Mazda RX-7

"Down To The Last Gram"

What we learned from Le Mans – pure sports car spirit and the importance of weight reduction.

The 59th Le Mans 24-Hour Endurance Race ended at 4 p.m. on the 23rd of June, 1991 when the winning Mazda 787B crossed the finish line having covered a total distance of 4,923 km. This was the first ever victory for a Japanese manufacturer in this prestigious event. Le Mans is the most gruelling race in the world, where speed, endurance and fuel efficiency are factors of paramount importance in determining the winner. This victory represents the pinnacle of our achievement in the development of the rotary engine to date.

Perhaps more important than this victory is that everything we learned from our many years of competing at Le Mans, both spiritually and from a technical standpoint, led to the evolution of the new RX-7. By challenging the best sports cars in the world, and sharing the passion of those involved in this sport, we captured the essence of what a sports car should embody – a feeling of oneness between car and driver – and thus gained a clear insight of how we should design the new RX-7.

Needless to say, the key factor in creating our ideal sports car was weight, not only in terms of absolute performance but also in relation to the sensation of driving. Light weight was essential to our development of a sports car second to none in speed and driving pleasure.

Extensive weight reduction was thus selected as the technological theme for the development of the new RX-7. Mazda is the only car manufacturer currently using the compact, high-performance rotary engine, which gave us the ideal starting point.

The perfect location for heavy components, such as the engine, is between the front and rear axles. This configuration optimises front and rear weight distribution and minimises the yaw moment of inertia, both vital ingredients for a sports car designed for exhilarating handling. In the new RX-7, the rotary engine is located behind the front axle. This is what we call the front-midship layout. The more conventional rear-midship layout, where the engine is located between the cabin and the rear wheels, sacrifices luggage space and limits access. We believe that the front-midship layout is the ideal configuration for sports cars, since it necessitates fewer concessions in terms of design.

However, one major obstacle exists in implementing this ideal layout – the space between the front axle and cabin. Extending the wheelbase would be one solution, however this would sacrifice sports car dynamics. The compact rotary allows this layout without sacrificing the interior space, nor enlarging the wheelbase. As a result, weight distribution can be optimised, and the yaw moment of inertia minimised.

Our target was clear from the beginning, to develop a car that fully exploits the advantages of the rotary engine while being endowed with the spirit of a pure-bred sports car. One that would be exemplary in a world where the paradigm has shifted. From a technical standpoint, all parts and components were the target of our weight reduction endeavours – down to the last gram.

For example, aluminium has been used for many components. These range from large parts such as the bonnet to detailed items like the arms and links of the four-wheel double wishbone suspension, brake and clutch pedals and even the jack. The overall size of the vehicle, door configuration and even the shape of the windscreen, along with a host of other details, have been the target of weight saving.

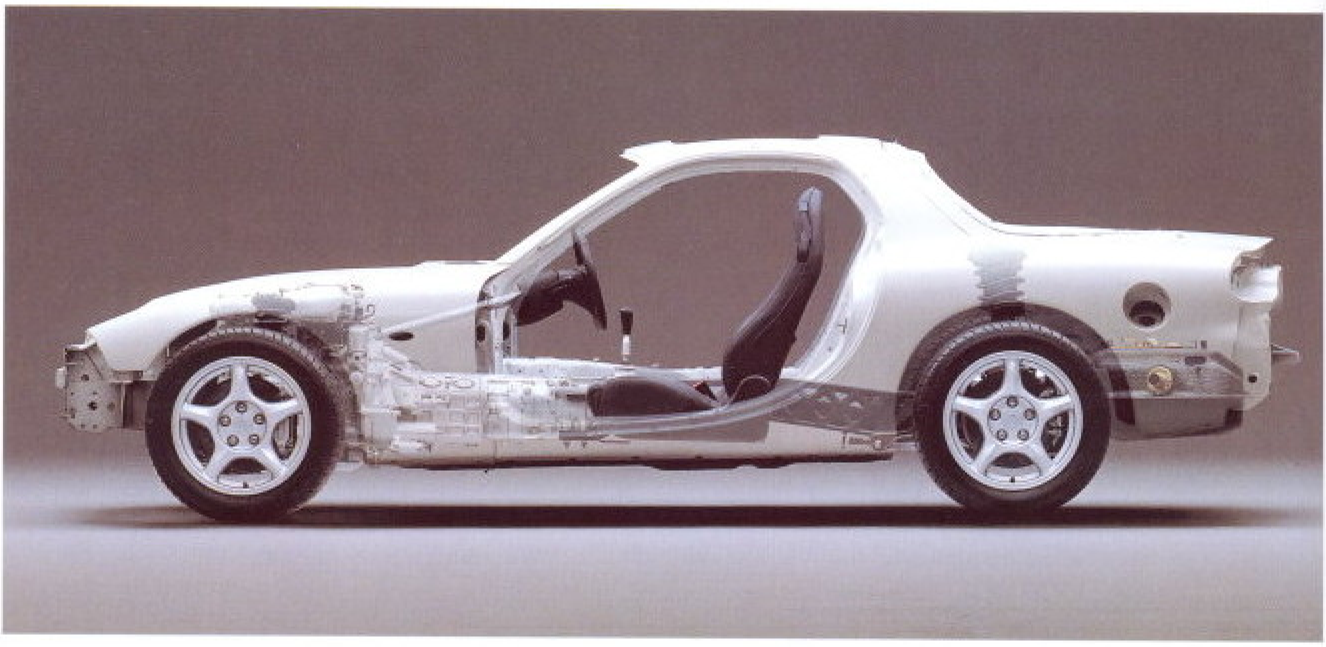
On the other hand, weight has been added selectively in areas of particular importance. Additional cross-members were added to improve body rigidity, and the Powerplant Frame has been used to increase the rigidity of the drivetrain.

Major safety features such as the driver's-side airbag, side impact bars in the doors, anti-lock brake system, and the latest Torsen® limited-slip differential are also standard equipment. We believe that all these features are indispensable to realising a secure feeling of oneness between car and driver.

The new RX-7 is a pure sports car. A sports car is not a vehicle that serves a solely utilitarian purpose, neither will it provide the same pleasure of ownership to everyone. We believe that a sports car should be a car for those individuals who require the satisfaction that can only come from the feeling of driver and car interacting as one. We hope the new RX-7 will bring back the spirit of freedom which existed at the inception of the genre. It is built for those people who truly love sports cars.

The pleasure of consummate interaction between driver and car, something that has been lost in many of today's sports cars, is waiting for you in the driver's seat of the new RX-7 – where the best of the world's modern technology has been harmonised.

Our styling designers succeeded in their task of creating a sports car with the beauty of a wild animal.



The styling proportions were not adopted merely for the sake of beauty – they were inevitable for the performance we sought for the new RX-7.

The capabilities we most desired in the new RX-7 were ideal sports car handling coupled with a sharp turn-in, both of which are necessary to elevate the sensation of oneness between car and driver to new heights. To realise these requirements, weight distribution to the front and rear wheels must be equal and the yaw moment of inertia must be minimised. The styling proportions were essential to achieve these goals.

For handling pleasure, the front and rear wheels must reach their cornering limits at the same time. In other words, the lateral forces that are generated during cornering must be equally distributed between the front and rear wheels.

The front-midship configuration is the key to realising an ideal weight distribution of 50:50. It is made possible by the compact dimensions of the rotary engine, which itself has become synonymous with the RX-7. The engine is mounted behind the front axle, allowing the front overhang to be shortened considerably.

Ideal sports car handling is not the only requirement for the new RX-7. The car must respond immediately to driver input. The yaw moment of inertia is the product of the mass multiplied by its distance from the centre of rotation. Thus, if heavy components are located in the front overhang, the yaw moment of inertia is increased and turn-in response is impaired.

With the new RX-7, we placed great importance on reducing the weight in the front overhang, and we were able to shorten it by 125 mm compared to the previous model. Plastic has been used for all linkages and lids resulting in a total weight reduction of approximately 4 kg. The bonnet is made of aluminium and is 10 kg lighter than a steel version. A 2 kg reduction was also accomplished by using plastic for part of the front tyre housing. The front bumper reinforcement is blow-fabricated, fibre-reinforced plastic, and the rear bumper is reinforced by aluminium resulting in a reduction of 4 kg compared to the previous model. Even the spare wheel is made of aluminium.

The position of the driver and passenger in the vehicle is crucial regarding weight distribution. The seats are located exactly at the centre of gravity, resulting in the loads on the front and rear wheels remaining virtually unchanged regardless of the weight of the occupants. The effect on the yaw moment of inertia is also at a minimum.

The short overhangs, thin fenders, sharply raked windscreen and short rear deck combine to conjure an image of an animal about to pounce. The uninterrupted, continuous curves constitute a new shape for sports cars, embodying muscular yet elegant lines.

The proportions of the new RX-7 were essential to achieve our performance targets.

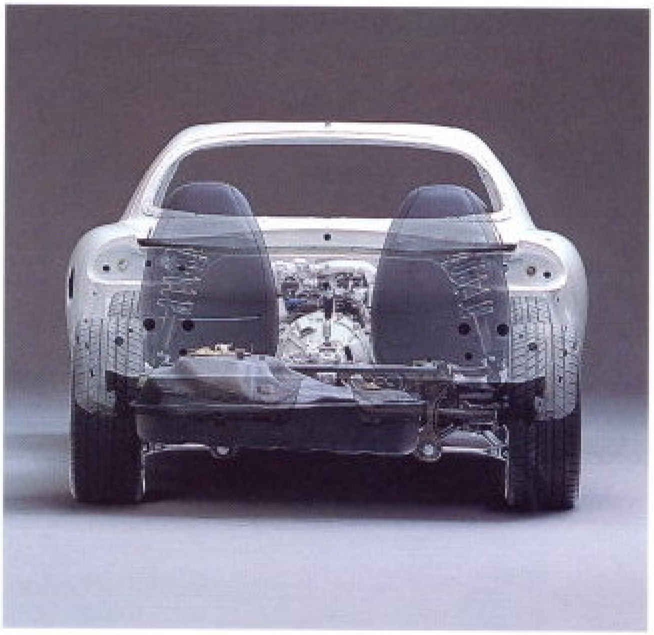
To lower the centre of gravity, simply making the car lower is insufficient, every heavy component should be located at the lowest possible position.

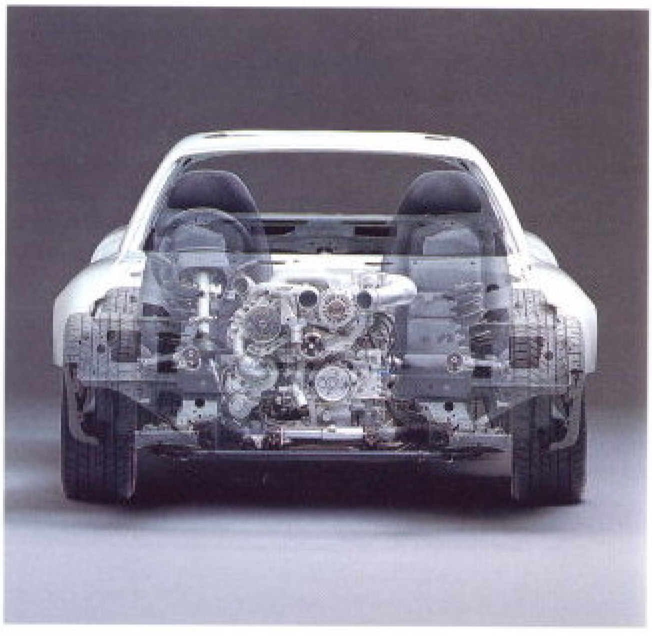
The new RX-7's styling is unique. The low, wide front end incorporates an integrated soft facia, and the large, central air intake is flanked by smaller side intakes. The wing peaks are clearly visible to the driver, for easier manoeuvring. The compact cabin is further evidence of the racing heritage. The smoked-lens tail-lights make signals exceptionally clear to following drivers, while the integrated design of the rear deck, wings, and venturi-type spoiler leaves a distinctive impression. Overall proportions – front, side and rear – were dictated by our pursuit of performance.

In order to realise our performance targets, we were faced with the task of countering centrifugal forces. On top of our exhaustive efforts to reduce weight, we endeavoured to lower the centre of gravity to the last millimetre.

The overall height has been lowered by 35 mm compared to the previous model. But, lowering the overall height alone is not enough, and what is more important is the location of the heavy components within the car. The following comparison with the previous model shows the extent of our efforts. The bonnet has been lowered by 70 mm, the engine height has been reduced by 50 mm and the hip-points of the seats have been lowered by 50 mm. The net result is a 25 mm reduction in the overall height of the centre of gravity.

The width of the track is also a key factor. The wider the distance between the left and right wheels, the smaller the weight transfer caused by centrifugal forces. The track of the new RX-7 has been widened by 15 mm and 25 mm at the front and rear respectively, compared to the previous model. Overall width has been increased by 60 mm to





accommodate these increases in track dimensions and the larger-size tyres.

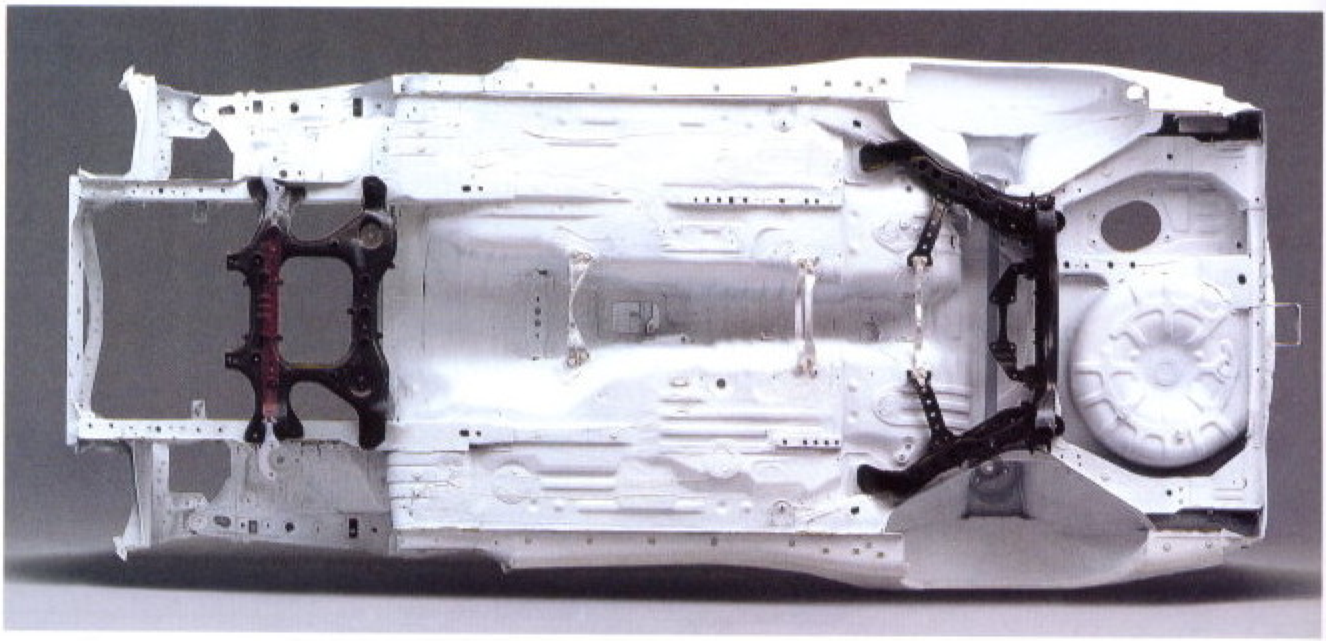
Extensive wind-tunnel testing contributed greatly to the aerodynamic analysis and design. The Aero-Wave roof is an example of this. Its unique design accelerates air flow from the windscreen and helps to eliminate turbulence at the rear of the cabin. A supercomputer was used for simulation of dynamic forces and body rigidity, leading to improved cornering performance. The front spoiler, rear deck and rear spoiler were specially designed to minimise front and rear lift.

The aerodynamic coefficients are as follows:

Cd (Drag coefficient) = 0.31
Clf (Front lift coefficient) = 0.04
Clr (Rear lift coefficient) = 0.01

The low, wide configuration of the new RX-7 was an inevitable result of our pursuit of sports car beauty as well as of our performance targets.

What we call "The Space Monocoque Body" results in both weight reduction and high rigidity and was also designed to enhance the cornering performance.



Our design philosophy – down to the last gram – is also reflected in the development of the body for the new RX-7. The process, however, was far from easy since it was not just a matter of shaving weight from the car.

The main requirement was body rigidity. An example of how body rigidity affects handling can be seen in this anecdote from the development of the 787B Le Mans racing car.

In the early stages of the development programme, the drivers reported to our chassis engineer, who also designed the RX-7 chassis, that the handling of the 787B was not linear. After extensive analysis, through our supercomputer and repeated track testing, the engineer finally found the cause of this problem – the suspension had not functioned correctly because of the lack of body rigidity. The solution to this problem consisted of attaching a strut with a wing-shaped cross-section laterally beneath the floor. The result was impressive – lap times over a four-kilometre track were trimmed by more than one second.

The engineer arrived at this solution not only through detailed analysis but also through his involvement with the body construction of the new RX-7.

The RX-7's unique Space Monocoque Body consists of a monocoque body structure combined with a race-proven space-frame configuration, assuring outstanding rigidity. A longitudinal member with a large cross-section runs along the underbody. The cross-sections of the side sills are as large as possible and a mini bulkhead is also built in. The cross-section of the tall centre tunnel has also been enlarged, the opening of the tunnel is reinforced by three aluminium bars, and five cross-members support the longitudinal frame.

The front and rear cross-members, where the suspension arms are mounted, have been bolted rigidly to the body without rubber inserts, thus ensuring the stiffness of the suspension mountings. The cross-member for the rear suspension is connected to both ends of the rearmost tunnel bar via diagonal bars to strengthen the pick-up areas of the toe-control links. The box section of the front cross-member's mounting area is strengthened by a bonding-welding method, which combines adhesive bonding with conventional welding. The front and rear suspension towers are connected, increasing the stiffness of the suspension mountings as well as raising the static and dynamic rigidity of the entire body.

The net result is a 50% increase in lateral rigidity and a 30% increase in camber rigidity for the front suspension. At the rear, lateral rigidity is increased 100%, while camber rigidity is increased 60%.

The body of the new RX-7 allows supple, calculated movements of the suspension to be translated into precise handling characteristics. In our pursuit of a stiffer body however, we did not neglect our basic criterion of weight reduction. Through various ingenious methods such as the extensive use of high tensile steel, the total weight of the whole body, including the doors, bonnet and boot lid, remains unchanged from the previous model.

The importance of unsprung weight was not taken lightly – aluminium alloy was employed in the fabrication of every suspension component.

Among the countless technological innovations featured in the new RX-7, the new suspension system is perhaps the most noteworthy. Our aim was to realise a chassis that responds to driver input in a natural and linear manner. We therefore eschewed the use of hydraulic or electronic control in favour of a purely mechanical system in order to create the ultimate suspension system.

A double-wishbone design with optimum camber characteristics was adopted at the front and rear. This is the ideal layout for pure-bred sports cars where outstanding tracking performance and quick, yet linear, handling characteristics must be balanced at an extremely high level. The design itself is nothing new, in fact it is almost traditional for sports cars, however it was unthinkable for us to use this alone as the backbone of our technology.

The A-shaped upper arms of the front suspension are fabricated from squeeze-forged aluminium and mounted directly to the highly rigid body shell. The L-shaped lower arms, which are subjected to higher loads, are made of forged aluminium and mounted to a steel cross-member.

The upper A-arms of the rear suspension are mounted on the same cross-member as the lower I-arms and trailing links. Toe-control links placed between the lower and upper arms, just ahead of the wheel axis, locate the hub supports. The I-arms, since they are subjected to heavy loads, are made of forged aluminium, while the hub supports are fabricated from squeeze-forged aluminium.

It is obvious from the explanation so far that this is not just another suspension system. We refer to it as the white suspension, taken from the colour of the aluminium. No matter how sophisticated the mechanism, absolute lightness is essential for suspension components since they are a major contributor to unsprung weight. Our relentless pursuit of lightweight construction also manifests itself in the suspension components.

Just by using aluminium, the total weight of the suspension system was reduced by 10 kg compared to the previous model. The super-lightweight 16 × 8JJ alloy wheels each weigh only 7 kg, which is comparable to many 14-inch wheels, and the exclusive, lightweight 225/50/ZR16 tyres are less than 10.5 kg each.

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The powerful, four-wheel anti-lock brake system provides ample stopping power for this high-performance sports car. Since the brakes also contribute to unsprung weight, the opposed four-piston calipers on the front are made of aluminium. All four wheels feature ventilated rotors and the inner fins on the front discs are staggered to improve cooling efficiency as well as to reduce weight. Although the pedals do not contribute to unsprung weight, they are also aluminium resulting in a total weight reduction of 500 g and the newly developed ABS actuator is now 3.3 kg lighter than the previous type.

The new RX-7 uses a rack-and-pinion type steering system developed with the same philosophy as the suspension. The mounting bracket for the steering gear is integrated with the cross-member to increase stiffness and the joint of the steering-column is less articulated, resulting in smoother movement. Engine-rpm sensitive power-assisted steering prevents over assistance. Even the rack bar is hollow to reduce weight even further.

The net result is that each wheel assembly now weighs only 45 kg. The outstanding attributes of the unique Four-Wheel Dynamic Geometry Control system are further enhanced by the exceptional tracking performance made possible by the lightweight suspension.

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1. All-aluminium four-wheel double-wishbone suspension 2. Four-wheel ventilated disc brakes 3. Drilled aluminium brake pedal

However, weight has been added selectively in essential areas – the Powerplant Frame being the most prominent example.

The pleasure of driving a sports car lies in the feeling of oneness between car and driver. It is a sensation felt only when the movement of the car precisely reflects the driver's input, such as the g-forces experienced when accelerating or decelerating. These characteristics are still important even though the new RX-7 is not intended to be a car that is merely fast in a straight line. Accurate response to delicate throttle openings is essential for enjoyable, controlled cornering.

Although our basic philosophy was to reduce weight down to the last gram, we accepted increases in other areas at the expense of the reductions made in hundreds of other parts. The Powerplant Frame is one such example and is bolted between the trailing edge of the transmission case and the leading edge of the differential case, thus rigidly connecting these two drivetrain components. This effectively transforms the engine, transmission and differential into one unit. The distance between the front and rear mounting has been expanded to 2150 mm, so that when starting from rest the reactionary forces that act on the differential case are reduced and the torque is transmitted directly and linearly to the road as traction. This process eliminates differential wind-up, resulting in transmission of torque that is free from lag and vibration. It is like having the engine, or more accurately the rear wheels, directly connected to the driver's right foot.

Another benefit of the adoption of the Powerplant Frame is the reduced pitching motion of the engine, resulting in a more precise feel to the gearbox. Furthermore, since there is no need for mounting points on the gearbox, the location of the engine and the floor pan could be lowered substantially.

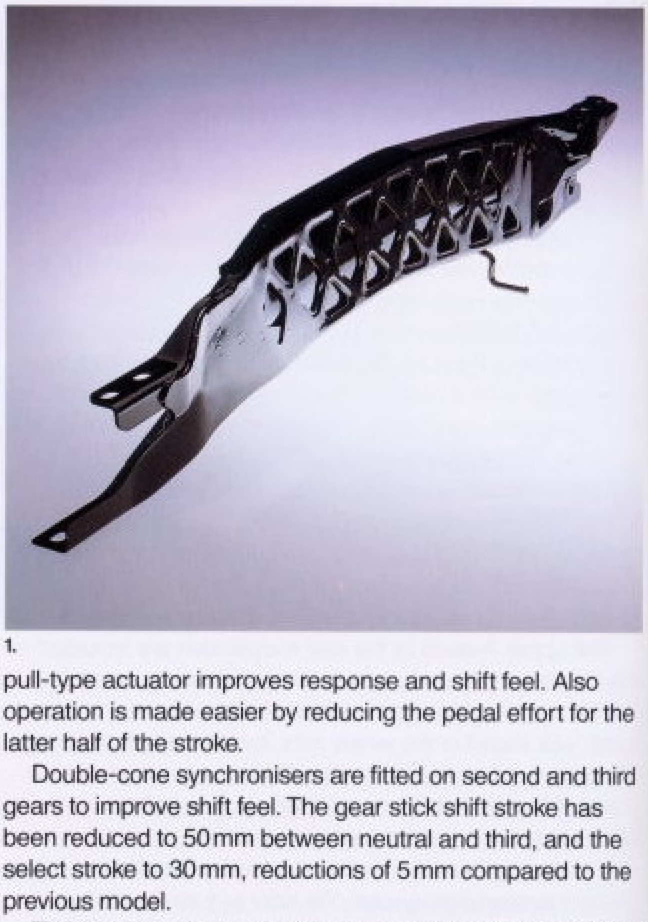
The Powerplant Frame offers many advantages, however, we did not accept the extra weight unconditionally. On the main frame, which is made of high-tensile steel, there are large apertures and by creating a closed section with the inner frame made of vibration-absorbing steel, the entire frame is exceedingly strong yet lightweight.

The Torsen® limited-slip differential is another weighty contribution which we employed to realise direct and accurate throttle control. Developed by Zexel-Gleason USA, Inc., Torsen® is a registered trademark and is short for torque sensing. Compared to conventional multi-plate or viscous-coupling type limited-slip differentials, the Torsen differential has a higher torque bias ratio, thus realising more accurate control under changing road conditions and weight transfer during cornering.

The dry, single-plate hydraulic clutch uses a diaphragm spring. Compared to a conventional push-type, a highly rigid pull-type actuator improves response and shift feel. Also operation is made easier by reducing the pedal effort for the latter half of the stroke.

Double-cone synchronisers are fitted on second and third gears to improve shift feel. The gear stick shift stroke has been reduced to 50 mm between neutral and third, and the select stroke to 30 mm, reductions of 5 mm compared to the previous model.

The combination of the improved clutch operation and the new high-precision gear linkage has resulted in outstanding shift feel. The drivetrain of the new RX-7 becomes one with the hands and feet of the driver.



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The interior is where driver and car interact, therefore the various factors necessary for a modern sports car were given careful consideration.

All components, such as the instruments, switches and gear lever have been ergonomically positioned to facilitate ease of operation even the centre console is angled towards the driver to give a feel of oneness with the car.

The five round instruments each have a chrome outer ring and are angled slightly downwards, as in the Le Mans car, to reduce reflections from ambient light and to ensure legibility. The electric speedometer prevents needle fluctuation and transmission of noise, while highly visible liquid-crystal displays are used for the trip and odometers.

The gear stick knob and the three-spoke, leather-covered steering-wheel have dimples where the driver's hands fall, not only to offer better grip but also to absorb moisture.

The centres of the seat cushions and both sides of the leather faced seats are completely separate. This design gives full support to the driver and passenger under the considerable g forces generated during cornering or heavy braking.

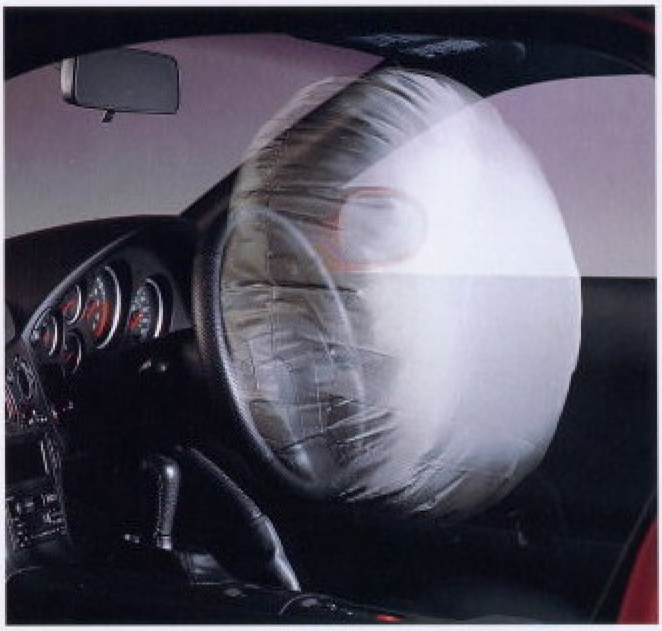
The pedals are highly rigid and are laid out to permit heel-and-toe operation. Lightweight materials have been used – the clutch and brake pedals are drilled aluminium while the throttle pedal is made of plastic.

In terms of weight reduction, small gains from countless measures have added up to huge savings compared to the previous model. For example, the seat-cushion frame is approximately 2.5 kg lighter through the use of plastic, the smaller doors, including the windows, are each 6 kg lighter and the windscreen is almost 9 kg lighter.

Some of the weight saved through these exhaustive measures was subsequently utilised for the higher levels of safety and comfort required in modern sports cars. After extensive testing, we concluded that accident avoidance is as important as crashworthiness, and the ultimate comfort of a sports car depends on functional, as opposed to excessively luxurious features.

The driver's-side SRS airbag is standard, both doors house a side-impact bar and fire-resistant material is used throughout the interior. The switches for the power windows are located in the door trim and the door locks are power operated. The electrically operated tilt and slide sun-roof is also standard.

The new RX-7 is designed to be a pure sports car. The word luxury is totally alien to this car, although we did compromise a little when we felt it was becoming too spartan. The ultimate judge of the effectiveness of the balance we have achieved will be the driver.



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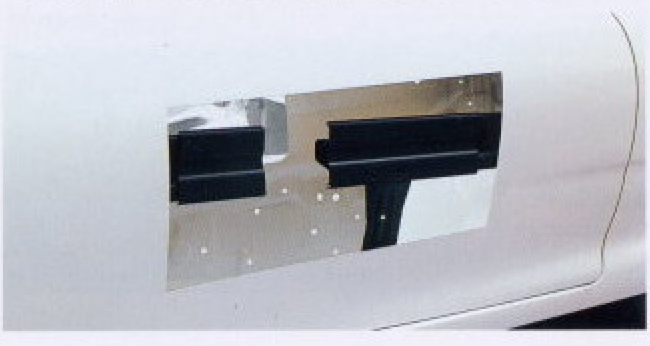

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1. Powerplant Frame
2. Torsen® LSD
3. Supplementary Restraint System (SRS)
4. Side impact bars
5. Tilt and slide sun-roof

The engine of our new RX-7 capitalises on the vast experience of our years of competing at Le Mans.

The rotary engine for the new RX-7 is the proven twin-rotor 13B unit (2×654 cc), basically identical to the R26B which powered the 787B Le Mans racing car. The only major difference is in the number of rotors.

The many lessons we learned at Le Mans could be directly applied to the development of the new RX-7's engine. The technological achievements, resulting from our 13 attempts to win this event over a period of 18 years, represent an evolution within the same generation.

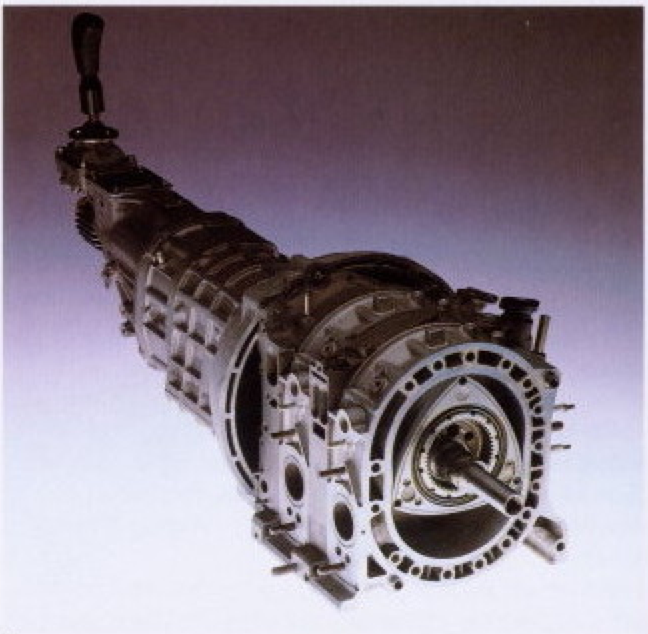
Our goals were substantially increased horsepower and exceptional response, to be accomplished while maintaining maximum reliability. We achieved our aims by drawing heavily on the technology that supported the 700bhp 787B for 24 hours at Le Mans.

The surfaces of the thin-walled, cast-iron rotors are precisely machined to completely realise the compression ratio for each chamber. The grooves of the apex seals on the rotors received a special hardening process to improve wear resistance. The coolant passages extend right up to the spark plug housings to maximise the cooling of areas subjected to intense heat and the main metal bearings are machined to a perfect cylindrical shape to improve lubrication.

An electronically controlled oil injector is used to improve lubrication over the previous-generation engine. In the new engine, oil is only squirted onto the rotor housing near the apex seals instead of oil being supplied separately to the swept area from the intake port and rotor housing, resulting in a considerable reduction in oil consumption.

The twin oil coolers receive air from the two small intakes located on either side of the front bumper. To bypass this heated air from the oil coolers around the front brakes, an additional air duct has been installed on the inside of each wheel arch, and the heated air comes out of an outlet behind the wheel opening.

Many new technologies have been employed to improve the rotary engine and close attention was also paid to weight reduction.



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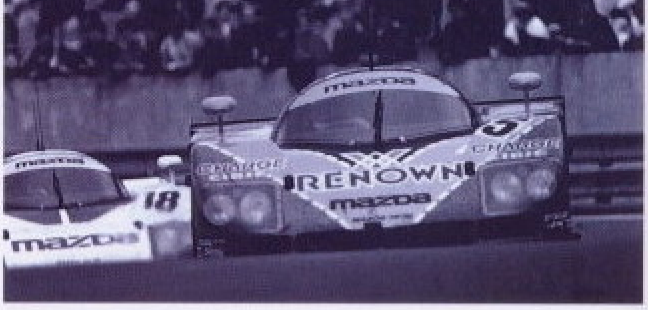
Engine-mounted ignition coils, much shortened high-tension leads, and a newly adopted, compact, crank-angle sensor result in a more than 2.3 kg weight reduction. The radiator, which is slanted as in the 787B race car, is fully ducted and two, three-stage electric fans provide maximum cooling efficiency, resulting in a weight reduction of 1.2 kg compared to the previous model. The smaller water pump contributes a weight saving of 0.5 kg, and the flywheel and clutch assembly is 1.9 kg lighter.

The net result is a new powerplant, including engine ancillaries, exhaust system and final drive, that is much more powerful, yet at approximately 320 kg weighs no more than the previous engine.



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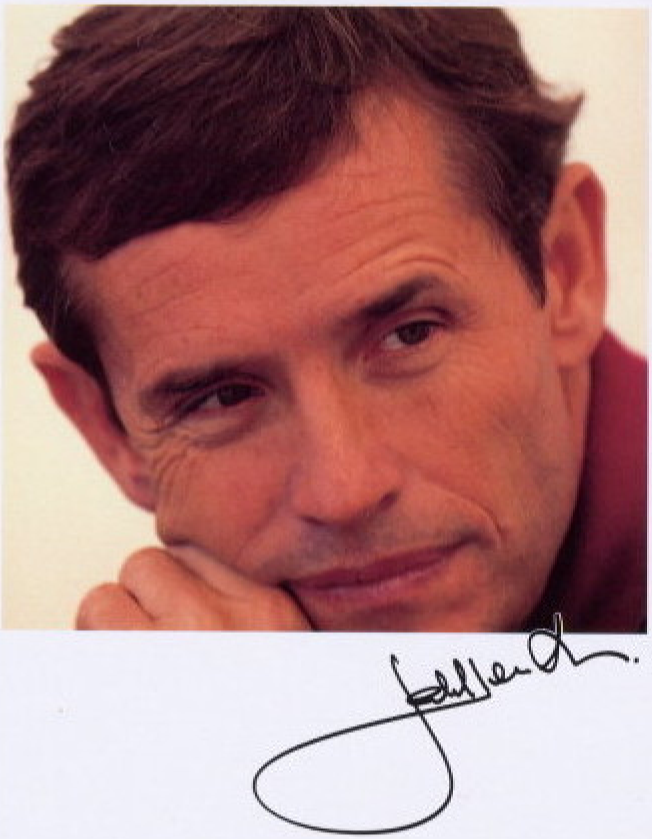
"Behaves like a race car, yet remains comfortable at any speed." Jacky Ickz describes his impressions of the new Mazda RX-7.



I must say that I was really excited when I first saw the latest Mazda RX-7. The rounded, smooth shape makes it stand apart from its competitors.

It is obvious that for the past four or five years Mazda has devoted an enormous amount of time and effort into creating something new and unique.

After having driven it, I am now looking forward to owning one.

One of the reasons I have always been impressed by Mazda, especially after the win at Le Mans, is the rotary engine. The company philosophy is that racing improves the breed, and therefore the development of production cars, in this case the new RX-7.

The rotary engine is unique in that Mazda is the only company that has been able to perfect this technology. It is also unusual these days to find race car components used in a production model.

Also the Sequential Twin-Turbo rotary offers a fantastic range of power. It is equally at home at high speed on a race circuit or in the rush-hour traffic conditions of our major cities. Very few engines can deliver this type of flexibility. With a touch of the throttle you have excellent acceleration to transport you to another world and another style of driving.

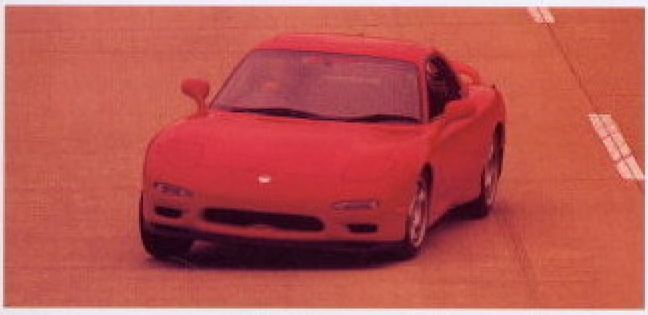
Such a world is that of the test track where I drove as fast as I could in both wet and dry conditions. The car was very easy to drive – extremely stable, with precise, predictable steering characteristics.

Most sports cars today have a hard suspension with stiff springs, which can make them a little bit shaky and unstable and sometimes more difficult to drive. I think Mazda has achieved the perfect balance between sporty handling and comfort – assuring the capability of fast driving without the inherent discomfort of a real racing machine.

I was particularly impressed by the precision of the steering. Correct positioning – left or right – can be achieved in a fraction of a second, without any sliding and with the car maintaining a nearly neutral attitude. Since it is a rear-wheel-drive vehicle you always expect a little bit of oversteer, but in the RX-7 that point is only reached if you are trying really hard, and even then it is perfectly controllable.

On the test track I was able to indulge in heavy braking from high speeds. Braking was always very progressive without any grabbing or fading. The initial feel of the brake pedal, smooth and progressive, is very attractive and inspires confidence.

The suspension has been carefully thought out and set up. You can enter a corner very smoothly, add a touch of throttle and the progressive engine output enables you to control the whole situation very well. Even if you lift off in mid-corner, it is still very stable and controllable. It is a very



safe car even when not in the hands of a professional driver. If this was your very first sports car you could immediately have a great deal of fun with it.

Mazda's new four-wheel Dynamic Geometry Control Suspension system, which ensures that the front and rear wheels adopt the most desirable positions and angles under any driving conditions, is very effective. In fact, I cannot recall another sports car that has turn-in and cornering performance to match it.

The RX-7 is equipped with a Torsen® limited-slip differential, which gives a big improvement in grip as you apply the throttle when coming out of a corner. Traction is smooth and progressive, and I believe this is one of the reasons why the car is so easy to drive in wet conditions.

What really impresses me most is that it can be used every day. It is the embodiment of a sports car, yet unlike so many other exclusive sports cars that are driven only occasionally, you will enjoy this car so much that you will want to take it out at every opportunity.

A sports car bridges the gap between a passenger car and a race car. My first reaction on driving the RX-7 was to say it behaved like a race car. It had a lot of grip, the steering was very precise and the handling was excellent. However, to my surprise, it was extremely comfortable. With this car, Mazda is the first manufacturer to achieve the correct balance of sports car agility and passenger car comfort.

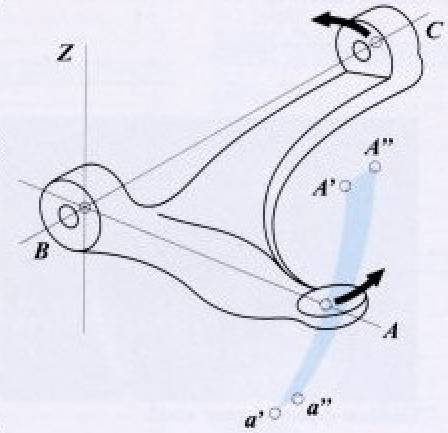
Weight, or the reduction of it, is one of the most important factors in racing. Lightness increases cornering speed, grip and acceleration. The lightness of the car is one of Mazda's biggest achievements.

The world will continue to evolve, things will certainly be different in the years following the turn of the century, but there will always be a category of people who want to buy something exclusive, people interested in performance and style. In my opinion, that will never change, even 100 years from now.

An explanation of the Double Wishbone Suspension and the Four-Wheel Dynamic Geometry Control.

The traditional description of the new RX-7's front and rear wheel suspension is double wishbone. This type of layout offers optimum lateral rigidity and camber control, both of which are important in maximising handling capability as well as the pleasure of cornering. However, we did not simply adopt the classic double wishbone layout for the new RX-7 – to reduce weight, while eschewing complication, many innovative ideas to this basic suspension were necessary.

The wheel's axis of rotation is fixed by the suspension upright, which is, in turn, located by three joints – the upper arm, the lower arm and the control link. The relative positions of these three joints control the wheel's axis of rotation. Therefore, the first critical decision in the design process was the positioning of these arms and links to optimise their location and movement.



The positions of the three joints, however, do not trace the geometric locus as defined in the engineering drawings. The mounting points of the arms seem immovable in the drawings, but unless it is a pure-bred race car with a double wishbone set-up, a reasonable amount of compliance is necessary for better NVH. The compliance on the locus varies according to the bushing characteristics as well as the magnitude and direction of suspension input. The second critical decision in the design process was to determine the amount of compliance of the pivots and joints.

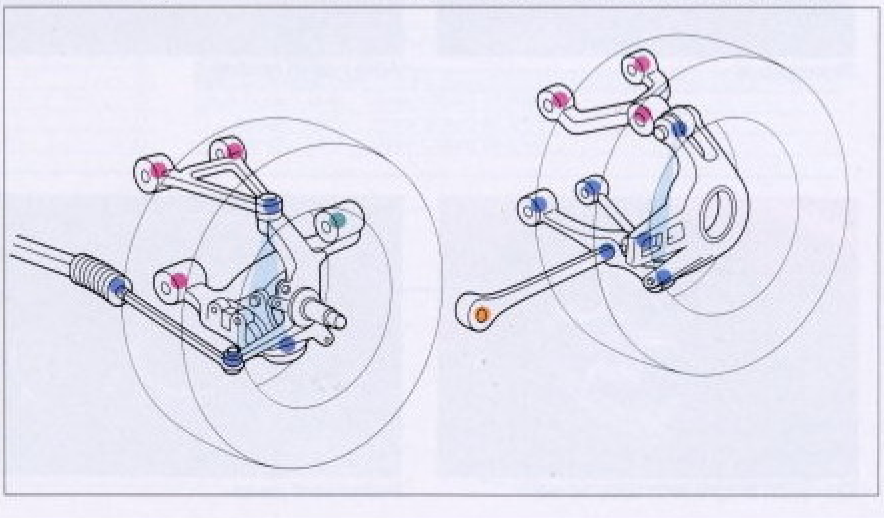
If we examine the movement of the joint between the front wheel upright and lower arm, point A is the joint, and points B and C are respectively the front and rear body mounting positions of the lower arms. As the suspension operates under normal driving conditions, A' a' describes the locus traced by point A, which draws an arc around the B – C axis with a radius of B – A.

During braking, point A is subject to a rearward retardation force, and this, because of the relative locations of points A, B and C, becomes an inward force at point C. This force slightly deforms point C, and as a result, point A' moves rearward as it draws an arc centred around axis Z, which is located vertically above point B. Furthermore, since the car's nose dives under braking, point A actually moves to points A'' and a'', rather than points A' and a'. In other words, we must view point A as dynamically moving within the area defined by the sector surrounded by points A', A'', a' and a'' aligned on the surface of the sphere which has point B as its centre.

Similarly, the joints of the upper arm and control link move over the spheres that are described by the radii defined by their respective arm or link. Consequently, the upright contacts the surfaces of the three spheres and seemingly glides over them. When (i) the radii of the spheres, (ii) the relative distances between the centres of the spheres, or (iii) the area defined by the sector, changes, the movement of the axle, which is fixed by the upright, also changes. In fact, this compliance causes changes to these factors in varying degrees, depending on driving conditions.

In response to the aforementioned considerations, the arms and links of the RX-7's suspension are laid out in optimum positions. To withstand lateral forces in a straight line, the front lower arms are L-shaped. The rear lower arms, unlike in a conventional double wishbone layout, are constructed of separate I-arms and trailing links. The changes in geometry of the arms and links are utilised to control the axis of rotation of the wheels.

The bushes and joints are made to satisfy certain specific characteristics, in order to contain the negative effects of compliance. The basic approach was to increase the rigidity of the arms and links so that they follow the locus described in the engineering drawings. To accomplish this, all of the

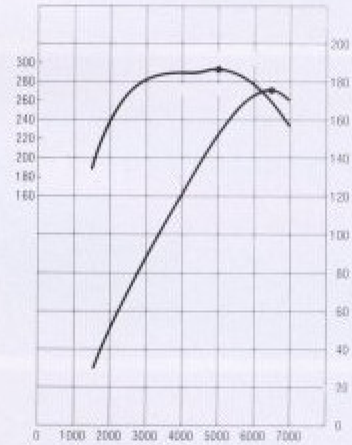


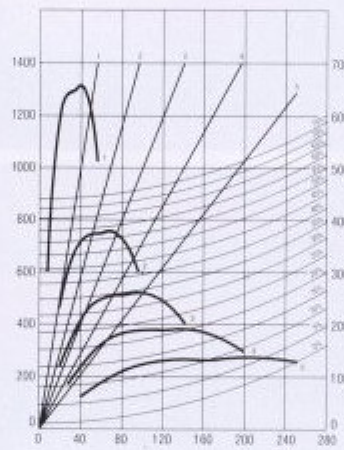
joints for the front and rear uprights are of the pillow-ball type, and the rear suspension employs bushings impregnated with pillow balls for the body mounting points of the lower arm.

New bushings with special characteristics have also been developed. For the front suspension, sliding rubber bushings are used at the front and rear pivots of the upper arms and the front pivot of the lower arms. The same type are employed at the front and rear pivots of the rear suspension's upper arms. Inside these bushings are collars that slide in the axial direction, thus creating fore and aft compliance. In the lateral or torsional directions, the bushings provide minimum compliance and maintain a high level of rigidity. Liquid-filled bushings are used for the rear pivots of the front suspension's lower arms, to limit their fore and aft movement between the uprights and lower arms.

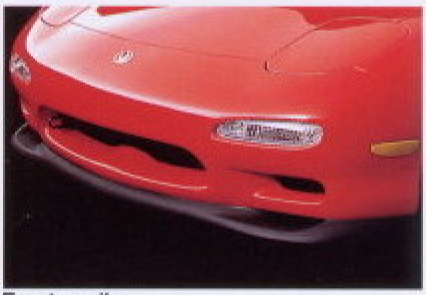
In contrast to the front suspension, compliance of the rubber bushings is fully utilised at the rear pivots between the body and the rear suspension's lower arms. The bushings are stiff if moved in a forward direction and supple if moved rearward. The geometric movements caused by this compliance are used to control toe changes during acceleration and deceleration.

Lateral forces generated during cornering, acceleration and braking change the tyres' contact with the road surface, which, when not adequately controlled, upsets the handling and braking characteristics. The suspension of the new RX-7 controls the wheels and tyres to maintain ideal angles and locations under any driving conditions, and is designed to maintain ideal sports car handling characteristics at all times. That is why we called our new system the Dynamic Geometry Control Suspension.

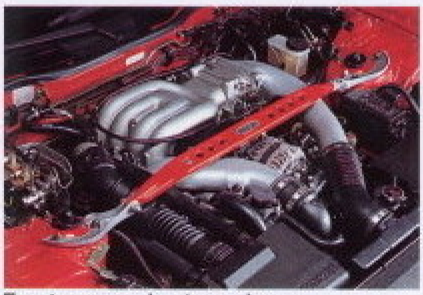




Equipment and Specifications.


Front spoiler


Power steering


Front suspension tower bar


Rear spoiler


Leather-covered gear knob


Rear suspension tower bar


Storage box

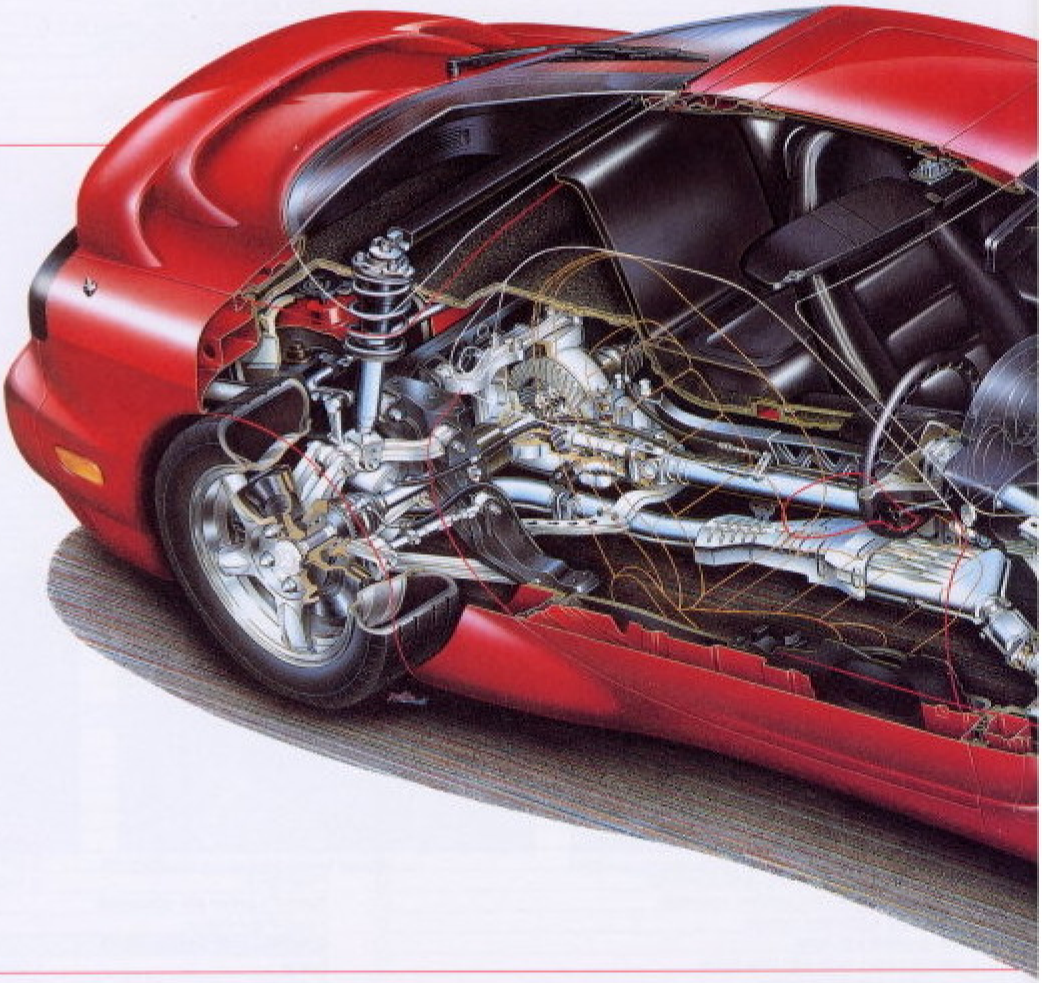

Auto cruise control


Audio system


225/50ZR16 tyre with alloy wheel


Instrument panel


Air-conditioner controls



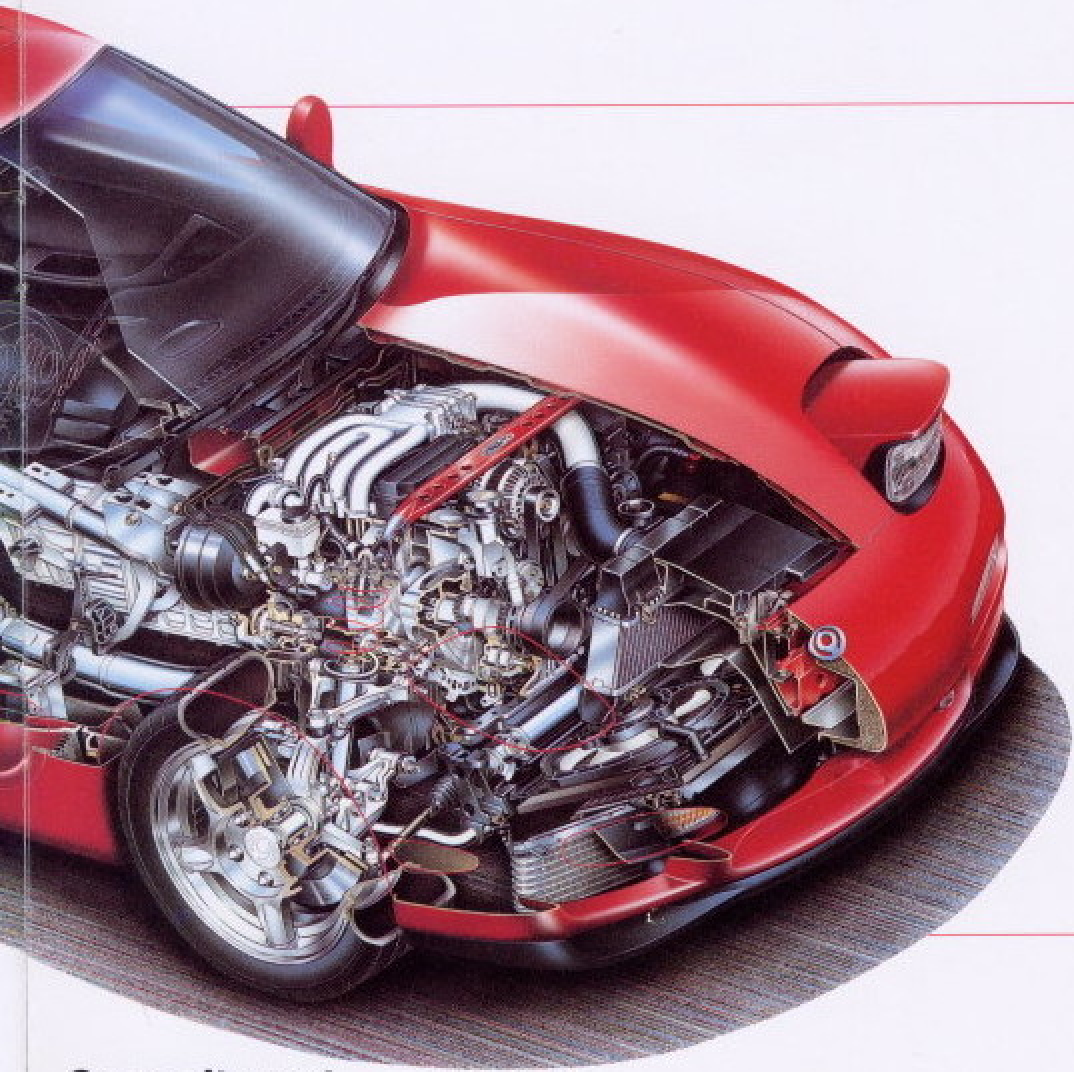
Embodying our ideals – a message from the RX-7 development team.

Our dream came true when Mazda's 787B won the gruelling Le Mans 24-Hour Endurance Race. Mazda achieved its first victory in the race and the excellence of the rotary engine was further proven.

We have accumulated experience through years of competition at Le Mans, IMSA and on racing circuits world-wide. Through all those years, we concentrated on one thing: the fundamentals of sports cars. And we came out of it all knowing the three most critical factors which directed our development of the RX-7. They were (1) exterior and interior designs that instantly attract, (2) the unity of driver and car, and (3) overwhelming, dynamic performance. We realised that the superior performance we required could only be found by addressing the fundamental issues of overall weight, weight distribution, and yaw moment of inertia. And it was the compact rotary engine that was crucial in achieving the front-midship layout that contributed so much to these fundamental issues.

We placed emphasis on weight reduction, but not at the expense of safety, to realise the dynamic balance and breathtaking performance we had determined the new car must have. Our unique approach to automotive design made it possible to achieve a superb weight-to-power ratio of 5.4kg per ps at the power curve's 241ps (DIN) peak.

The history of the RX-7 series, the rotary engine technology achieved only by Mazda, and the years of development that led to our first victory in the Le Mans 24-Hour Endurance Race – all of these went into the new RX-7. Simply said, it was designed to be the premier sports car on the road.



Commitment.

We designed it to be as light as possible in order to capture the pure spirit of a sports car and to convey the excitement that is engendered when driving such a machine. Safety enhancement and the protection of the environment were also two areas of great concern for us.

A car must be made as safe as possible. We therefore incorporate the latest safety features into every car we build. Our efforts, however, do not stop at existing technology – new advances are constantly being explored. For example, we are currently working on a Safe Driving System which combines the benefits of an advanced navigation system and local traffic monitoring. It informs the driver of the fastest route to a given destination, and the estimated time required, while cruise control monitors the car's speed according to the traffic conditions.

At Mazda, we believe that a car should create as little damage as possible to the environment. In addition to reducing harmful exhaust emissions and the use of chlorofluorocarbons, we are addressing the issue of recycling. Two pilot reclamation and reprocessing programmes were recently started in Germany and Japan and a feasibility study of bumper recycling is currently being undertaken. Mazda announced the world's first prototype, hydrogen-fuelled rotary engine in 1991. It achieves a complete, natural energy-cycle since, when burned, hydrogen forms the same amount of water as was used to produce it.

The overall win by the Mazda 787B at Le Mans in 1991 proved our strength in motor sport. More importantly, all our vehicles benefit from the feedback resulting from such competition. The same individual passion for excellence and commitment to quality that resulted in this victory is also behind every Mazda produced.

EQUIPMENT LIST

○ Standard

EXTERIOR	
Lower front spoiler (with brake side air ducts)	○
Aluminium Bonnet	○
Aerodynamic engine under-cover	○
Rear tailgate spoiler	○
Colour keyed bumpers	○
Side sill anti-pitch coating	○
Integral rear mudflaps (black)	○
Lightweight retractable halogen headlamps	○
Headlamp levelling	○
Headlamp washer	○
Rear fog lamp	○
Laminated windscreen	○
Grey tinted glass	○
Time adjustable intermittent front wipers	○
Intermittent rear washer and wiper	○
Heated rear window with timer	○
Colour keyed electric outer mirrors	○
Electric tilt/slide steel sunroof	○
Remote trunk lid opener	○
Remote fuel lid opener	○
Fuel cap holder	○
Black door outer handle	○
Door key cylinder illumination (driver side only)	○
225/50ZR16 tyres	○
Alloy wheels 16 × 8.0JJ	○
Security window etching	○
Front number plate holders	○
INTERIOR	
Tachometer	○
Oil pressure gauge	○
Torsen® limited slip differential (LSD)	○
Power Plant Frame (PPF)	○
Electric antenna with 5 speaker audio system	○
Panasonic RDS radio cassette unit	○
Panel light control	○
Ignition key cylinder illumination	○
Sound warning (ignition/headlights on reminder chime)	○
Three spoke leather steering wheel	○
Leather gear knob	○
Leather handbrake grip	○
Drilled aluminium clutch pedal	○
Drilled aluminium brake pedal	○
Drivers foot rest	○
Quartz digital clock (integral in audio unit)	○
Power windows (drivers side one touch lowering)	○
Central door locking (drivers side key operated)	○
Illuminated cigar lighter and ashtray	○
Lockable glovebox with lamp	○
Door operated room lamp with map lights	○
Drivers sunvisor with ticket holder	○
Passenger sunvisor with vanity mirror	○
Drivers door storage box	○
Vinyl door trim with moulded arm rest	○
Vinyl headlining	○
Rear storage boxes (drivers side lockable)	○
Trunk room lamp	○
Tonneau cover	○
Loop pile carpeting (cabin area)	○
Boot mat (unwoven cloth)	○
Power steering (RPM sensing)	○
Cruise control	○
Air conditioning	○
Electronic heater controls (dial type)	○
Side de-misters	○
Lightweight highback bucket seats	○
Black leather seat facings	○
Tensionless three point ELR seat belts	○
Flame retardent interior material	○
Four wheel anti-lock braking system	○
Four wheel ventilated disc brakes	○
Side impact door protection bars	○
Drivers side air-bag (Supplementary Restraint System)	○
Front and rear stabilisers	○
Front and rear strut bars	○
Spacesaver alloy spare wheel (16 × 4)	○
Spacesaver tyre (T135/70R16)	○
Warning triangle	○
First aid kit	○
Lightweight aluminium car jack	○
Tool kit	○

SPECIFICATIONS

TYPE		
Body Type		Two-door coupé
Engine		13B sequential twin turbo rotary
Transmission		Five-speed manual
DIMENSIONS AND WEIGHT		
Overall Length		4295 (mm) (with licence plate holder)
Overall Width		1750 (mm)
Overall Height		1230 (mm)
Wheelbase		2425 (mm)
Track	Front	1460 (mm)
	Rear	1460 (mm)
Minimum Ground Clearance		135 (mm) (unladen)
Kerb Weight		1310 (kg)
Maximum Roof Loading		50 (kg)
ENGINE		
Type		Water-cooled, in-line two-rotor
Displacement (cc)		654 × 2
Compression Ratio		9.0:1
Maximum Output (DIN)		237 bhp @ 6500 rpm
Maximum Torque (DIN)		218 lbs/ft @ 5000 rpm
Fuel Supply System		EGI (Bosch D-Jetronic)
Exhaust System		Single tube system/catalytic converter
Fuel and Tank Capacity		76 litres
Fuel used		Unleaded 95 ron
DRIVETRAIN		
Clutch Type		Dry single-plate diaphragm clutch
Gear Ratio	1st	3.483
	2nd	2.015
	3rd	1.391
	4th	1.000
	5th	0.720
	Reverse	3.288
Final Ratio		4.100
Torsen® Limited slip differential		
Power Plant Frame		
CHASSIS AND SUSPENSION		
Frame		Lightweight/rigid monocoque body
Suspension type:	Front	Double-wishbone/coil spring
	Rear	Double-wishbone/coil spring
Steering		Rack and pinion (power assisted)
Steering Wheel turns (lock to lock)		2.9
Max. Turning Circle	(wall to wall)	10.9 (m)
	(curb to curb)	10.2 (m)
Brakes,	Front	Ventilated disc (294mm)
	Rear	Ventilated disc (294mm)
Tyres and wheels		225/50ZR16 16 × 8.0JJ
ABS Type		Four sensor, three channel, four wheel anti-lock braking system
PERFORMANCE		
Max. Speed	(mph)	156
Acceleration	(0-62mph)	5.3
Drag Co-efficient	(CD)	0.31
FUEL CONSUMPTION		
Urban Cycle – MPG	(litres/100km)	17.7/16.0
56mph – MPG	(litres/100km)	37.2/7.6
75mph – MPG	(litres/100km)	29.4/9.6

*Seats are upholstered in leather except for vinyl on rear of seatbacks and other minor areas.

All specifications and equipment described in this catalogue are subject to change without notice and may vary according to locale. Please consult your RX-7 appointed dealer.

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DIMENSIONS AND WEIGHT