, two turbochargers that increased the power to 320hp. With a six-speed gearbox, rather unusual then, and an integrated traction system, the Dodge Stealth was one of the first cars in the world to incorporate a rear-axle active steering system.

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THE REAR RIGHT WING

In this assembly session we will show you how to attach the rear right wing to the body of your model. Follow our instructions and the accompanying illustrations carefully.

PIECES FOR THIS STAGE

80A



AM



DM

80A Rear right wing

AM Screws 2 x 4mm (x 11)*

DM Screws 1.7 x 3 x 5mm (x 3)*

* 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

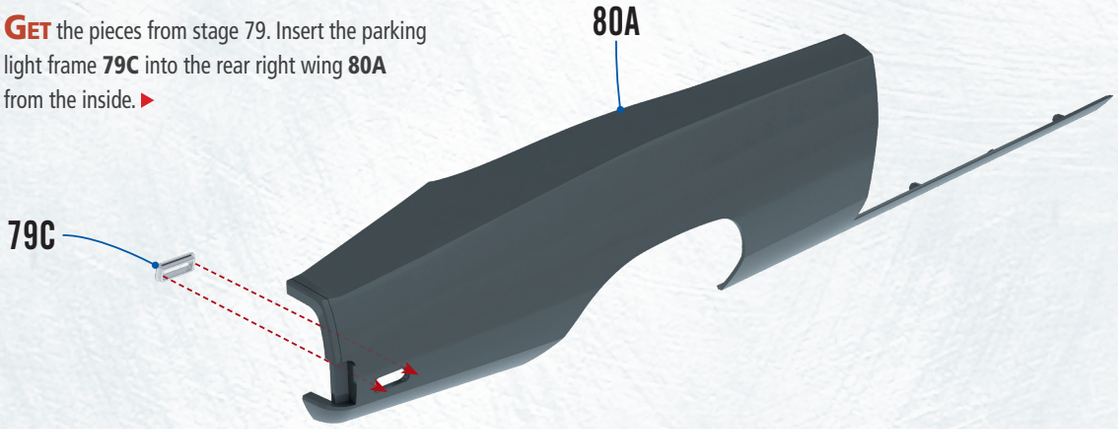


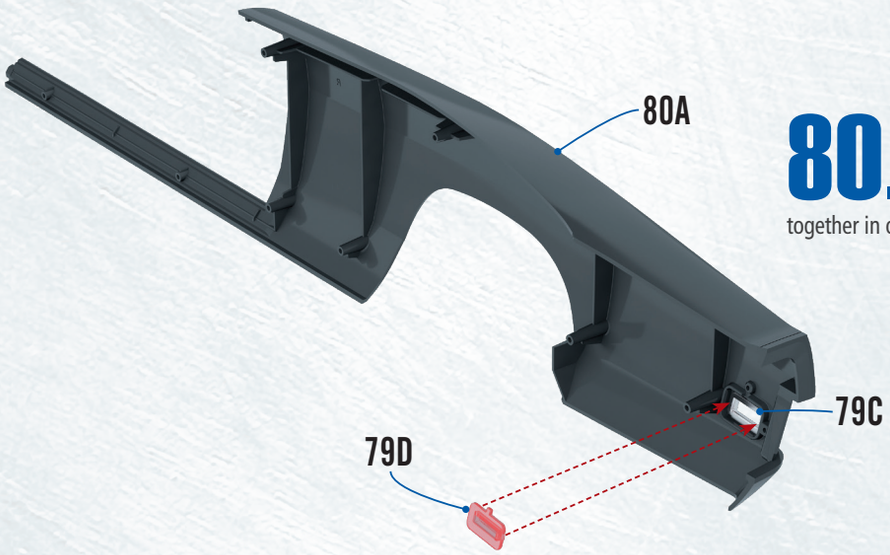
CAR BODY

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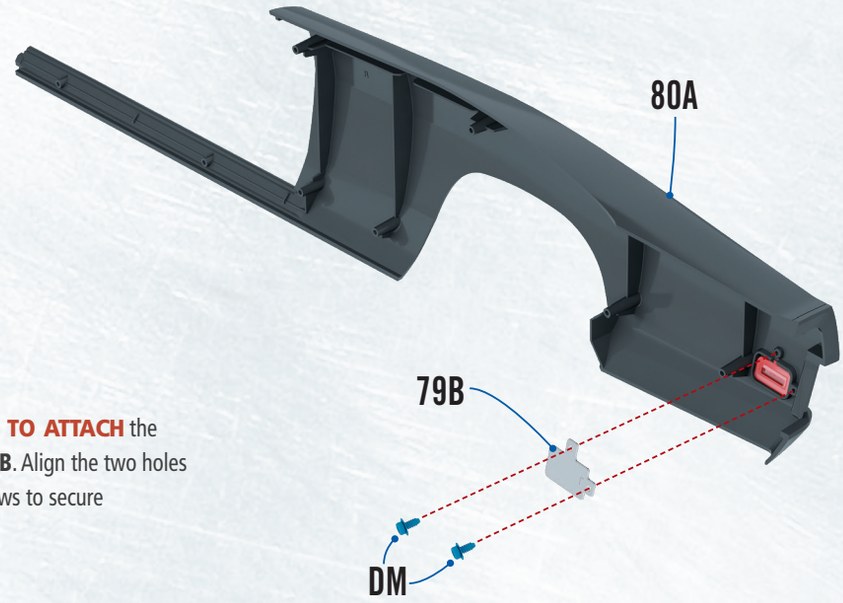
The rear right wing

80.1 **GET** the pieces from stage 79. Insert the parking light frame **79C** into the rear right wing **80A** from the inside. ▶





80.2 **AGAIN** from the inside, insert the lens **79D** into the frame. The interlocking elements mean that the pieces only fit together in one way. ◀



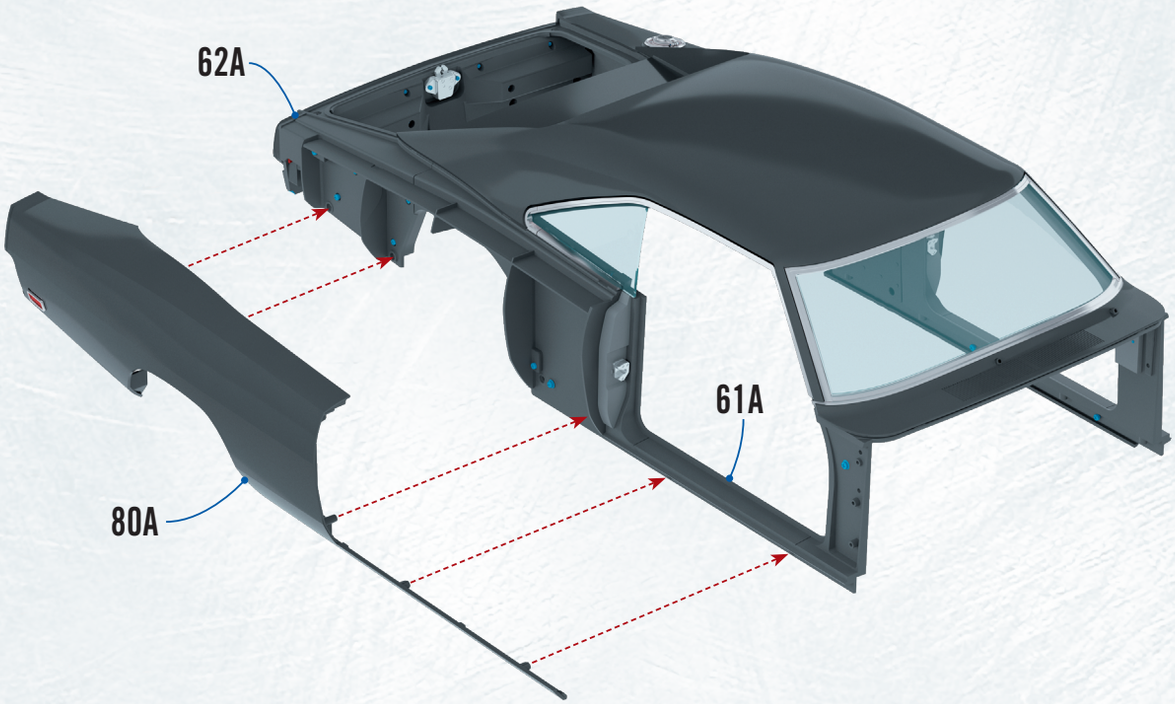
80.3 **YOU ARE NOW GOING TO ATTACH** the parking light mount plate **79B**. Align the two holes and insert two type **DM** screws to secure the plate to the wing. ▶

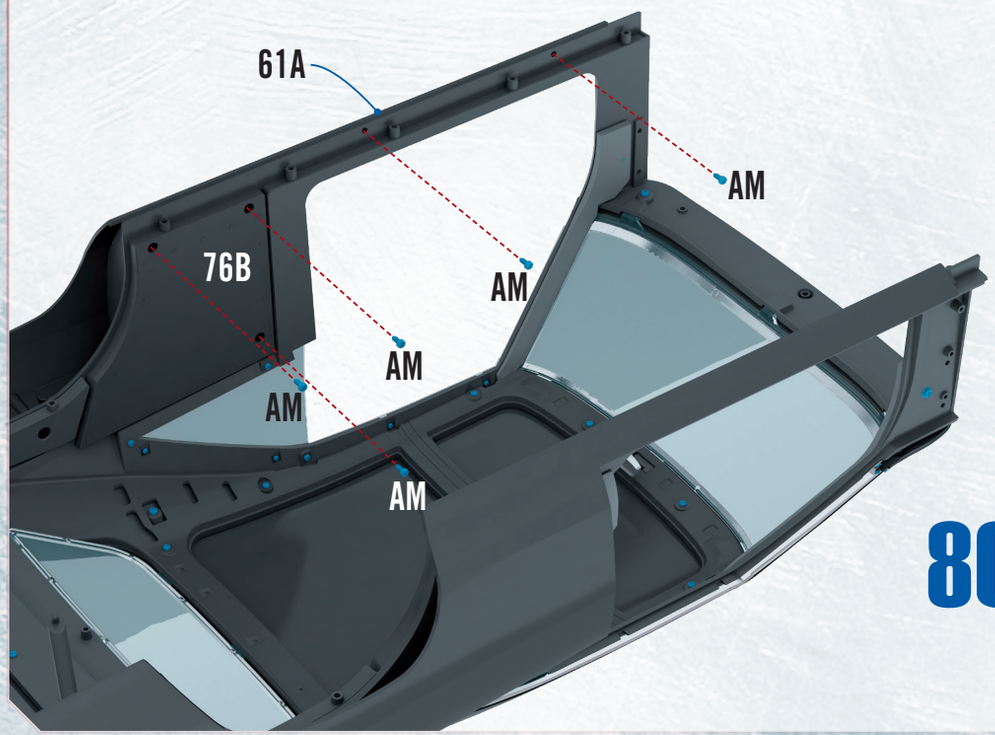
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80.4

USING the guide pins mount the wing **80A** on the right side of the car body. ▼



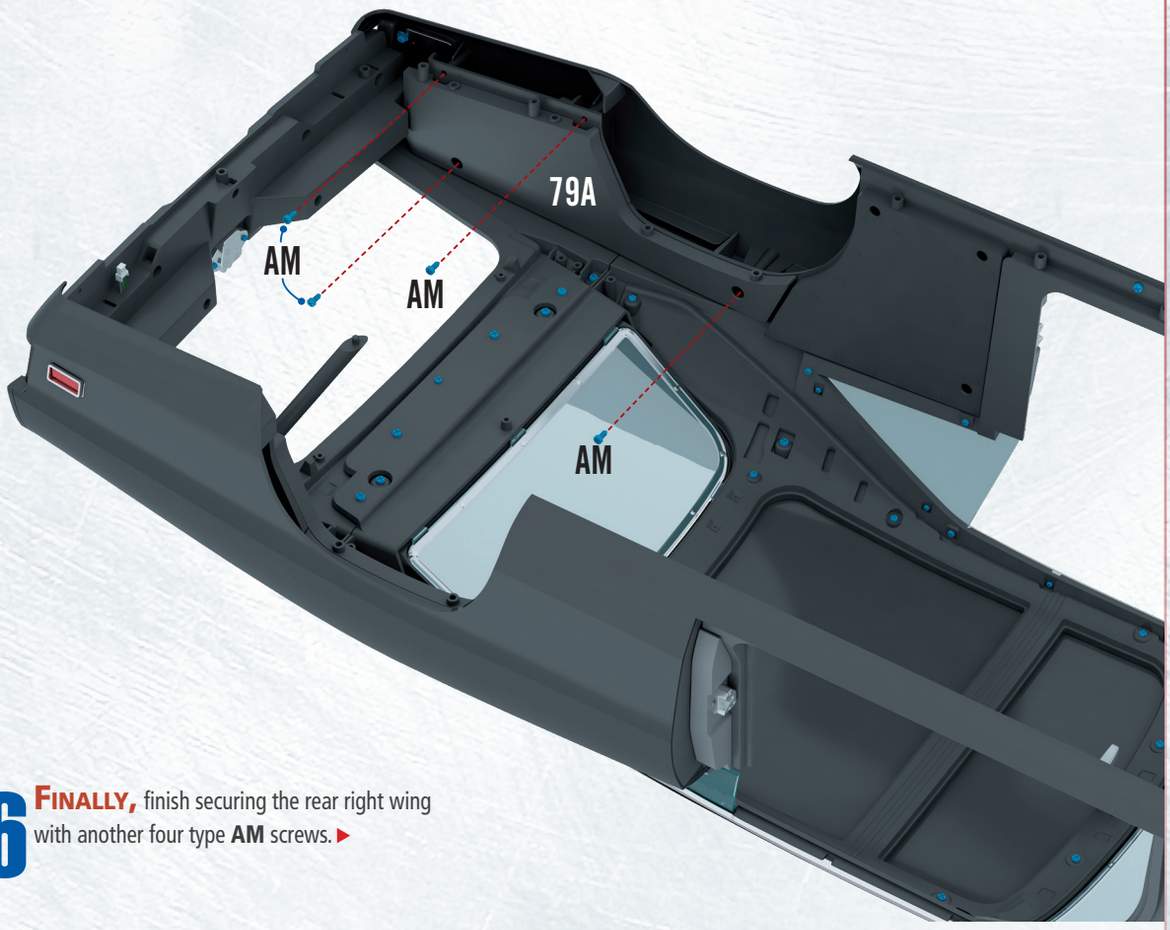


80.5

SECURE the wing from the inside using five **AM** screws. ◄

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The rear right wing



80.6 **Finally,** finish securing the rear right wing with another four type **AM** screws. ▶

RESULTS OF STAGE 80



You have now mounted the rear right wing on the car body.

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IT'S ALL ABOUT FRICTION



In the presence of movement, friction between components is inevitable. Sometimes it is an enemy, because it absorbs power and causes wear, and must therefore be reduced to a minimum. In other cases it is essential, for example for the brakes and the clutch. In this edition, we shall take a look at this phenomenon.

Friction is a force caused by the resistance that one surface or object encounters when moving over another. It is a resistance to motion between two surfaces that are in direct contact with each other. If the surfaces are lubricated it is called mediated friction. Where there are rollers or ball bearings, it is known as rolling friction. In these cases, the resistance varies according to factors such as the type of friction, the characteristics of

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It's all about friction

the lubricant used, the geometry of the surfaces, and the materials of the components that are in contact. Furthermore, friction causes heat, because by resisting the motion, kinetic energy is generated. Think of Formula 1 cars. Under extreme braking it is not uncommon to see images of red-hot brake discs.

We can therefore affirm that the forces of friction are dissipative. That is, they waste energy that is dissipated, or transformed, so that it is no longer usable. What can be done, in many cases, is to try to reduce the waste as much as possible. This is what happens in the case of motors, in which a decrease in friction losses determines an improvement in mechanical efficiency. Therefore, there is an increase in overall efficiency: for the same power delivered per unit of time, fuel consumption is lower, or vice versa, for the same fuel consumption, the power is greater. Additionally, the efficiency of energy transmission from the engine output to the drive wheels depends on the friction losses that take place between the two locations.

STATIC AND DYNAMIC FRICTION

Resistance to motion is closely linked to the lubrication, the load and the characteristics of the materials that are in contact. Of course, we must also take into account the geometry of the bodies that are in contact. For example in the presence of spherical components, they will not be a sliding against each other but rolling.

Therefore, friction varies according to the materials, their shape, and what is defined as their coefficient of friction.

However, it is not accurate to state that every material has its own coefficient of friction (defined as μ), because we must consider the other material with which it comes into contact. As regards sliding friction, which occurs when one component slides against another, specific tables indicate the friction coefficient between pairs of materials in common use. Anyone interested in the subject will notice that often, in addition to the coefficients of dynamic friction that occur in the presence of relative movement

When a body in contact with another does not slide, but rotates on it because it has a cylindrical, discoidal or spherical shape, it is denominated "rolling friction". In this case, the resistance to motion is extremely low. It is caused by the micro-deformations that inevitably exist, and by the local elastic deformations of the two surfaces.





between the parts, the figures for static friction are also considered, which are generally much higher. As an example, it is easy to understand that it is much easier to push a crate across a floor once it is already in motion than it is to initiate the movement from a standstill.

WHEN FRICTION IS NEEDED

In many cases, friction is not just useful, it is indispensable. For example, no road-going vehicle could work if there was no friction between its tyres and the road surface. This is because forces could not be transmitted to the ground and therefore the vehicle would be unable to move, accelerate, vary its speed, or brake. It would not even be able to steer!

Tyres fall into a separate category in that when they come into contact with the ground they are a "soft" material, which, thanks to the load on the wheels, generate grip via a dual mechanism. To the molecular adhesion, which is obviously temporary during rotation, is added mechanical anchorage. Rubber, thanks to its ability to deform elastically, penetrates into the texture of the road surface and "clings" to it. Adhesion, also known as "grip", is the tyre's ability to transmit forces to the ground, both longitudinally, during acceleration and braking, and transversely, when cornering. The transmission of forces due to friction that is produced during rotation is static friction, while the one that comes into play under braking or turning is dynamic friction, and is a lesser amount.

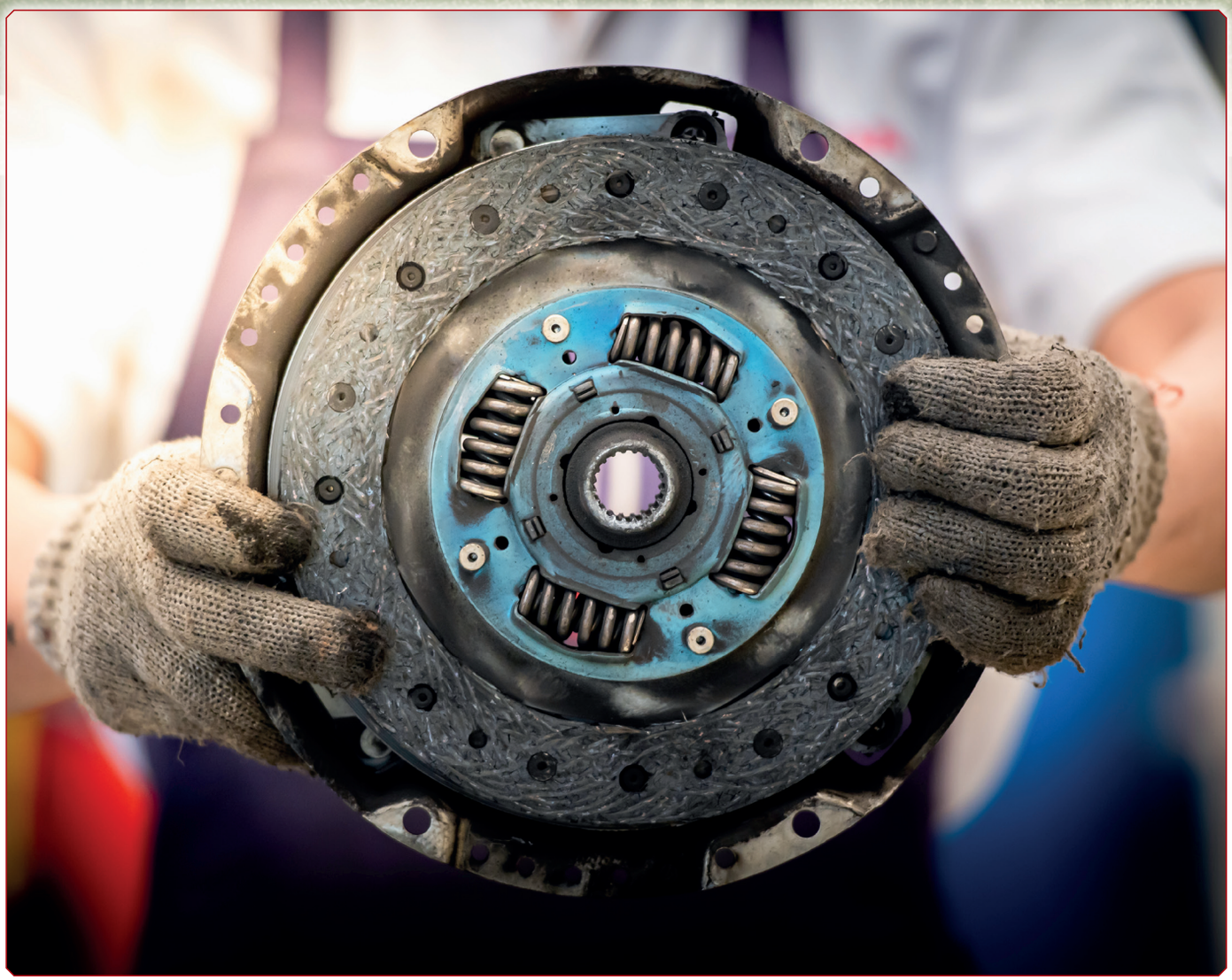
Another point worth remembering is that the sum of the longitudinal and transverse friction is more or less constant. This means that if you use up all the grip when braking or accelerating, you will lose the ability to steer. Experienced drivers will know that you cannot steer a moving car with the front wheels locked.

FRICTION AND THE CLUTCH

The operation of a car's clutch also depends on friction. In this case, the rotation of the drive shaft by the power unit. A diaphragm spring presses a clutch plate against a flywheel and the friction between the two transmits the driving force from one to the other. The abrasive material on both sides of the clutch plate is similar to

Screws, nuts and washers do their job of uniting various components thanks to friction. Without it, the threaded surfaces would not grip each other.

It's all about friction



Friction is a fundamental factor in the automotive world. Even the operation of the clutch is tied to this physical phenomenon. Without friction, coupling between the flywheel and pressure plate would be impossible.

the material used for brake pads. In addition to the classic single disc and dry automotive clutches, there are those used in automatic gearboxes and in some double clutch transmissions, which are multi-disc and work in oil bath. Since the surfaces of a "wet" clutch can be slippery, in these cases, a "stack" of multiple clutch discs is used. These alternate with the same number of driven disks to eliminate slippage under power when fully engaged. The engagement is obtained thanks to the action of a pressure plate, which presses against the discs, making them integrate with each other.

LOCK THE ROTATION

We all know that brakes are used to stop a car in the shortest possible distance. Their operation is based on friction, or more precisely, on what takes place between the moving part (the disc or drum) and the fixed parts that press against it (the brake pads or brake shoes). The amount of heat generated is often massive and must be conveniently disposed of.

The characteristics of the materials used are all the more important in this case. In addition to the coefficient of friction, the specific heat of the material with which the disc is made is also of considerable importance. The disc must also be light, and this explains, even more than its ability to work at very high temperatures, the use of carbon fibre in racing car discs.

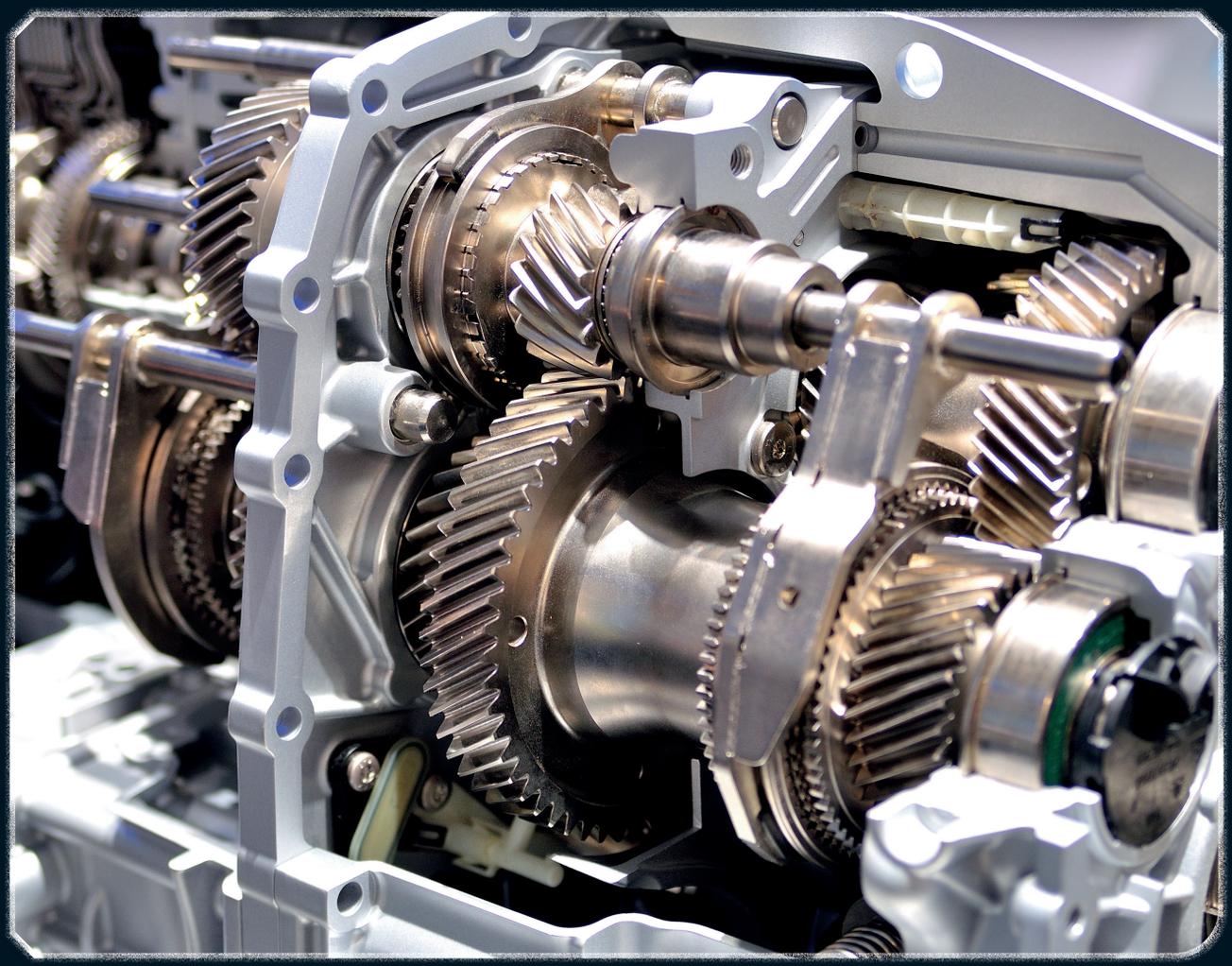
The initial grip, and the maintenance of an almost constant coefficient of friction as the temperature increases during braking, is fundamental. On production cars, the friction material of the pads is in most cases organic, i.e. it is made up of various substances that are compressed and "baked" to form a compound that has the desired characteristics. Recently, especially for certain high-performance applications, sintered friction materials have begun to find applications.

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The importance of lubrication

Things change when a film of lubricant comes between the moving surfaces: the resistance to motion decreases considerably. In an optimal situation, this lubricant layer should have a depth such as to make the components "float" on each other, without the micro-abrasiveness of the surfaces coming into contact. In this case (a hydrodynamic regime), the resistance to motion is minimal, since it consists only of the internal friction of the fluid, i.e. of the oil separating the metal surfaces. In order to establish this type of lubrication, it is essential that the movement take place at high speed. Another parameter to be taken into account is the viscosity of the oil, which determines the load capacity of the lubricating film. When the depth of the oil layer is not sufficient to allow complete separation between the two surfaces, contact begins to occur between the microscopic abrasions of the surfaces. The resistance to motion increases considerably and the tribological properties (the slipperiness) of the oil become more important. In this case, what has been established is a "mixed" lubrication regime. On the other hand, when the contact between the abrasiveness of the surfaces becomes greater and the depth of the oil layer becomes smaller (it can even be reduced to a few layers of molecules adhering to the metal surfaces), we are in the presence of limited lubrication.

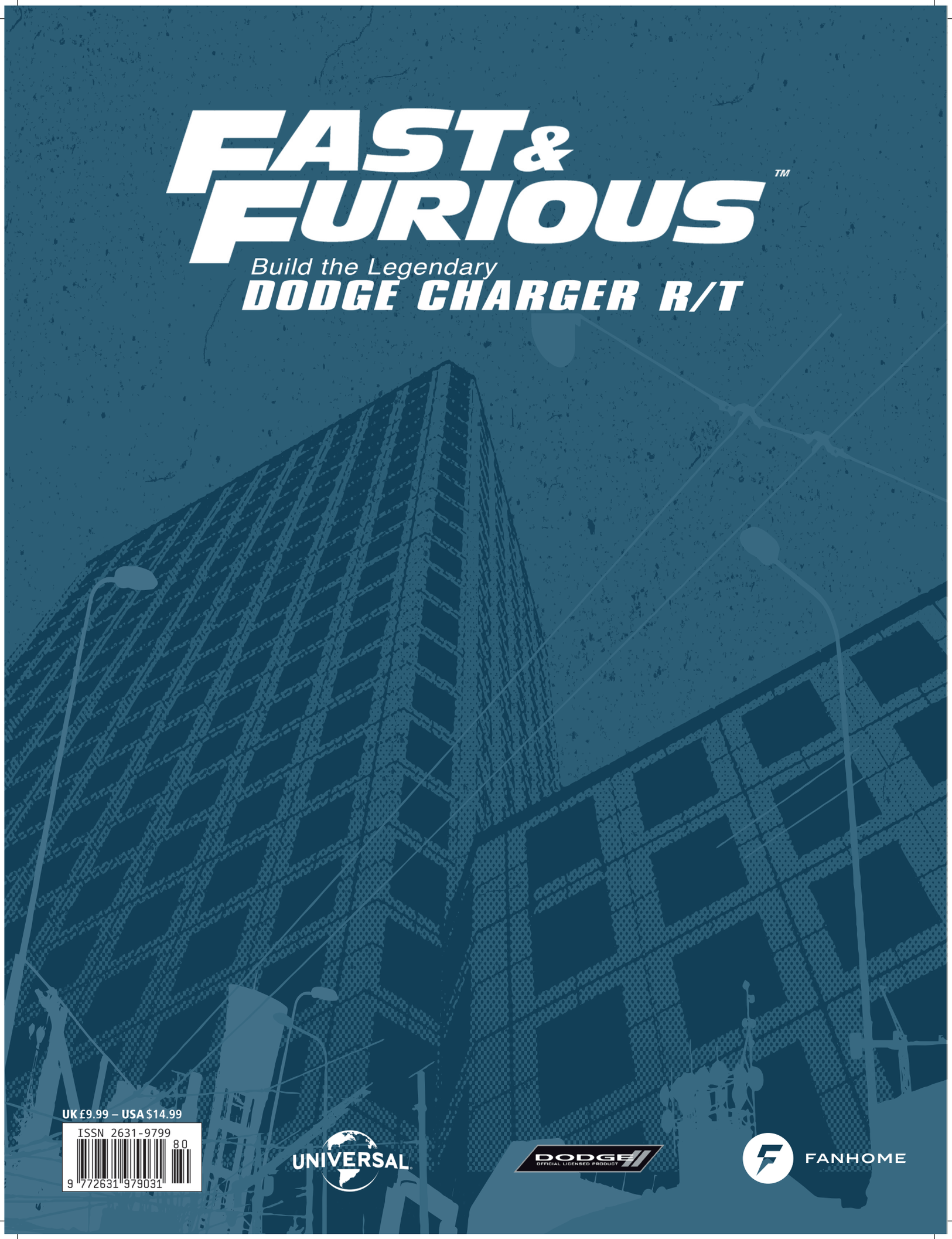
In this case, only the tribological characteristics of the oil are considered (adhesiveness, slipperiness, anti-wear properties and EP - extreme pressure): the viscosity is no longer important and the resistance to motion is high, even though it is far lower than that which is obtained between "dry" surfaces.



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