HONDA

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Honda S2000 99

HONDA S2000

Contents

HONDA S2000

Introduction

The all-new HONDA S2000 is a 240 PS front-engined, rear-wheel drive, two-seater roadster, clothed in a sleek, muscular body. Aimed at the sports car purist, its traditional configuration is underpinned in true Honda style by innovative, race-bred technology that is guaranteed to stir the emotions of performance motoring enthusiasts everywhere.

At its heart lies an extraordinary, spine-tingling four cylinder 2.0 litre DOHC VTEC engine that spins all the way to 9,000 rpm before hitting the rev limiter. At 120 PS/litre, its specific output is greater than any naturally aspirated engine on the market and yet, incredibly, it conforms to some of the toughest emissions legislation in the world, including both California's LEV (Low Emission Vehicle) and the full EU2000 requirements.

Dubbed a 'high performance eco engine', it propels the HONDA S2000 from 0 to 100 km/h in just 6.2 seconds and on to a top speed of 241 km/h. It is also remarkably flexible even at low speeds thanks to the latest generation of Honda's VTEC variable valve timing.

This outstanding combination of abilities owes much to the expertise developed by Honda's engineers during four decades of motorsport activity on race tracks around the world.

A lightweight six-speed manual transmission with short-throw shift action, compact electric power steering, anti-lock braking with electronic brake force distribution, and torque-sensing limited slip differential as a guard against wheelspin in tight corners complete the technologically-advanced specification.

The HONDA S2000's compact dimensions and low weight provide outstanding agility. Under the skin is a unique and innovative structure known as a 'high X-bone frame', in which the frame rails and centre tunnel combine to create an immensely strong body-chassis. Its effect is to provide a level of rigidity and passenger crash protection equivalent to that of a closed body, while keeping overall weight to a minimum.

Precise, balanced handling

It also provides a solid platform from which the HONDA S2000's new generation in-wheel double wishbone suspension can work effectively. Together with a low centre of gravity, an optimum 50:50 front/rear weight distribution and a compact engine mounted well behind the front axle, Honda's new roadster provides precise, balanced handling, responding to driver input in a predictable and linear fashion.

Styling is purposeful, yet elegant. With an arrow-like nose, sweeping headlamp covers and ultra-low bonnet line, the HONDA S2000 has real on-road presence. Taut flanks that flare out to tightly hug the front wheels signal its performance potential.

The cockpit-like interior features a small, leather-wrapped steering wheel, supportive leather seats and Formula 1-inspired digital instrumentation designed to convey the high-tech, high-revving nature of the new Honda engine. The electronic tachometer and speedometer illuminate once the ignition key is turned, but the engine is actually fired by a push button starter - a feature that will appeal to all motoring enthusiasts.

For fresh air aficionados, top down motoring can be achieved in seconds thanks to an electric hood mechanism, while the HONDA S2000's boot is ideally sized for a weekend away, swallowing two large soft bags with ease.

Generously equipped

The HONDA S2000 may be a lightweight, high performance roadster, but it is also well-equipped. Included in the standard specification are driver and passenger airbags, central locking, immobiliser, power windows, power mirrors, power roof, leather-trimmed steering wheel, leather seats, stereo radio/cassette, roll over bars, alloy wheels, ABS, limited slip differential, electric power steering, and high intensity discharge headlamps. Air conditioning is either standard or a factory fit option depending on the market. There are four colours to choose from: silver and black complemented by either black or red leather upholstery and red and blue with black leather upholstery.

The HONDA S2000, along with other Honda models, is covered by a comprehensive 3 years / 100,000 km warranty.

The HONDA S2000 philosophy

Released to celebrate the company's 50th anniversary, the HONDA S2000 is designed to reflect the company's exemplary tradition in sportscars and its rich motorsport heritage: a thoroughbred sportscar crammed with racing-derived technology in other words. In particular, Honda sees it as the spiritual successor to the S800 sports car launched in 1965; indeed, the HONDA S2000 is the first front-engined, rear-wheel drive Honda since that model.

In positioning the new car, Honda identified three categories of affordable sportscars currently available: 'Ultra-enthusiast' cars which provide enormous driving pleasure but which may not be easy to live with in everyday usage; 'nostalgic' sportscars, which are often based on the floorpans of ordinary saloons, use conventional technology and lack much of the technical content of a traditional sportscar; and thirdly, 'advanced' sportscars, which match luxury with technology, may therefore be compromised, and aimed at owners more concerned with making a style statement than the driving experience.

With its new sportscar, Honda wanted to match the driving excitement of the ultra-enthusiast cars with the sophistication and comfort of the advanced class rivals, while also minimising environmental impact. To do this Honda elected to develop an all-new car, with an all-new drivetrain, and the SSM (sports study model) concept roadster first shown at the 1995 Tokyo Motor Show formed the basis of the new model.

The complete project was handled by Honda's engineers at the Wako and Tochigi, Japan R&D Centres. Development lasted almost three years, longer than that required by a typical Honda, but reflecting the challenge of creating the first front-engine, rear wheel drive model for 34 years, and the project team's desire for outstanding performance. As part of

the development programme, the HONDA S2000 was optimised for European driving conditions with a comprehensive test programme in Europe.

Manufactured at the NSX plant

The HONDA S2000 is built at the Takanezawa plant in Tochigi, Japan alongside the Honda NSX and production is limited to around 12,000 cars a year. It is subject to the same meticulous build process as the NSX, and the prime objective of the low volume, high technology plant is the achievement of world-leading levels of quality. Rather than a heavily automated assembly line, the HONDA S2000 is constructed at a series of work-stations by a number of teams.

The HONDA S2000 has already picked up an award even though it has yet to go on sale. 17 motoring journalists from 10 countries voted it Cabrio of the Year at the 1999 Geneva International Motor Show.

European sales are set to commence in late summer.

HONDA S2000

The driving experience

Lifting the aluminium bonnet of the HONDA S2000 provides the first insight into its unique character, revealing a powerplant pushed to the very back of the engine bay in the quest for a low centre of gravity and an optimum 50:50 weight balance.

A red and black crackle-finished cam cover bearing the legend DOHC VTEC in machined lettering hints at its engineering precision. 240 PS at 8,300 rpm, in the lightweight HONDA S2000 equates to an outstanding 5.26 kg/PS power to weight ratio, and on the road this translates into outstanding performance. Acceleration from 0 to 100 km/h takes just 6.2 seconds, from standstill 400 m is reached in only 14.5 seconds, while top speed is 241 km/h.

While the basic engine sound is a smooth tenor, as engine speed builds the note changes progressively to add to the core emotional appeal of the HONDA S2000, echoing Honda's decades of involvement with high-revving Formula 1 and CART ChampCar race engines.

While the HONDA S2000's high revving engine gives it its irrepressibly sporty feel and

unique character, reverting to relaxed, leisurely driving is also eminently possible thanks to the latest generation VTEC system and finely tuned engine breathing.

A chassis to match

The HONDA S2000's performance capability demands a competent chassis to harness and efficiently exploit that power on the road, and an immensely rigid body, advanced in-wheel double wishbone suspension, low centre of gravity and good weight balance are complemented by communicative steering, and powerful, progressive brakes.

From the outset the company worked to provide the HONDA S2000 with a low yaw moment of inertia by placing as much weight as possible close to the centre of the vehicle for quicker, more linear steering and responsive handling, in all speed ranges.

The HONDA S2000's compact engine is mounted deep within the car and behind the front axle line, while comparatively lightweight components, including the aluminium radiator and plastic engine air intake ducting lie ahead of the engine. Similarly the fuel tank lies over the rear axle, with only the exhaust pipe finishers and silencers beyond the rear wheels. Compact dimensions, relatively long wheelbase and wide track enhance agility.

An optimum driving position

Even the positioning of the driver and passenger has been carefully considered in order to provide high levels of concise, accurate feedback. Occupants sit behind the car's overall centre of balance, and close to the centre of the rear axle; this pivotal positioning, combined with the 50:50 weight distribution gives the driver a feeling of being closely connected to the car.

The HONDA S2000 proposition naturally includes a sports-orientated car interior: racecar-like drilled aluminium pedals, short, stubby gearlever, small leather-trimmed steering wheel, F1-influenced digital tachometer and speedometer, low seating position with high centre tunnel to create a cockpit-like ambience, highly supportive seats and, the piece de resistance , a red push-button starter mounted on the facia. Thanks to careful aerodynamic tuning of the cabin plus an optional wind deflector between the seats, turbulence is kept to a minimum during top-down motoring.

HONDA S2000

Drivetrain

- **240 PS at 8,300 rpm, redline at 9,000 rpm**
- **120 PS/litre new record for mass produced, normally aspirated engine**
- **Engine remarkably compact and located behind front axle**
- **Design concentrates on breathing efficiency, component strengthening, inertial weight and friction reduction**
- **Uses Formula 1-inspired technology including forged aluminium pistons, lightweight valve springs, 11:1 compression ratio**
- **Latest generation of DOHC VTEC features roller-type rocker arms produced by world-first metal injection moulding process**
- **Advanced emissions equipment achieves compliance with Californian LEV, European EU2000 and German D3 regulations**
- **Lightweight six-speed manual transmission allows rapid shifting**

A normally-aspirated, four cylinder engine producing 240 PS at 8,300 rpm from a 2.0 litre displacement is little short of staggering and strong justification for describing this latest VTEC engine from Honda as an engineering masterpiece. What makes the achievement all the more exceptional is that the HONDA S2000 also meets the strict Californian Low Emission Vehicle (LEV), EU2000 and German D3 emissions requirements.

New benchmark figure

120 PS/litre is a new record for a mass-produced, normally aspirated engine, dramatically redefining the global standard in specific output. The benchmark had already been set by Honda: the 190 PS 1.8 litre engine of the Integra Type-R has a specific output of 105.7 PS/litre, while the (Japan only) 185 PS 1.6 litre Civic Type-R achieves 115.6 PS/litre.

There is a tendency for terms such as 'race-bred technology' to be used where their application has little justification, but in the case of Honda's brand-new engine, the term genuinely describes the engineering influences behind its development. Many of the design team were part of Honda's all-conquering Formula 1 engines team as well as being involved with the current US CART programme.

Attaining the necessary levels of power required for a high performance sportscar from a 2.0-litre four cylinder engine, at the same time providing suitable refinement and emissions performance, calls for some particularly advanced engineering solutions. Honda's engineers chose a four cylinder configuration primarily for its packaging benefits: the compact dimensions mean the engine can be positioned well back in the engine bay to the benefit of handling. It is also lighter than a V6 of equivalent capacity.

Turbocharging would have been the simplest way to boost power, but Honda chose instead to enable the engine to run at higher revs; more power can be extracted at high engine speeds since more revs mean more power strokes. However, such an approach means that the problem of higher frictional losses and increased stress on components

has to be addressed.

Honda has always had a reputation for producing high-revving engines, but according to chief engineer Shigeru Uehara, when moving past an 8000 rpm maxima, "new noise and vibration patterns were discovered. This was an 'untried zone' for us." His response to this technical challenge was not only to concentrate on advanced detail engineering, including lightweight, high precision valve gear, but also to painstakingly reduce inertial weight and operating friction, in both engine and key ancillary components, as well as ensuring good breathing efficiency. By combining advanced design and materials, plus key racing-inspired technologies, the Honda team achieved exceptional engine efficiency.

Virtually every engine component was designed and refined to aid the quest for high revs, from the straight port intakes, which sharpen engine response, to the low back-pressure exhaust and the light, race-influenced valve springs. Particular attention was paid to ensuring efficient combustion through advanced combustion chamber design, making full use of the knowledge gained from the company's racing activities. Key features in realising a 9,000 rpm maximum are a relatively short-stroke design (short-stroke engines have the ability to rev higher, while connecting rod length is kept to a minimum), low friction valve gear, and a very efficient oil pump. Certain components also feature a low-friction plating technique on bearing surfaces, a technology adapted directly from Honda's Formula 1 experience.

Keeping things compact

Efforts to reduce engine dimensions have been just as important as those aimed at increasing power output and starting with a clean sheet approach provided the opportunity for Honda's engineers to create a remarkably compact engine. Length, width and height are all reduced relative to Honda's conventional 2.0-litre DOHC VTEC engine and this has made it possible for the HONDA S2000's power unit to be located behind the front axle in a 'front midship' position to the benefit of handling. The engine is also exceptionally light - lighter than the 2.0 Prelude unit by around 10 per cent, in fact.

During the development period, Honda engineers discovered that a number of the key features aimed at performance enhancement such as the short stroke design, forged pistons, and lightweight connecting rods, also played a role in reducing NVH. Further refinement comes from the adoption of a liquid filled front engine mount and a liquid filled differential mount.

Balancer shafts have not been used, since their marginally higher levels of operating friction would adversely affect the quest for high revs and high output.

VTEC: the next generation

At the heart of Honda's new engine is the latest incarnation of the renowned Variable Valve Timing and Lift Electronic Control (VTEC) system which so successfully provides volumetric efficiency at all engine speeds to achieve good low to mid-range torque and vivid top-end output - all the more important given the high-revving nature of the HONDA S2000's engine.

VTEC works by maximising the amount of air-fuel charge entering, and the exhaust gas leaving the cylinders over the complete range of engine speed. Ideally, the valves should remain open for a longer duration and with greater overlap at high engine speeds to give the gases sufficient time to overcome their inertia and to enter and depart from the cylinder.

For each pair of inlet valves and each pair of exhaust valves, there are three rocker arms and three corresponding lobes on the camshaft. From idle to around 5850 rpm, the valves are operated by the two outboard cam lobes, their short duration and low lift ensuring good cylinder filling. Above 5850 rpm, pins in the rocker arms lock the two outboard rockers to the centre one which is operated by a high-lift, long duration cam lobe. Valve opening now matches the timing required for good output at high engine speeds.

Roller-type rocker arms

In its latest guise, the DOHC VTEC system uses new roller-type rocker arms to cope with the high engine speeds of the HONDA S2000. This is the first time Honda has chosen such an approach on its DOHC VTEC design, and a roller in contact with the camshafts substantially helps to reduce friction losses. At the same time, the VTEC design is made more compact - so reducing its inertia - by integrating the sliding pin used to operate the cam profile switch into the roller structure. As a further benefit, oil injection is now unnecessary and the simplified oil path leading to the camshaft journal now passes through the new hollow camshaft.

World-first metal injection moulding

In a world-first, an advanced production method is used to produce the lightweight, yet very strong rocker arms. Instead of conventional casting or forging processes which require complex machining afterwards, the components are formed in a single step using metal injection moulding which provides the higher precision finish required by the roller-type co-axial design. Heat treatment of the hollow rocker arms provides additional strengthening.

The valve springs are notably light and use materials developed especially for Honda's CART ChampCar race programme. Each high strength spring is formed from conventional round-section wire, further reducing inertial weight.

Compact scissors gear

High engine speeds call for a high degree of precision and a chain with automatic tensioner, rather than the more usual belt, drives the camshafts via a scissors gear. Using a scissors gear helps to reduce engine length, while keeping the gear diameter to a minimum allows a narrower camshaft spacing and a valve angle similar to that of an ordinary SOHC design, as well as a shallower rocker cover, a critical advantage in keeping the bonnet line low. The small pitch chain makes for quiet operation.

Engine dimensions are also kept to a minimum through the neat installation of the alternator, water and air conditioning pumps which are driven, in a single plane, by a serpentine belt driven off the crankshaft. And since the steering is electrically-assisted there is no power steering pump. To withstand high engine speeds, the belt core is in aramid to reduce elongation.

To ensure a hot, stable spark at high revs, an individual coil sits atop each iridium-tipped spark plug in the cylinder head which also makes for a more compact engine through the elimination of a conventional distributor.

Deep breathing

The intake and exhaust manifolds together with valve timing and overlap have all been tuned to reduce manifold back pressure and improve breathing efficiency. As befits a pure sports engine, the intake manifold features a simple, straight-through design with a large-bore, low-restriction inlet. Intake air is drawn directly from the front of the car and passes through a conical filter for reduced intake back pressure.

Similarly, each element of the exhaust system is designed to reduce back pressure and take advantage of exhaust gas energy and features include large diameter pipes, high-efficiency dual silencers with a two-stage pre-chamber, and a U-turn pipe.

An exceptionally high, racing engine-like 11:1 compression ratio further boosts output. A contributory factor in achieving this outstanding figure are the chain drive and scissors gear which have allowed the camshafts to be brought closer for a narrower valve angle to give a more compact combustion chamber. Furthermore, optimised water flow around the cylinders and the good heat dispersion properties of the Fibre Reinforced Metal (FRM) cylinder liners help to prevent engine knock despite the very high compression ratio.

Fibre Reinforced Metal

FRM involves an advanced metallurgical technique used by Honda in the 3.2 litre engine of the Honda NSX and it helps to increase bore size for a shorter stroked engine through its enhanced rigidity. During the casting process, the cylinder block's aluminium alloy is poured around cylinder cores composed of fibres of carbon and alumina which start to absorb the molten aluminium. Once complete, the cylinders are bored by removing most of the core material. However, the outer extremes are retained leaving a tough, wear-resistant composite cylinder wall, at least 0.5 mm thick, integral with the block but reinforced by the carbon and alumina fibres. The greater strength provided by this process allows larger bores within the same external block dimensions and bore spacing.

Forged aluminium pistons

The engine's bottom end offers a combination of strength and low reciprocating mass, vital in a high revving engine. In a first for Honda, race-style forged aluminium pistons are used for increased strength. At the same time, the adoption of a narrower oil ring and the tapering of the connecting rod's small end for a stronger piston pin boss help to reduce piston height and further increase strength. Piston weight and friction losses are thus reduced simultaneously.

In another competition-inspired technology, the connecting rods are not only forged steel, but also case-hardened for significantly increased strength. Slimmer connecting rods can thus be adopted to reduce weight without compromising strength. Similarly, nut-less connecting rod bolts permit a smaller crankcase. On the crankshaft side, shearing resistance is increased as the source of local torsional stress is reduced by chamfering the pin's oil supply holes.

Aluminium ladder-frame

A racing-style aluminium ladder-frame main bearing stiffener, located between the block and the sump, contributes to the block's compact dimensions, and working in concert with the aluminium sump, also increases rigidity. The breathing paths between each cylinder and the oil return paths are all lengthened to reach below the baffle plate to prevent oil from churning inside the crankcase at high engine speeds and to reduce both mechanical losses and oil aeration. The engine features a compact, 'silent' low-friction chain-driven oil pump.

The cast-aluminium sump is finned to help dissipate heat, and contributes to engine rigidity and noise reduction.

High performance goes green

Despite the difficulty raised by the long exhaust manifold required for high output, the HONDA S2000's engine is remarkable for its low emissions. Close control of the engine's

air/fuel ratio is achieved by the use of oxygen sensors both upstream and downstream of the catalytic converter.

The advanced emissions equipment employs a three-stage process - cold start, warm-up, and normal temperature operation - centred around an exhaust secondary air system that allows for very quick heating of the catalytic converter. When the engine is started from cold, the ignition timing is modified to give lower combustion temperatures for reduced emissions of NOx while still maintaining relatively high exhaust temperatures. Simultaneously, multi-port exhaust secondary air injection comes into operation which allows for very quick heating of the catalytic converter. An electric pump sends air into the exhaust ports to react with CO and HC particles contained in the exhaust, thus increasing gas temperature. Furthermore, the stainless steel exhaust manifold has a dual-wall design with an insulating air gap between the walls to help in the rapid warm-up of the catalyst.

The adoption of a thin-walled, low-heat-radiation, metal honeycomb catalytic converter with a low cell density in place of the more traditional ceramic type, not only increases the exhaust gas processing surface, but also promotes a quick rise in temperature.

In line with Honda's policy of environmental responsibility, the HONDA S2000 is designed to be very quiet at idle and the exhaust system includes individual silencers for the dual rear pipes.

Based on the HONDA S2000's Extra Urban fuel consumption of 9.9 litre/100km, the 50 litre fuel tank provides a practical 505 km range.

Six-speed manual gearbox allows rapid shifting

A compact six-speed close-ratio manual transmission enables the driver to fully exploit the HONDA S2000's engine to the full, while a low-inertia flywheel and lightweight gears ensure that its willingness to rev is not compromised. The gearbox, with integral oil pump, is designed specifically for the HONDA S2000 and shares no common components with the six-speed NSX manual transmission.

With the engine already moved as far back in the chassis as possible, space for the transmission was at a premium, so Honda engineers designed the transmission to be as narrow as possible. All six speeds and reverse are on two parallel shafts.

Both transmission shafts are coupled at the output end, a design feature borrowed from Honda's front-wheel-drive transmissions. This reduces the load on the gear synchronisers by as much as 40 per cent, which, in turn, allowed the gears to be smaller.

In addition to reducing the size and mass of the engine flywheel and transmission gears, Honda engineers reduced the size of the clutch by eliminating the separate friction disc and replacing it with a simpler design where both friction surfaces face each other. One friction surface is attached to the flywheel face and the other to the pressure plate. A pull-type clutch mechanism separates and engages the clutch faces.

Honda has aimed for a gear shift quality that allows smooth, rapid changes with little effort on the part of the driver. Using a direct-acting rod type mechanism, the shift action is just 23 mm in the horizontal plane and 40 mm in the vertical, facilitating wrist-flick shifts. Double-cone synchronisers are used on first, third and fourth ratios and triple-cone synchronisers on second.

An unusually large diameter propshaft is specified to maintain driveline rigidity from crankshaft to rear wheels and so ensure consistent handling characteristics irrespective of speed or cornering forces.

Power is transmitted from the differential to the rear wheels via a set of rigid, one-piece halfshafts. The outer end of each driveshaft connects to the wheel hub via a large flange, which distributes drive loads better than more commonly used splines.

Even the constant-velocity joints at the outer ends of the driveshafts have been designed so they have minimal rotational mass, and contribute to faster driveline response to throttle inputs.

ENGINE HIGHLIGHTS

	BREATHING EFFICIENCY		**WEIGHT REDUCTION FOR REDUCED INERTIA**
	Air intake conical filter for reduced		High-strength, lightweight valve springs
	back pressure		More compact VTEC system
	Straight port intakes		Lightweight rocker arms produced by
	Low back pressure exhaust with large		world-first metal injection moulding
	diameter pipes, dual silencers with		process

	two- stage pre-chamber		Hollow camshafts
	HIGH OUTPUT		**COMPACT ENGINE DIMENSIONS**
	Advanced combustion chamber		More compact VTEC system
	design		Camshaft scissors gear reduces engine
	Short stroke design		length
	High rpm		Small scissors gear diameter allows
	High (11:1) compression ratio,		shallower rocker cover
	assisted by narrower valve angle and use of FRM cylinder liners for good heat dispersion		Careful packaging of auxiliaries means alternator, water and air-conditioning pumps driven in a single plane by a
	Forged aluminium pistons for		serpentine belt
	increased strength		Direct ignition eliminates distributor
	Carburized forged steel connecting		Aluminium ladder-frame main bearing
	rods for increased strength		stiffener contributes to compact block
	Aluminium ladder-frame main bearing		Engine canted over by 15 degrees
	stiffener for increased rigidity		
	REDUCED OPERATING FRICTION		**EMISSIONS**
	Low-friction plating technique on		Multi-port exhaust secondary air injection
	certain bearing surfaces		Dual-wall stainless steel exhaust manifold
	Low friction valve gear (roller-type rocker arms)		Thin-walled, metal honeycomb catalytic converter

Chassis

- **Low polar moment of inertia and 50:50 front/rear weight distribution for balanced handling**
- **Low centre of gravity**
- **Innovative 'high X-bone frame' provides immense rigidity and outstanding impact characteristics**
- **Strengthened windscreen surround and roll hoops provide added safety**
- **New generation in-wheel double wishbone suspension**
- **Torque-sensing limited slip differential**
- **Electric power steering**
- **ABS and EBD braking**

The HONDA S2000's design ethos demands an unwaveringly secure chassis that responds faithfully to every driver input, and Honda's engineers have come up with a sports car that is sure-footed, fully exploitable and responsive in a predictable and linear fashion. And yet the ride quality remains supple without compromising those abilities.

Several fundamental aspects of the HONDA S2000 design contribute to these characteristics. A light, compact engine positioned well back in the chassis ensures a low polar moment of inertia; the optimum 50:50 front/rear weight distribution for balanced handling; the low centre of gravity; the high level of stiffness provided by the high X-bone frame body structure ensuring consistent suspension geometry alignment; and suspension technology that builds on Honda's racing experience all combine to provide the advanced chassis control.

The high X-bone frame

When designing any open car, the loss of a fixed steel roof as a load bearing structure naturally demands compensatory measures to maintain the body's rigidity. Furthermore, in a finely-honed, high-performance sports car it is even more essential that the body provides a highly rigid structure, thereby allowing the suspension to work to its full potential, uncompromised. And, in terms of crash safety performance, it is vital to provide adequate rigidity to allow front and rear crumple zones to operate effectively.

However, adopting a conventional approach to the problem that is, applying major structural reinforcement to the side sills and central floor can all too easily increase the weight of the car to a degree that harms performance, fuel economy and emissions performance, while the rigidity rarely matches that of a closed car.

Honda's engineers therefore opted for a totally clean-sheet approach and their solution offers rigidity and passenger protection equivalent to that of a closed body, but in a

lightweight bodyshell.

At its heart lies what Honda has termed a 'high X-bone frame'. While the bodyshell is in effect a monocoque, what sets it apart is the manner in which the frame rails and centre tunnel combine to form an exceptionally rigid body-chassis. The 'X' element of the high X-bone frame refers to a notably deep centre tunnel, box-shaped in cross section to offer good resistance to torsional loads, and a pair of 'legs' at either end running diagonally. Those at the front connect directly with the front longitudinal frame rails to cradle the rear of the engine; those at the rear abut the rear chassis frame rails.

A key element in this design is the single horizontal plane formed by the top of the centre tunnel and the front and rear frame rails; since they are all set at the same height, they provide immense rigidity. The result is a body offering torsional rigidity equivalent to that of a closed one and a level of bending rigidity far superior to either open or closed conventional bodies.

Creating a strong passenger cell

The high X-bone frame is only part of the story, however. The side sills have been made particularly deep and connect with the front frame rails at the same point as the front legs of the centre tunnel. And running back from this same point is a straight, central floor member which connects front and rear frame rails. This 'three point support structure' where the sill, frame rail, floor member and central tunnel all meet, is very efficient at distributing load. Together with the deep side sills, it makes the body extremely resistant to deformation to create a strong passenger cell.

In the event of an offset frontal collision, the high X-bone frame does not twist upon impact. Instead impact load is shared evenly between the central tunnel, which absorbs around 40 per cent of the energy, and the side sills and central floor element. Furthermore, the front side members are completely straight and constructed in high tensile steel (as indeed are the rear side members) to make them particularly effective at absorbing energy. Running across the centre of the passenger cabin is a sturdy middle cross-member which is designed to direct crash energy into the centre tunnel in the event of a major side impact.

The overall effect of this innovative design is therefore a structure that eliminates shakes and vibrations, ensures pin-sharp handling and steering characteristics and conforms to worldwide safety criteria to provide outstanding occupant protection in the event of an accident.

Roll-over protection

A windscreen surround specially strengthened by a tubular brace and a pair of fully-trimmed roll hoops behind each seat with internal reinforcements and securely anchored to the high X-bone frame provide excellent occupant protection in the unlikely event of a roll-over accident.

Compact in-wheel suspension

The HONDA S2000's suspension is a new generation 'in-wheel' double wishbone design with anti-roll bars front and rear, which although influenced by that of the NSX, differs in a number of critical details. Whereas the suspension of the NSX is largely aluminium, the HONDA S2000's is cast in steel, but because it is so compact, unsprung weight is kept to a minimum. Careful shaping of the components means that most of the structure can be located within the 16 in diameter wheels, to give packaging benefits; in particular, it helped the Honda design team in their quest for a low bonnet and rear deck line.

In-wheel suspension also provides greater rigidity by allowing the wishbones to be shorter and the upper and lower mounting points to be kept closer together; having a high stiffness to resist lateral forces improves the progressive, linear handling feel, the chassis' responsive nature, and general stability.

The front suspension employs a relatively low roll centre so enhancing steering feel and linearity by minimising suspension-jacking and track (width) changes as the vehicle corners or drives over uneven road surfaces. A low roll centre also helps keep the inner wheel closer to perpendicular (relative to the ground plane) during cornering.

The rear suspension features a wide based lower wishbone with a toe control arm for precise control (the NSX uses a toe control arm on the rear of the wishbone).

The HONDA S2000 suspension system is well damped without being harsh, thanks to its Honda Progressive Valve (HPV) shock absorbers. These gas-pressure dampers use a stacked disc-valve arrangement that yields easily and progressively to high-velocity damper-piston movement, such as that created by bumps or road impact. However, when they encounter the slower movement typical of body motion, the disc valves offer more resistance and increase the damping force.

As well as being compact, the racing-style coaxial spring/damper units both front and rear offer low friction characteristics, while another motorsport-inspired feature at the rear is a separate gas reservoir which allows a bigger piston than could be accommodated in the body of the damper, to give a finer ride quality.

Honda also worked closely with Bridgestone in developing suitable tyres and the construction and rubber compound of the Expedia S02 tread pattern are specifically tailored for the HONDA S2000. The standard 16 in diameter, five-spoke, dished centre, alloy rims are shod with 205/55VR16 tyres at the front and 225/50VR16 tyres at the rear.

Limited-slip

An aluminium, torque-sensing limited-slip differential (LSD), which is currently used on a variety of Honda models including the NSX and Integra Type-R, plays a key role in the car's rewarding and progressive road manners. Elegantly simple and wholly mechanical, the design is both lighter and quieter in operation than alternative plate-type or viscous coupling LSDs, and features a multi-plate clutch and helical-type planetary gears.

In a straight line, the amount of slip between the rear wheels is controlled by a preset spring-loaded disc imparting a force on the multi-plate clutch. However, when differential wheel movement exists and these gears are thus forced to move, they develop an axial force, proportional to the drive torque, which increases the friction developed in the multi-plate clutch. The limited-slip effect therefore varies with the drive torque, which greatly enhances vehicle behaviour in difficult driving situations. In particular, acceleration out of tight low gear corners is improved by some 10 per cent because the tendency of the inner wheel to spin is reduced; and maximum acceleration on a 'split-mu' surface (grip one side, slippery the other) is typically doubled.

Latest-generation electric power steering

With just 2.25 turns lock-to-lock and a turning radius of 5.4 m, Honda opted to equip the new car with power steering to make short work of tight parking manoeuvres. It was also keen to provide the HONDA S2000 with a system that had a crisp, linear action, able to contribute to high speed handling and provide excellent road feel at high speeds.

A hydraulic power assisted system of course requires a pump driven off the engine which can sap power by as much as 5 PS as well as adversely affecting fuel economy. For these reasons, the HONDA S2000 is equipped with electric power steering (EPS) which only absorbs electrical energy when required. It is also more compact, weighs less and provides greater flexibility in programming steering feel at all speed ranges compared to traditional hydraulic systems. EPS is also more responsive at high speed and has been tuned on the HONDA S2000 to minimise kickback. The rubber coupling at the base of the steering column is particularly stiff so it damps unwanted inputs while retaining good road feel and informative feedback.

Honda pioneered EPS and first introduced it on the NSX followed by Japanese-market Accord variants, but the HONDA S2000 design is new, with the motor and steering rack

mounted coaxially. A speed sensor in the system's electronic control unit registers road speed and, coupled with a torque sensing system, feeds a signal to the electric motor to provide varying levels of assistance. In the unlikely event of EPS failure, the car can still be driven and an EPS warning light illuminates in the instrument binnacle.

The HONDA S2000 also features Variable Gear Ratio steering (VGR), which provides a progressively quicker ratio as the steering wheel is turned farther off centre. This is accomplished by changing the pitch of the teeth in the steering rack. VGR has more on-centre feel when driving straight ahead and enhances manoeuvrability when parking.

Powerful braking

The HONDA S2000 has a braking performance to more than match the prodigious engine output and 16 in ventilated front discs and 15 in solid rear discs plus four-sensor, three channel ABS anti-lock braking and EBD (electronic brake force distribution) result in a powerful, linear pedal action for precise and balanced braking.

HONDA S2000

Exterior

- **SSM concept car provided styling basis**
- **Compact external dimensions**
- **Taut, muscular styling conveys performance potential**
- **High-performance HID headlamps**

Starting with the SSM concept car, the HONDA S2000 passed through three distinct design stages, each immediately recognisable as a sibling to SSM, yet differing slightly in proportion and the layout of headlamps, air intakes and vents. While the HONDA S2000 does not share the SSM concept car's split cockpit, which saw driver and passenger seats separated by a fixed spar linking the scuttle to the rear deck, Honda's designers have nevertheless retained each of the major design cues including the angular nose. The final production model includes a larger front air intake, a raised headlamp location, more pronounced rear bumper and a centre rear brake light located on the upper lip of the boot lid, where it also performs an aerodynamic function.

Honda aimed for compact external dimensions both to minimise weight and to enhance agility and the HONDA S2000 is 4135 mm long, 1750 mm wide and 1285 mm tall (with the top raised). Kerb weight is just 1260 kg. The body is all steel with the exception of an aluminium bonnet.

Beautifully proportioned, the HONDA S2000 has both an elegant and sporty appeal. From arrow-head nose and fared in headlamps to short, rounded tail, its styling manages to be distinctive without resort to retro styling cues. The chiselled, angular lines are purposeful and there is a dynamic tension about the whole car. The short front overhang, the ultra-low bonnet line (aided by canting the engine over by 15 degrees) and wheels pushed out to the very edges of the body give the frontal aspect an aggressive feel. Deep scallops carved out of the length of the sills and the base of the doors reduce the visual depth of the doors and accentuate the taut body sides and pinched waistline effect produced by the flared wheel arches.

A delicate crease line that runs from the front wheel arch through the door handle to the taillights and which is perfectly replicated in the fuel filler cover panel with pin-point alignment produces subtle lighting and shading effects and added definition.

Tailight clusters mirror the shape of the front light covers, wrapping round the rear corners as

they do so. The large, individual lights are circular, with the reversing lights located inboard of the tailights. Along the lower edge of the rear bumper a black panel insert with cut outs for the twin chrome exhaust tailpipes provides a slimming effect to the rear aspect.

Badging has been kept understated with the Honda H-mark appearing front and rear, on the wheel centre caps and, in a titanium finish, on the steering wheel boss. The sole 'HONDA S2000' identification is on the front wings just aft of the side indicators. A short 'bee-sting' aerial is positioned on the offside rear wing.

HID headlamps

The high performance HONDA S2000 is appropriately equipped with high intensity discharge (HID) headlamps. Providing luminosity twice as great as halogen units, HID headlamps use a high voltage current and a bulb filled with xenon gas to produce an output much closer to that of daylight.

To ensure that these powerful HID units are aimed accurately at all times, an automatic adjustment mechanism is provided. This consists of an ECU that continually monitors the car's attitude via suspension-mounted sensors, adjusting the headlamp aim to reduce the risk of dazzling oncoming motorists.

HONDA S2000

Interior

- **Sporty, cockpit-like interior**
- **Supportive, leather seats**
- **Push button starter, drilled aluminium pedals, aluminium gear knob provide true sportscar flavour**
- **Digital instrumentation reflects high-tech nature of engine**
- **Controls placed immediately to hand to left and right of steering wheel**
- **Convenient storage area between seat backs**
- **Electrically-operated hood folds in seconds**
- **Practical boot provides space for two large soft bags**

With its low slung seating position, high doors and high centre tunnel, the elegantly simple, yet purposeful interior is snug and cocooning. Its resemblance to a cockpit heightens the HONDA S2000's intimately sporty feel, but there is ample leg room, with the seats providing generous fore and aft as well as rake adjustment. Although the occupants sit low, visibility is good with the driver able to see most of the bonnet and wing surfaces.

With firm bolsters providing excellent support, the comfortable, sporty seats feature integral head restraints which in turn echo the shape of the individual roll hoops. Seats and door panel inserts are trimmed in either red leather (silver or black body colour) or black leather (silver, black, red or blue body colour). The seat belts pass through a guide on the side bolster to place the webbing conveniently to hand.

Pure sports feel

Based around a theme of 'pure sports feel' the interior design emphasises clean simple shapes with a driver-focused racecar style digital instrument pack and controls immediately to the left and right of the steering wheel.

Providing a novel touch to the HONDA S2000 driving experience is a push button starter. To start the engine you twist the column mounted ignition key and then push the red starter button prominently located, within its chrome surround, close to the driver's left hand (LHD cars) or right hand (RHD cars). Pedals of drilled aluminium and polished metal kickplates bearing the legend 'S2000 Honda manufactured by Honda Motor Co' in black provide added distinction to the interior.

Specific attention has been paid to the tactile quality of the car's interior surfaces to ensure they are satisfying to the touch, including the leather-trimmed steering wheel, aluminium gearshift knob and subtly-dimpled door pulls. Given that the interior could be exposed to strong sunlight for long periods while the top is down, the trim materials have been checked for susceptibility to degradation from ultra-violet light; they have also been selected for their resistance to the occasional rain shower that may be encountered before

an opportunity can be found to raise the hood.

The HONDA S2000 has newly developed, compact SRS airbags and seatbelt pretensioners as standard equipment, and the small, stowed size of the driver airbag allows for a sports-orientated steering wheel design with unobtrusive boss.

Digital read-out

In a reflection of the high-revving, high-tech nature of the engine, and taking inspiration from the world of Formula 1, the HONDA S2000 uses digital instrumentation in a single, semi-circular display which is black with the ignition off, but illuminates once the key is turned, providing perfect visibility through the three-spoke steering wheel.

The graphical tachometer is a semi-circular display arcing over the digital speedometer. It reads from 0 to 10,000 rpm as a curving bar, with the 0 to 9,000 rpm segment in orange and the final 9,000-10,000 rpm flashing red as the fuel cut-off intervenes to prevent over-revving. The digital speedometer features large orange numbers in the centre of the display reading up to 250 km/h, and either side of this are the water temperature and fuel gauges represented by a pair of yellow bars. The odometer, with tripmeter, is also a digital display, sited below the speedometer.

Controls close to hand

On either side, the facia curves towards the driver placing a number of controls close to hand. On the left hand side (right hand on RHD cars) the remote audio controls include a large, circular mode button which accesses various functions by repeated pushes, a button which allows the radio to seek or the optional CD player to access the next track, and a 'mute' button which silences the in-car entertainment system. A vertical rocker switch with a soft action increases or decreases volume.

To the right (to the left on RHD cars) are the heating, ventilation and air-conditioning controls, including individual soft-feel rotary knobs controlling air distribution and temperature selection. Fan speed is controlled by a vertical rocker with a visual check comprising seven green LEDs. There are four fascia vents: one either side of the steering wheel, one on the passenger side of the facia and another on the centre console above the audio unit. The powered mirror and window switches are located on the door armrests.

The column stalks follow established Honda practice but are notably short and carefully sculpted, with a crisp action. The short, stubby gear lever is cupped in a leather gaiter and topped by an aluminium gear knob with a satinised finish and inscribed gear pattern, adding to the HONDA S2000's air of engineering precision and mechanical solidity.

On the centre console, ahead of the gear lever is the audio system with a push open security cover.

Convenient storage

There is a vertical, lockable storage area with cubbies between the seats which takes the place of a conventional glovebox. Lifting its top lid reveals a deep bin to the rear and a shallower one to the front, while below these is another compartment accessed from the front by a bottom-hinged cover. The cover itself has an elastic strap for the retention of items such as tickets or papers, while within the cubby is the boot release button and a 12 V power outlet. A stretchy mesh pocket - suitable for storing a map or mobile phone - is located on the passenger side of the centre tunnel. A pair of hooks is provided on the rear bulkhead behind each seat.

Open-air motoring in seconds

In shaping the windscreen and proportions of the cabin, the HONDA S2000 was subjected to extensive wind tunnel testing to ensure an exhilarating top-down experience, allowing occupants to enjoy sun and fresh air without any of the discomfort from buffeting often experienced in convertible cars. An optional transparent plastic shield approximately 12 cm tall sits between the roll hoops acting as a wind deflector, and cutting turbulence. There's even an additional heater setting designed to encourage open top motoring when the weather turns that little bit cooler: in 'open mode', the system pumps heated air to the centre console vents above the audio unit, so warming occupants from hip to toe.

While an essential element of the design philosophy for the HONDA S2000 has been to minimise weight wherever possible, the company elected to fit an electric hood, since it considered convenience and ease of use to be overriding factors. The mechanism weighs in at just 6 kg.

The hood is retracted by releasing the two over-centre catches on the windscreen header rail and then pushing the rocker switch located on the centre console. Once unfurled, a soft hood cover can be snapped in place to protect the top. Raising the hood is simply the reverse procedure and the complete operation in either direction takes just six seconds. The hood has a plastic rear screen. An optional hard top will be available in the near future.

Luggage for two

With practical dimensions and a volume of 160 litres (VDA), the HONDA S2000's boot is capacious enough to swallow the luggage of two on a weekend away. The fully-lined trunk is notably deep, and can, for example, hold two large soft bags. A space-saver spare tyre is stored horizontally on the right and inset into the forward boot panel, while the boot floor

is recessed and is sufficient to accommodate the full-size punctured tyre and wheel. The floor of the recess, when lifted, reveals a small storage area containing the stowed jack and tools.

An immobiliser anti-theft system is standard on the HONDA S2000. The ignition key has a built-in transponder, which, when removed, immobilises the engine fuel injection and ignition so the engine cannot be started. When the key is inserted, a radio signal from the ECU (Electronic Control Unit) interrogates the transponder. If the code in the key and the code in the ECU agree, then the ECU allows the engine to be started.

HONDA S2000

An illustrious heritage

The HONDA S2000 effectively combines two strands of Honda's heritage. The company has an exemplary tradition in sportscars from the original S500 to the current NSX and a global reputation for excellence in motorsport, both in the Formula 1 World Championship - where it has taken six constructors' championships between 1983 and 1992 - and the American CART series where Honda-powered drivers have won the coveted title for the past three seasons.

As a spiritual successor to the S500-600 sports cars launched by Honda in the 1960s and culminating in the S800, it was only natural that this brand new roadster should be named the HONDA S2000, with the '2000' referring to the cubic capacity of its extraordinary engine.

It's a link that extends beyond just badging, however, and a remarkably similar ethos spans the 34 years separating the two cars. Both the Honda S800 and HONDA S2000 are lightweight two seater sports cars powered by high revving engines adopting unconventional engineering. Just as company founder Soichiro Honda was moved to comment that he "didn't want to build a car like everyone else's" when questioned about his radical early sportscars, so HONDA S2000 chief engineer Shigeru Uehara and his team chose to seek new approaches to high performance sportscar design - not for the sake of being different, but to use elegant engineering solutions to produce a performance engine of the highest efficiency and boasting excellent emissions performance.

The S800: thinking the unconventional

Honda had been in business 15 years and was already extremely well established as a motorcycle manufacturer when it introduced its first cars at the 1963 Tokyo Motor Show.

The S360 and S500 - 'S' standing for 'sports'- were miniature sports cars with a front engine, rear-wheel drive configuration, but manufactured with a new precision.

Power for the S360 came from an intoxicating, aluminium hemi-head 360 cc four cylinder engine, developing 33 PS at the remarkably high speed of 9,000 rpm. It also featured a roller bearing crank and twin overhead camshafts, while a Keihin carburettor for each of its four cylinders was a legacy of Honda's racing motorcycles. To ensure a particularly low bonnet line the little engine was canted over at an angle of 45 degrees.

The remarkable specification included a five speed gearbox which transmitted power to the wheels via separate chains whose oil baths formed trailing arms for the independent springing. On early models the rev counter read up to 14,000 rpm.

Although the S360 never went into full production and the 531 cc S500 was made only until 1964, they were replaced in that year with the evolutionary 606 cc S600 offered in both fastback coupe and open 2-seater bodystyles. Denny Hulme even drove an S600 to a class win in the 1965 ADAC 600 Kms endurance race at the Nürburgring.

The S800, the ultimate S-series sports car, made its debut at the 1965 Tokyo Motor Show. This automotive classic had independent front suspension with wishbones and torsion bars, precise rack and pinion steering and a box-section ladder frame, cross-braced chassis. The unique chain drive would later be replaced by a conventional live rear axle and the five speed gearbox by a four.

Despite a capacity of only 791 cc, the engine generated an amazing (for the time) 71 PS at 8,000 rpm, revving safely to 10,000 rpm. That equated to 90 PS per litre, yet the engine was a model of smoothness and refinement, ran on low octane fuel and had the potential for 160 km/h.

After this foray into the sports car market, Honda for the next 10 years concentrated on establishing itself as a major global car manufacturer and developing expertise in low emissions engine technology.

The sportscar lineage

The launch of the Prelude range in 1978 signalled a return to Hondas with increasingly sportier pretensions, later to be joined by the CRX which demonstrated to a wide audience the amazing flexibility and performance potential of Honda's VTEC system. But it was the NSX which really showcased Honda's abilities. This widely-acclaimed, all-aluminium supercar brings together rewarding, yet ultimately forgiving handling and blistering

performance in a stunning mid-engined package that boasts the traditional Honda attributes of reliability and good build quality. Finally, Honda's recent Type-R derivatives - the Integra and the Accord - with their high-revving, no compromise engine technology aimed at knowledgeable enthusiasts, have been a precursor to the HONDA S2000.

Honda sportscars through the years:

1963: S500

1965: S800

1978-1982-1988-1992-1996: Prelude

1983-1988-1992: CRX/Del Sol

1991: NSX; 1994: NSX Type-R; 1995: NSX-T

1991: Beat

1996: Integra Type-R

1997: Civic Type-R

1998: Accord Type-R

1999: HONDA S2000

Racing improves the breed

Just as the HONDA S2000 is a spiritual successor to the S800, so too does it encapsulate the forward, innovative thinking that has always operated within Honda and which has been the force behind the company's phenomenal motor racing success story. That racing improves the breed has always been a deeply held belief at Honda. Soichiro Honda, a keen racing driver himself in Japan during the 1920s and 1930s, saw racing as a means of not just promoting sales but also as a way of stimulating creativity: moving engineers between racing projects and production cars, he reasoned, could only be to the benefit of the customer, quite apart from its morale-boosting effect on employees.

Motorsport experience stretches to the very top

That philosophy permeates throughout the company to this day and it is interesting in this regard to reflect on the background of successive Honda presidents. Kiyoshi Kawashima, who succeeded Soichiro Honda in 1973, was the designer of the company's first four stroke engine and laid down the racing engines for the 1950s and 1960s TT races; Tadashi Kume, who took over the presidency in 1983, was responsible for the engines with which Honda entered single-seater motor racing; and Nobuhiko Kawamoto, who headed the company between 1990 and 1998, designed and worked on the racing engines under Kume, was head mechanic for Jack Brabham's victorious 1965 Formula 2 team and played a key role in the Formula 1 programme of the 1980s and 1990s. And among the variety of posts held by current president, Hiroyuki Yoshino, was the presidency of Honda

R&D and Honda Racing Corporation between 1983 and 1987.

Honda's first Formula 1 era

Today, Honda is justifiably regarded as one of the greats of Formula 1: Honda-powered cars have captured six consecutive world constructors' titles, five world drivers' championships, and 71 Grand Prix victories in all.

The company entered the fray in August 1964 with its own chassis and engine at a time of intense competition between teams such as Ferrari, Lotus, BRM and Cooper. The Honda RA271 featured a jewel-like 60-degree V12 uniquely mounted in a transverse position ahead of the rear wheels.

1965, the final year of the 1.5 litre formula, saw the debut of the RA272 and the first glimmer of success. At the year's third event, the Belgian Grand Prix, Richie Ginther captured sixth place.

Victory in Mexico

Another sixth place came in the Dutch Grand Prix, but it was to be the last race of the year, in Mexico, that would finally bring Honda hard-earned success. Ginther's win signalled the first victory by a Japanese car since the dawn of grand prix racing, as well as being the final race of the 1.5 litre formula.

Honda's contender for 1966, the RA273, did not appear until late in the season. The elegantly engineered 3 litre V12 engine, installed longitudinally, developed 400 PS at 10,000 rpm, 50 PS more than its closest rivals, yet was at a weight disadvantage. There would be only one points finish, a fourth place in Mexico City.

With John Surtees on board as driver, technician and strategist during 1967, results began to improve, first with the RA273, and then with the lighter RA300 which brought Honda its second victory, this time at Monza, with a last-lap sprint to the line in one of the most dramatic grands prix of modern times.

The subsequent RA302 of 1968 was one of the most innovative cars of the 3 litre formula, its air/oil-cooled V8 engine initially developing 390 PS at 9,000 rpm. However, the need to devote engineering resources to the task of reducing engine emissions in production cars, led to Honda's withdrawal from Formula 1.

Back to the rostrum

Honda's quiet return to Formula 1 in the 1980s gave little indication of the eventual impact the Japanese manufacturer would have in the world's most technologically advanced race series.

The Formula 1 programme got off the ground with a turbocharged 1.5 litre V6 engine in a Spirit chassis driven by Stefan Johansson, providing invaluable experience prior to a concerted effort with the Williams team. A new FW09 Williams-Honda was built in the summer of 1983, and raced in the South African Grand Prix at the end of the season, finishing an impressive fifth with Keke Rosberg at the wheel. Then in 1984 at Dallas, Rosberg captured what was to be the first of many, many victories for Honda-powered cars.

The 1985 season was one of steady engine development as the team worked towards achieving competitive engine output whilst maintaining reliability. Victory for Rosberg eventually came in the season's sixth event at Detroit, then, towards the end of the season, team-mate Nigel Mansell scored two resounding wins and Rosberg rounded off 1985 by winning the final race in Australia, demonstrating conclusively that the Honda engine was a match for anything.

Honda's grip on Formula 1 was now secure, and during 1986 Nelson Piquet won four races, Mansell five. The Englishman narrowly lost the world championship to Alain Prost following a 180 mph tyre failure in the last race, but Williams-Honda secured the constructors' championship - 45 points ahead of second placed McLaren-TAG.

During the following season, Honda engines were used by Lotus as well as Williams, giving Ayrton Senna two victories, while Piquet in the Williams-Honda captured his third world championship notching up three victories, his car failing to finish only twice. With team-mate Mansell's six wins, it meant Honda had taken a second constructors' championship, this time 61 points ahead of McLaren-TAG.

A clean sweep - almost

The 1988 season - the last of the turbo era - saw the formidable pairing of Senna and Prost in McLaren-Hondas and they went on to win 15 of the 16 races (Senna eight to take the title, Prost seven), gaining pole position 15 times, and collecting the constructors' championship with an unprecedented 199 points. The results spoke for themselves, as they did again in 1989 when a new, naturally-aspirated 3.5 litre V10 went into a new McLaren. Alain Prost emerged as world champion, with Honda collecting its fourth constructors' championship.

For 1990, the McLaren-Honda pairing were Senna and Gerhard Berger and despite fierce competition from Prost's Ferrari throughout the season, both the team and the Brazilian once again took championship honours.

The Honda engine in the Marlboro McLarens in 1991 was the more powerful 121E V12, and went on to win eight races, bringing Honda the constructors' cup for the sixth year in a row and the drivers' championship (Senna again) for the fifth.

End of an era

1992 marked the end of a truly outstanding era, for in that year Honda withdrew from Formula 1.

Yet Honda was not to be long out of the motor racing limelight, for in 1994 American Honda made its first venture into the PPG Indy Car World Series, competing with characteristic Honda success: manufacturers' titles in 1996 and 1998, and the drivers' titles in 1996, 1997 and 1998.

Honda's motorsport highlights

1964 August: Honda takes part in first Formula 1 race, the German Grand Prix at the Nürburgring

October: Richie Ginther's RA272 wins Honda's first Formula 1 race, the Mexican GP

1966 October: Honda engines win 11 consecutive Formula 2 races

1967 September: Honda wins second Formula 1 race, the Italian Grand Prix, with John Surtees driving the RA300 V12

October: Honda finishes joint fourth with Ferrari in world constructors' cup

1980 June: Honda resumes European F2 racing

1981 November: Ralt-Honda wins European F2 championship (Geoff Lees)

1983: Ralt-Honda wins European F2 championship (Jonathan Palmer)

March: Twin-turbocharged 1500 cc Formula 1 racing engine announced

July: Honda re-enters Formula 1 Grand Prix racing: Spirit-Honda F1 makes debut at Silverstone

October: New FW09 Williams-Honda makes debut at the South African Grand Prix and finishes fifth (Keke Rosberg)

1984 June: Ralt-Honda F2 sets new record of 12 consecutive victories (from 7 th race in 1983 to the 6 th race in 1984)

July: Williams-Honda (Rosberg) wins F1 US GP at Dallas, the first GP win since Honda's return to F1

1985: Williams-Honda takes four victories (Rosberg two, Nigel Mansell two)

1986: Nelson Piquet wins four races, Mansell five, to give Honda its first constructors' championship

1987: Honda engines power both Lotus to give Ayrton Senna two victories - and Williams cars. Piquet secures three victories, and the drivers' championship, Mansell six victories, and Honda its second constructors' championship

1988: The McLaren-Honda era. Senna and Alain Prost win 15 out of 16 races (Senna eight to take the title, Prost seven). Honda's third constructors' championship

1989: Honda's new 3.5 litre V10 takes Prost to a drivers' championship and the McLaren-Honda team to another constructors' championship (Senna seven wins, Prost four wins)

1990: Fifth constructors' championship. Senna takes the drivers' championship (six victories)

1991: Sixth constructors' championship, this time in a V12-powered McLaren- Honda. Senna wins drivers' championship (seven victories), while team- mate Gerhard Berger wins Japanese Grand Prix

1992: Three wins for Senna, two for Berger

September: Honda announces withdrawal from F1

1994: Honda enters American CART series

1996: Honda wins its first American CART series manufacturers' and drivers' titles

1997: Honda wins its second American CART series drivers' title

1998: Alex Zanardi collects Honda's second American CART series manufacturers' title as well as the drivers' title

Honda announces its intent to return to Formula 1 in 2000

HONDA S2000	
ENGINE	
Type	Aluminium alloy in-line 4-cylinder, 4 valves per cylinder, DOHC, VTEC variable valve control, Euro 2000 and LEV compliant
Bore x Stroke (mm)	87 x 84
Capacity (cc)	1997

Compression ratio	11:1
Max power kW/PS @ rpm	177/240 8300
Max torque Nm @ rpm	208 7500
Fuel system	Honda PGM-FI electronic injection
Fuel rating	Unleaded 98 Ron
TRANSMISSION	
Type	Six-speed manual transmission, rear wheel drive via limited slip differential
SUSPENSION	
Front	Double wishbone, coaxial damper/spring, anti-roll bar
Rear	Double wishbone, toe control arm, coaxial damper/spring, anti-roll bar
STEERING	
Gear Type	Rack and pinion with electric power assistance
Turns lock to lock	2.25
Turning radius at body (m)	5.4
BRAKES	
Front	16 in ventilated disc
Rear	15 in solid disc ABS and EBD
Handbrake	Mechanical, on rear wheels

WHEELS AND TYRES	
Wheels	16 in 5-spoke alloy
Tyres Front Rear	205/55 VR16 225/50 VR16

DIMENSIONS, WEIGHTS, CAPACITIES		
Overall length (mm)	4135	
Overall width (mm)	1750	
Overall height (mm)	1285 (with top raised)	
Wheelbase (mm)	2400	
Front track (mm)	1470	
Rear track (mm)	1510	
Ground clearance (mm)*	130	
Luggage space VDA (litre)	143	
Kerb weight (kg)	1260	
Fuel tank (litres)	50	
* with passengers in vehicle		
PERFORMANCE		
Max speed (km/h)	241	
Acceleration 0-100 km/h (secs)	6.2	

Fuel consumption		
(l/100km)		
Extra Urban	9.9	


HONDA


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S2000（NAVI装着車）　1999.4


S2000


160 LWA 47


160 LWA 47


S2000


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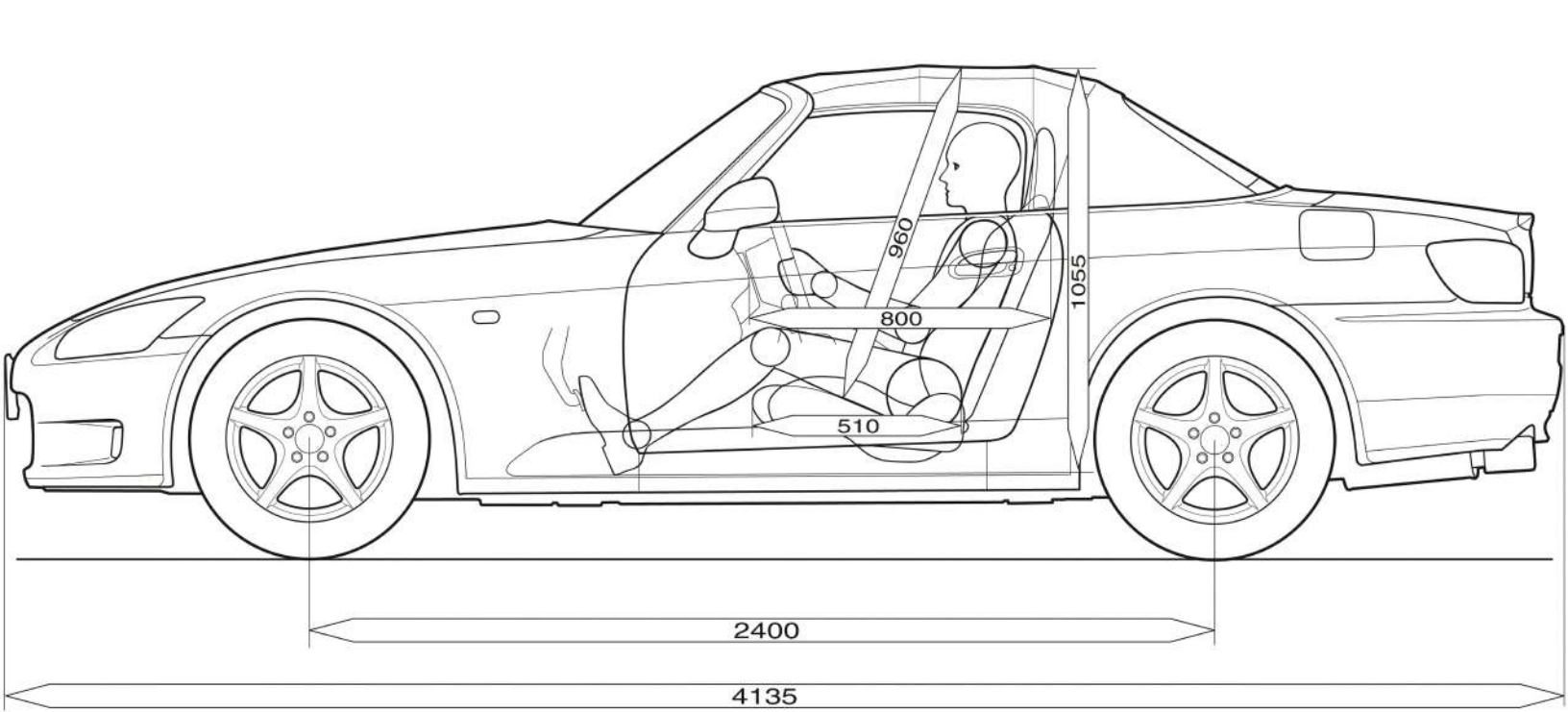
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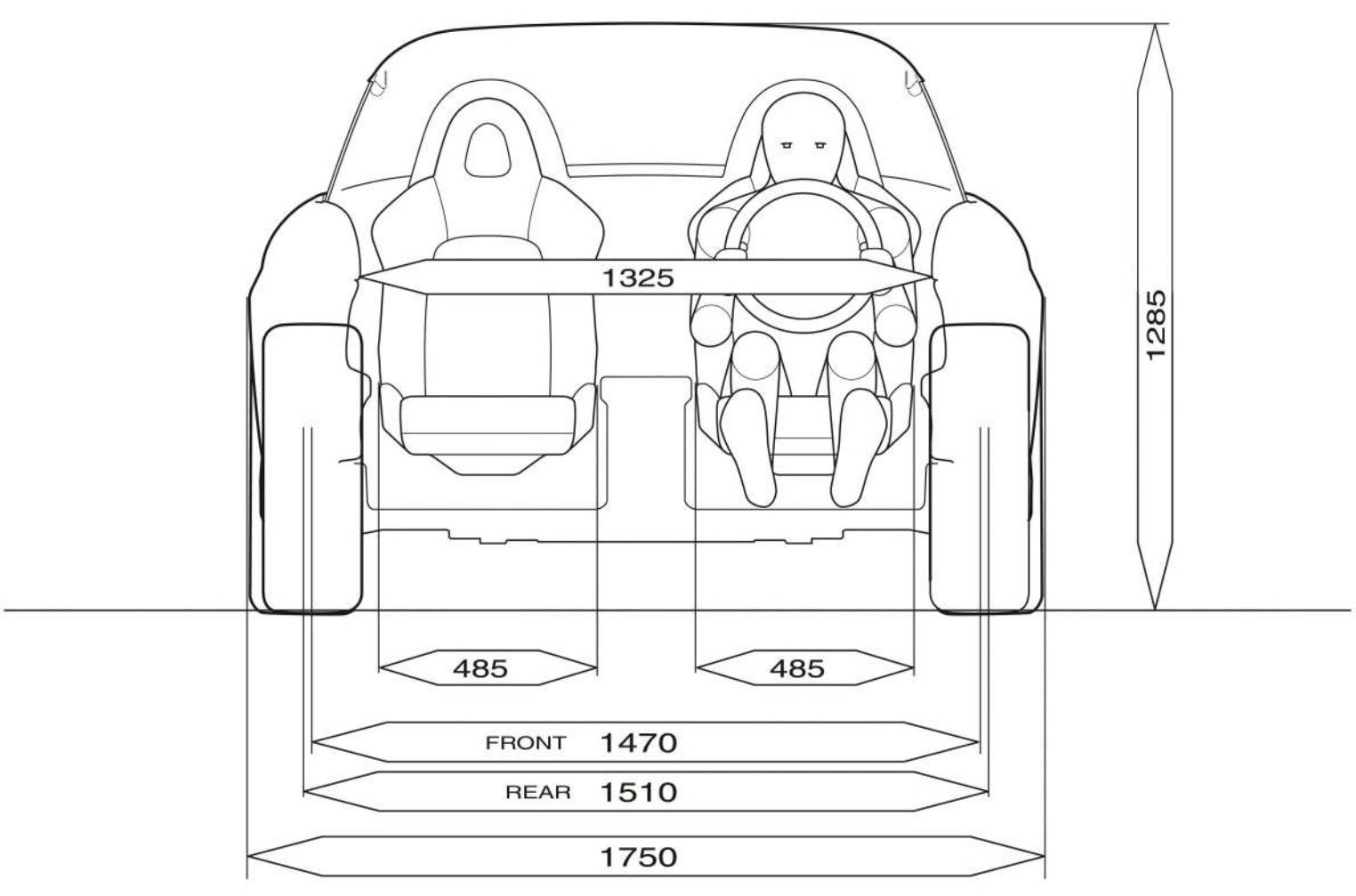
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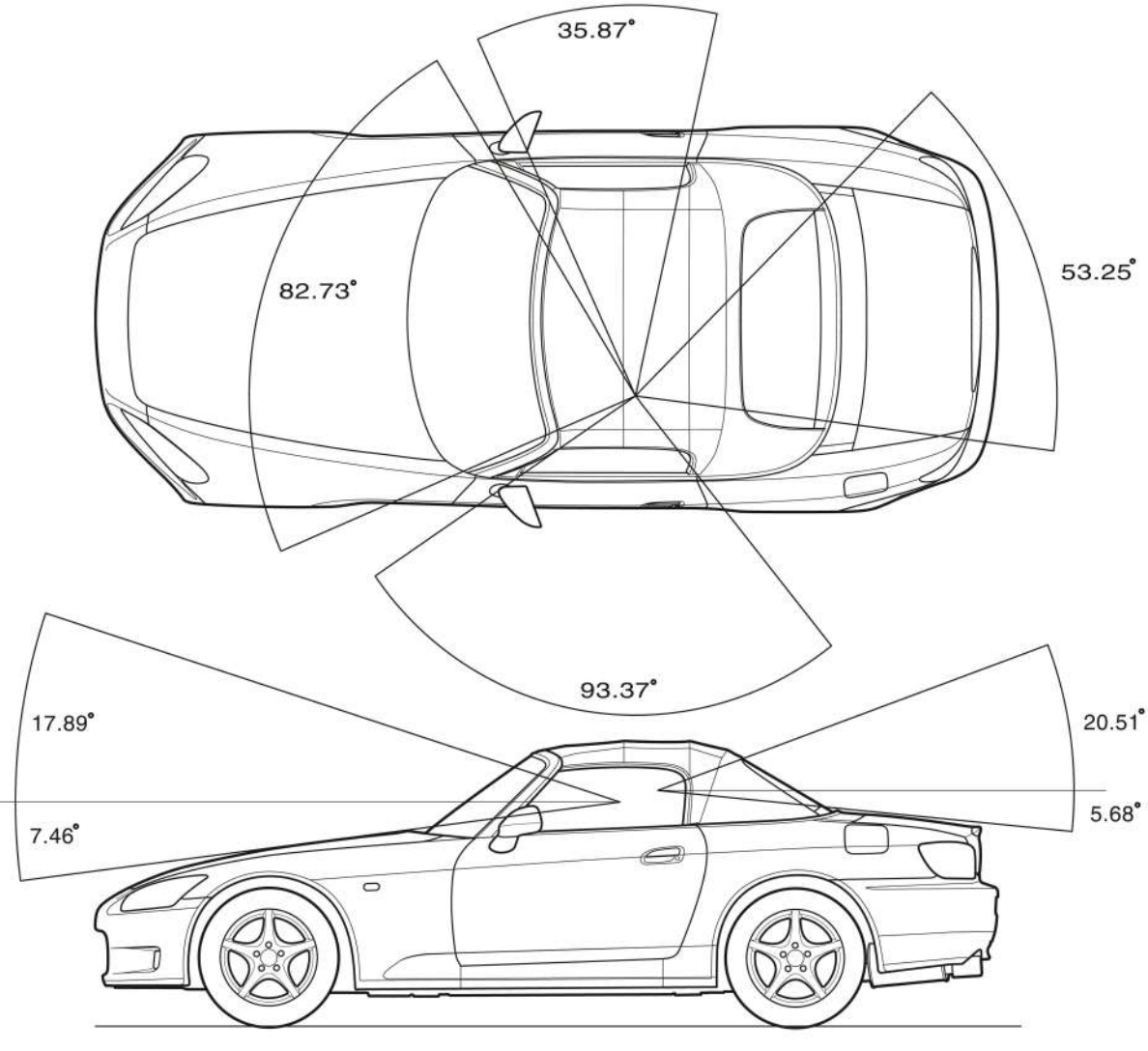
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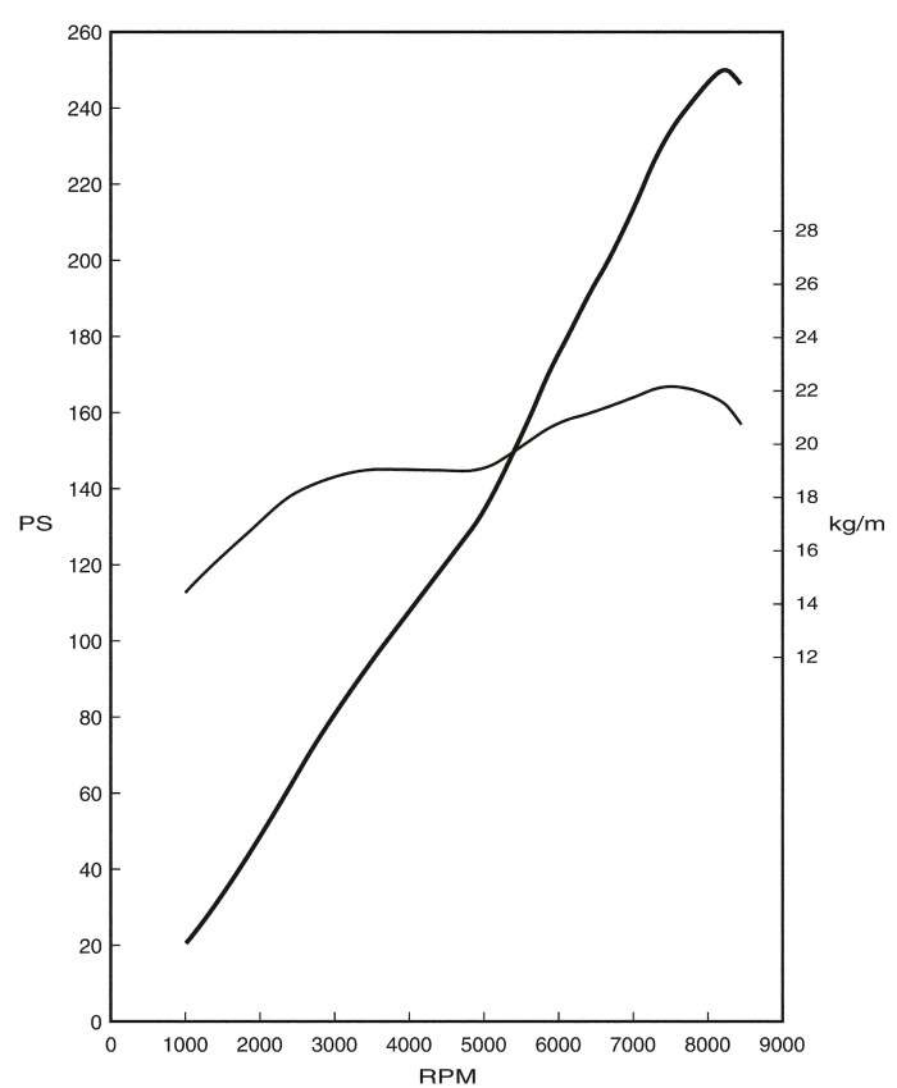
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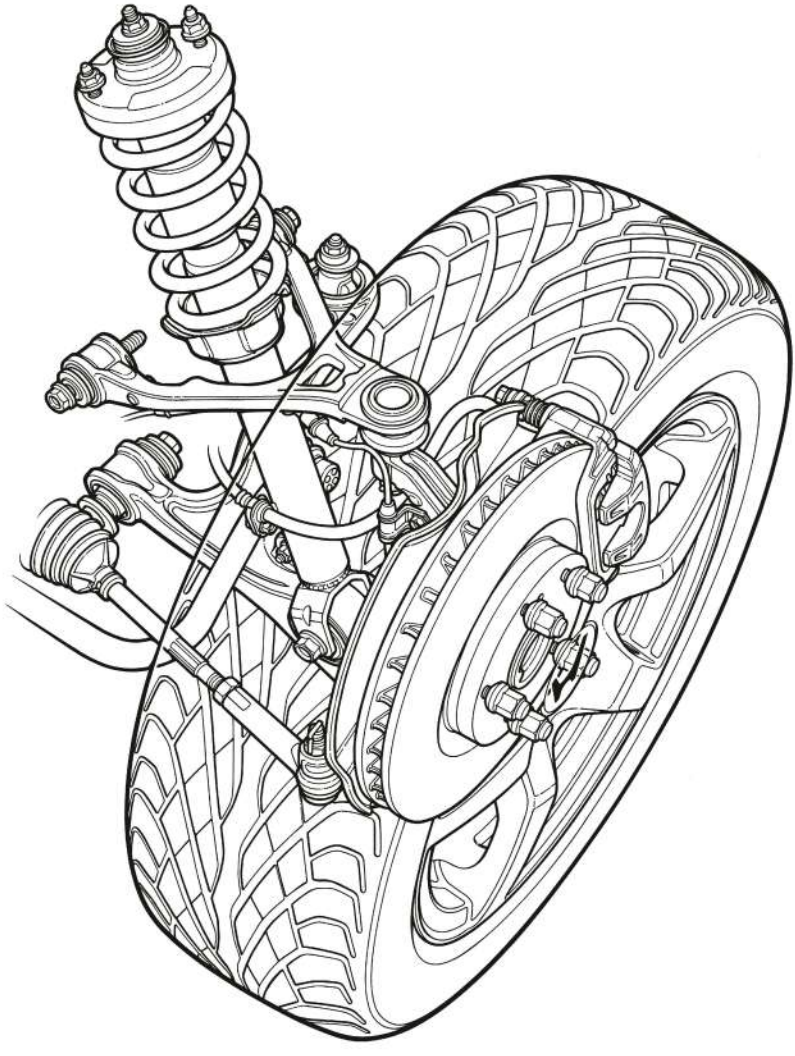
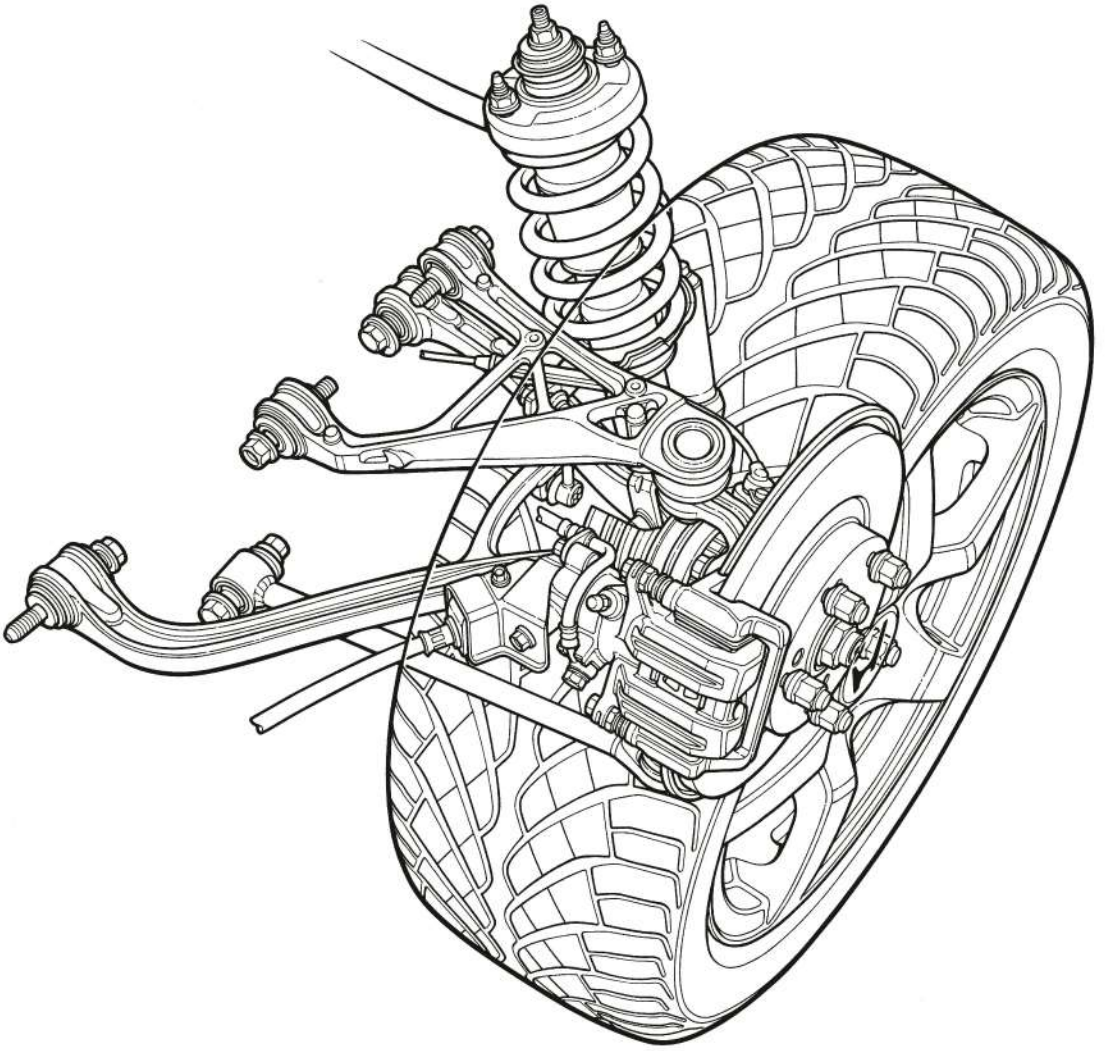
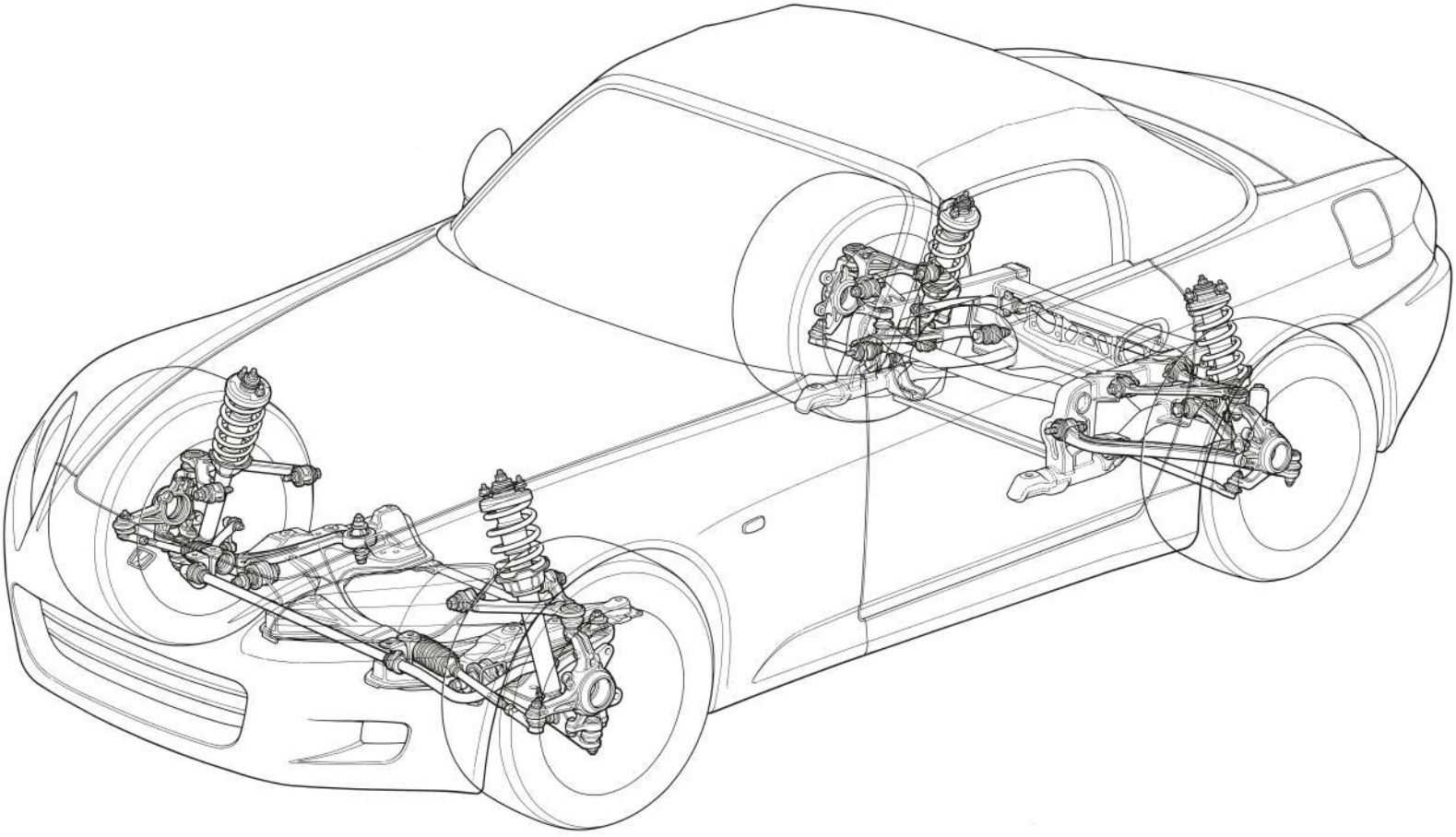
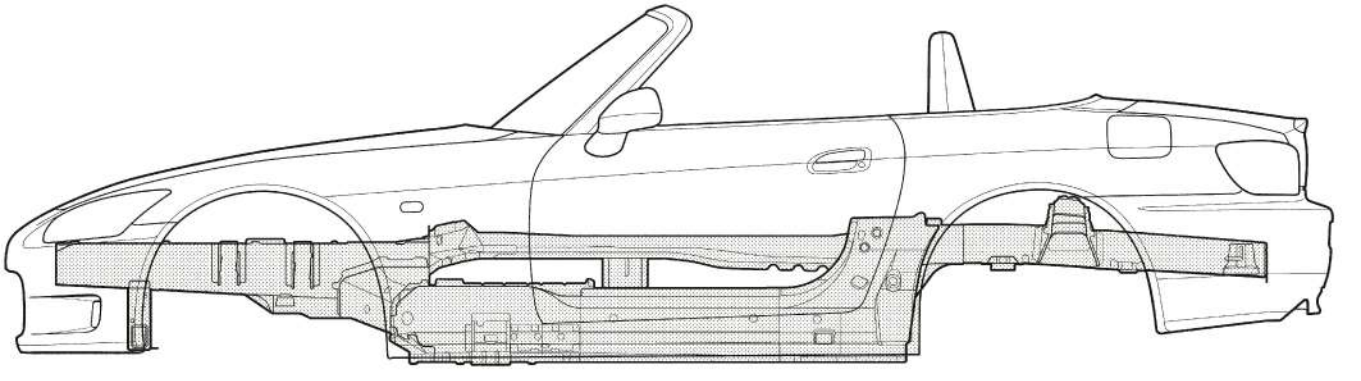
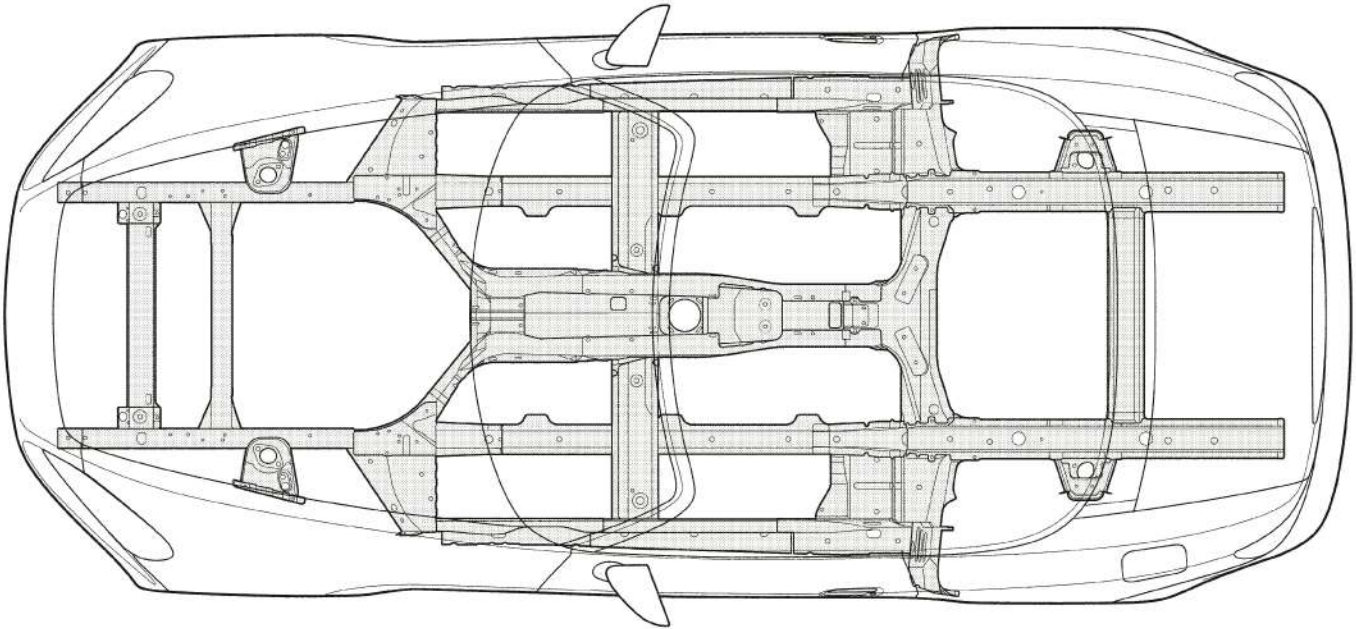
RPM

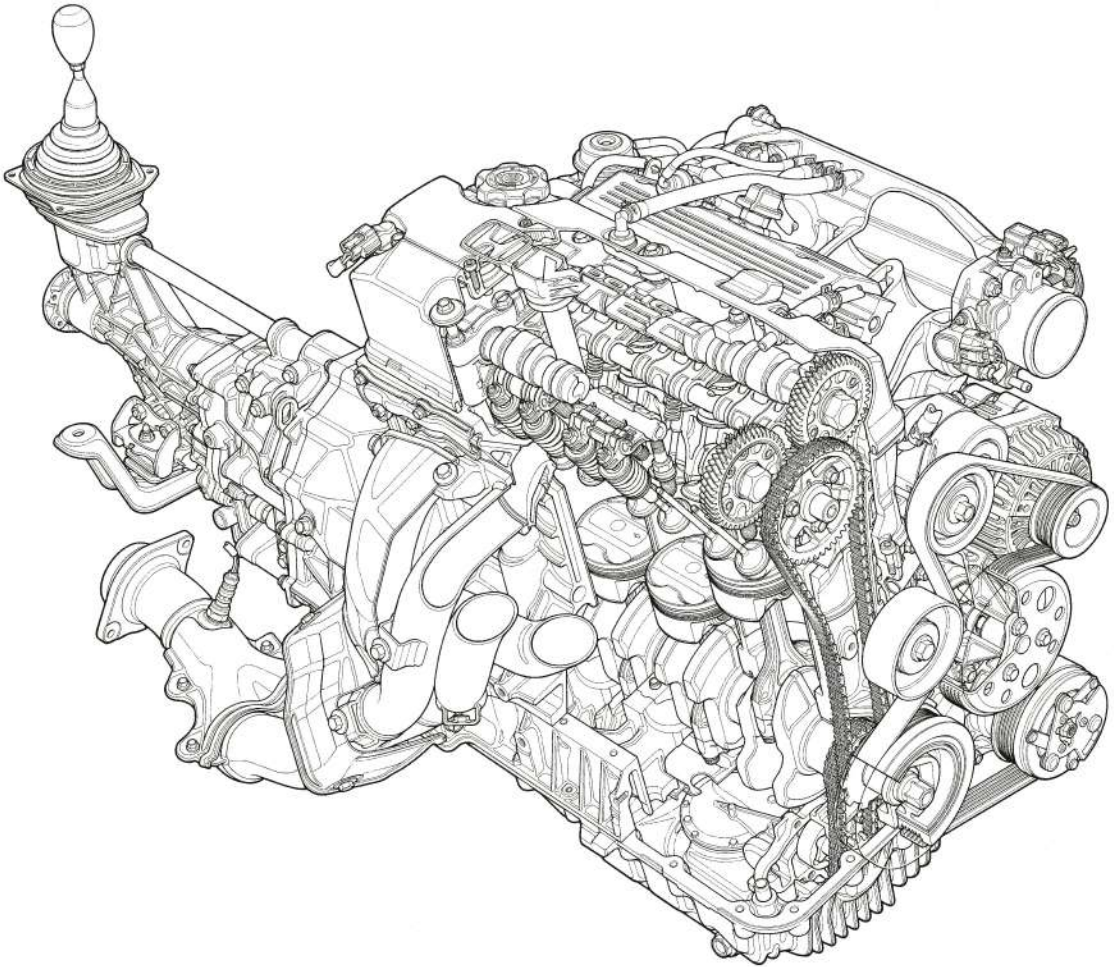


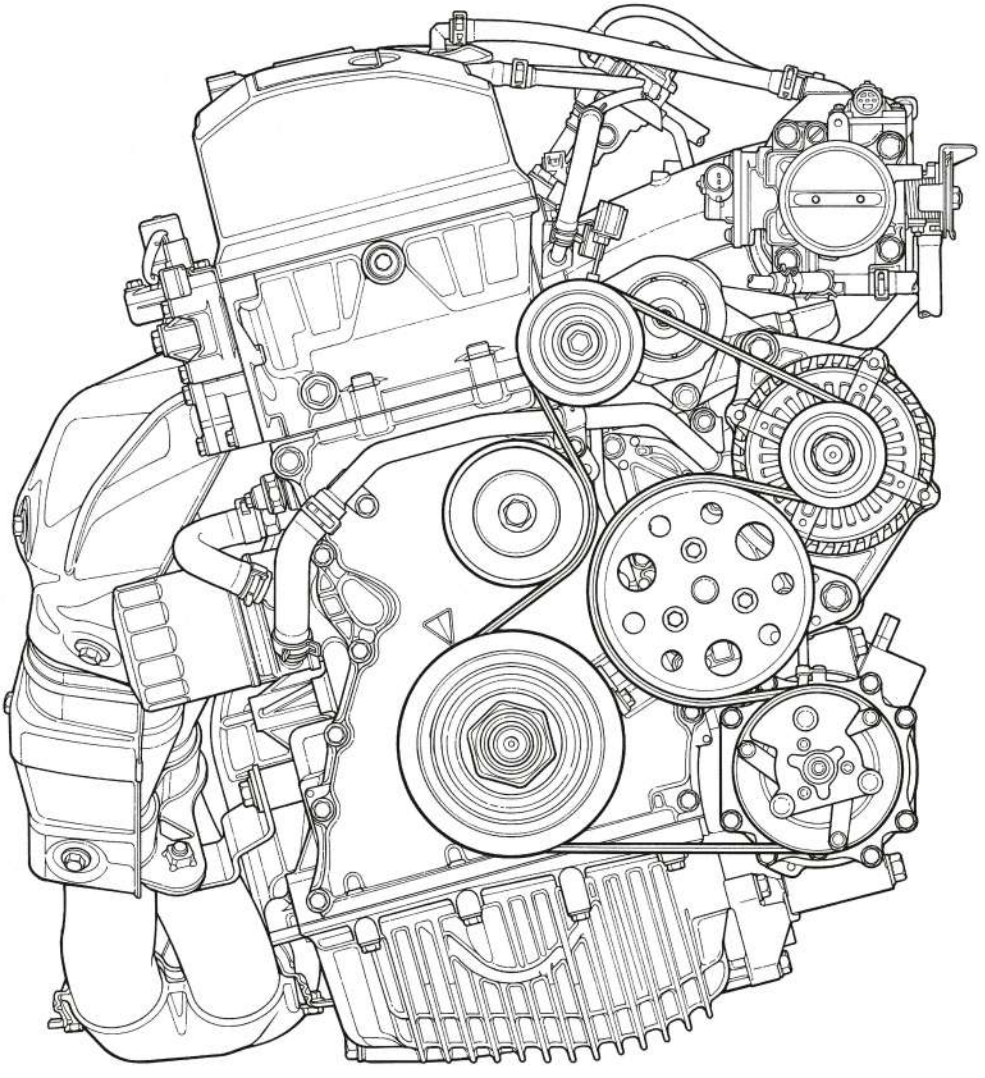


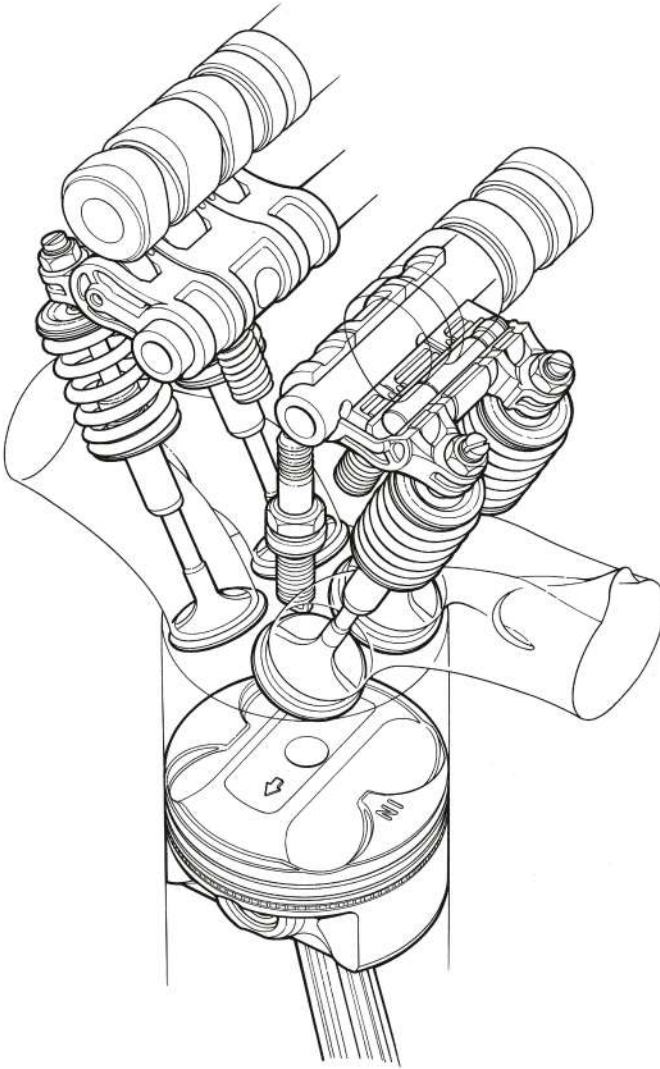


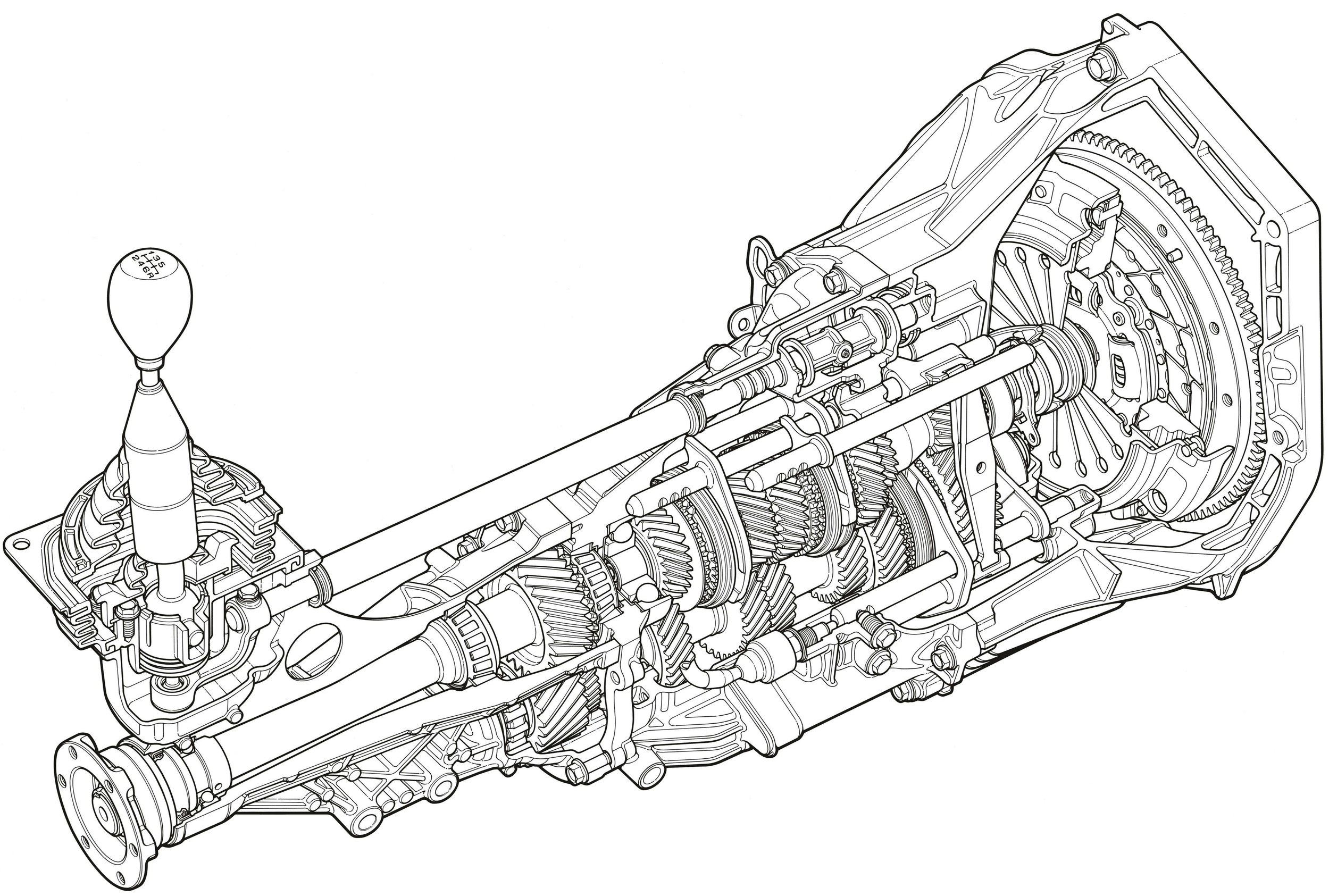


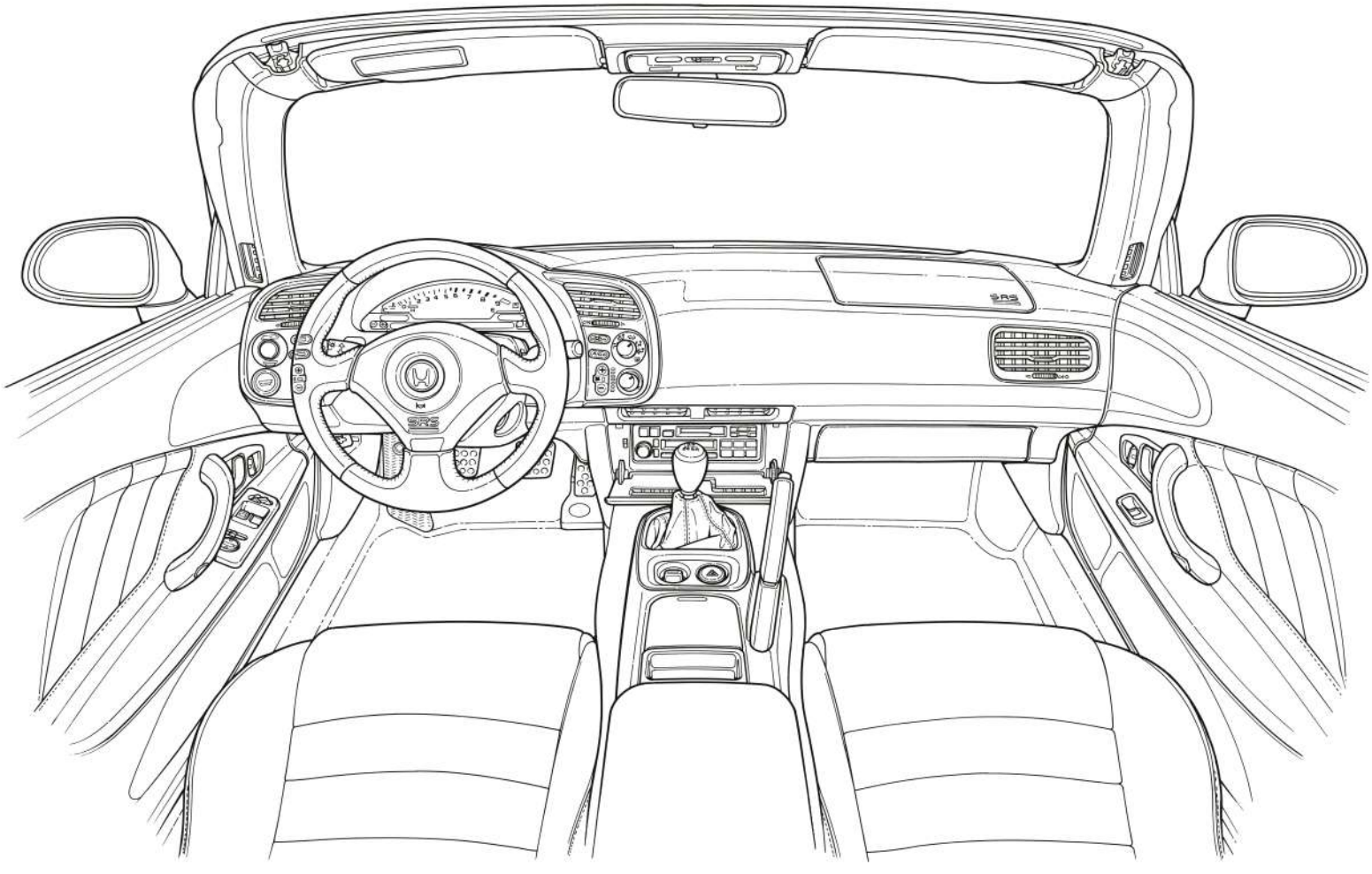


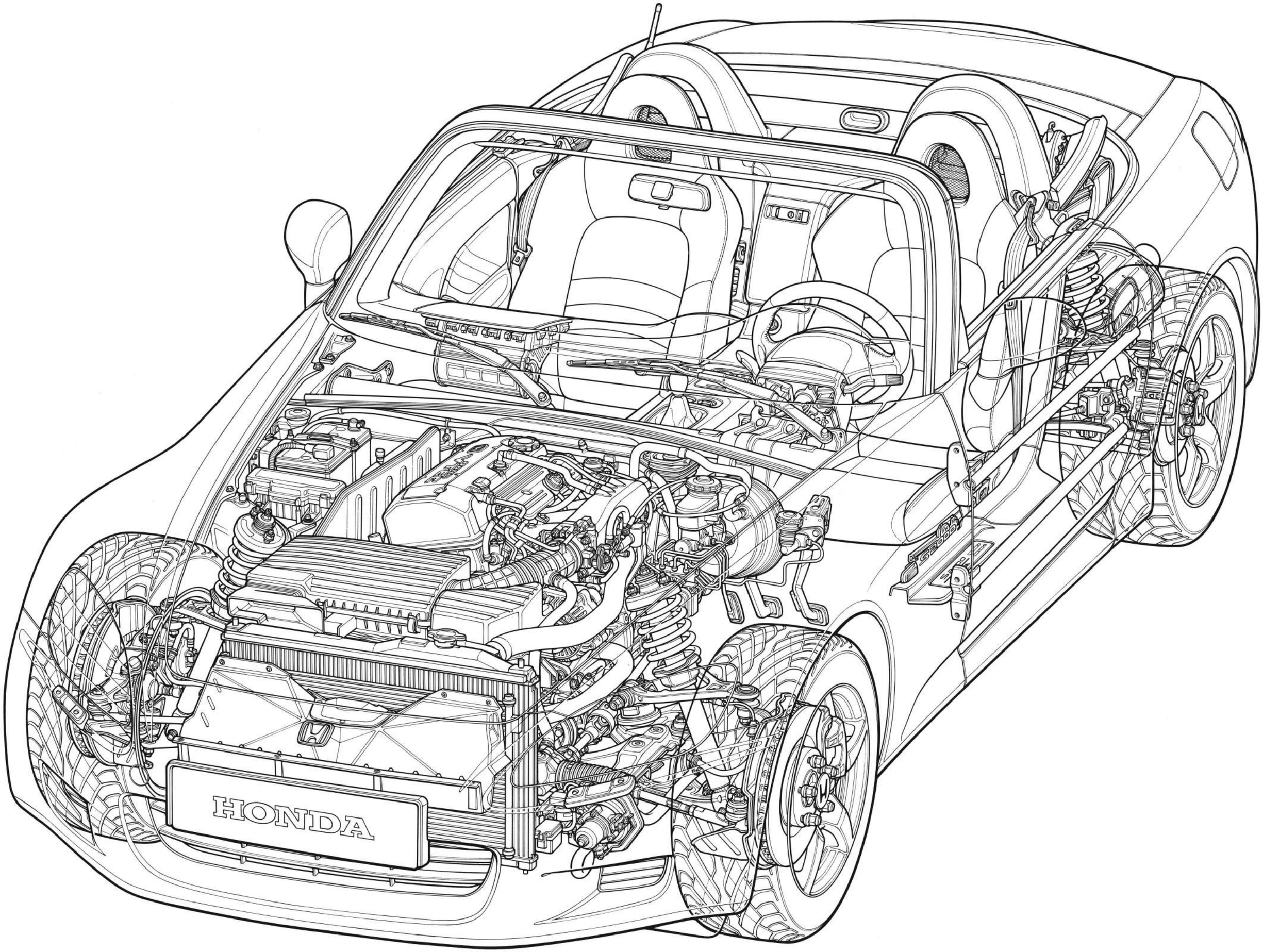







1 3 5
2 4 6 R


SRS
SRS


HONDA


HONDA

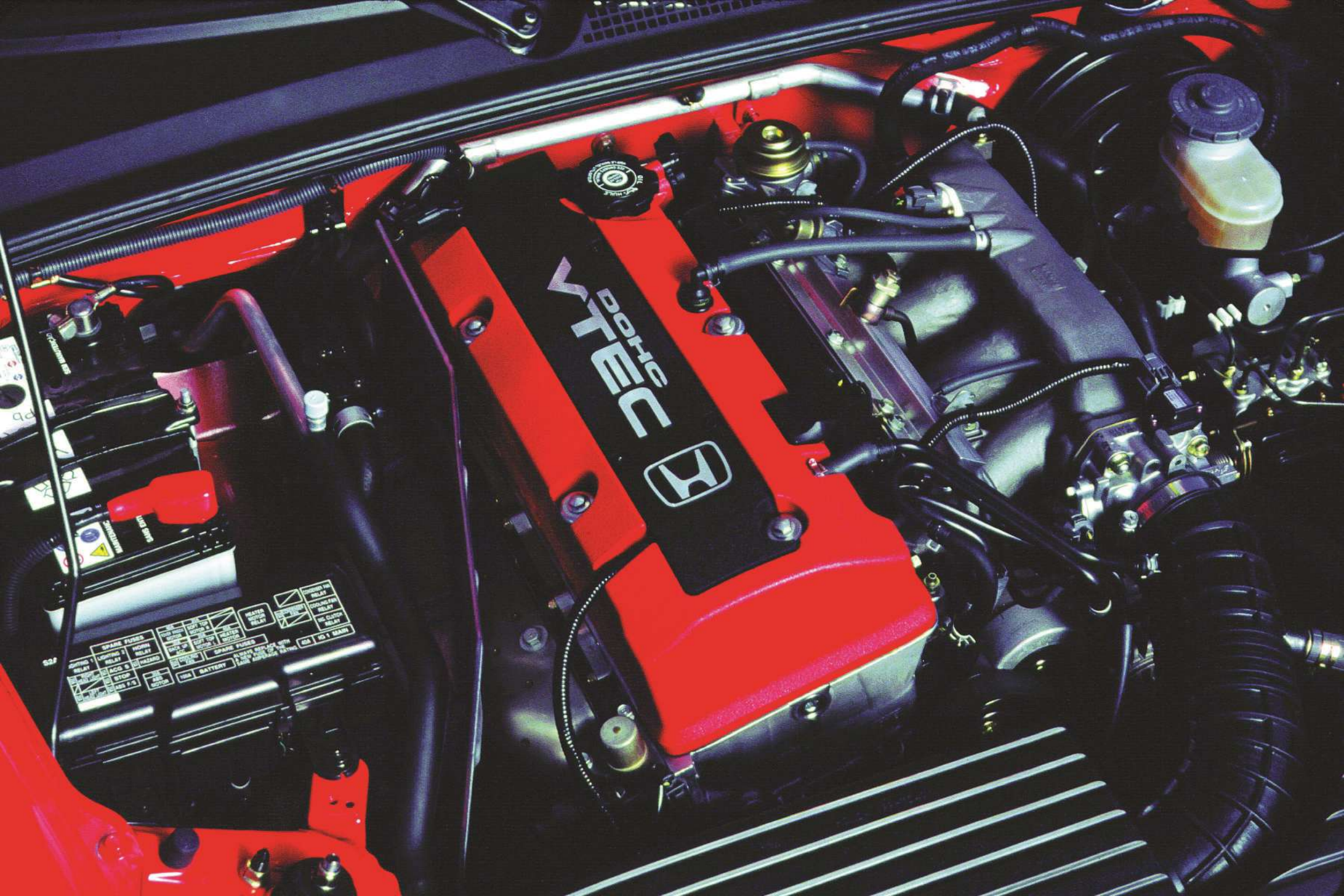

Honda
S2000

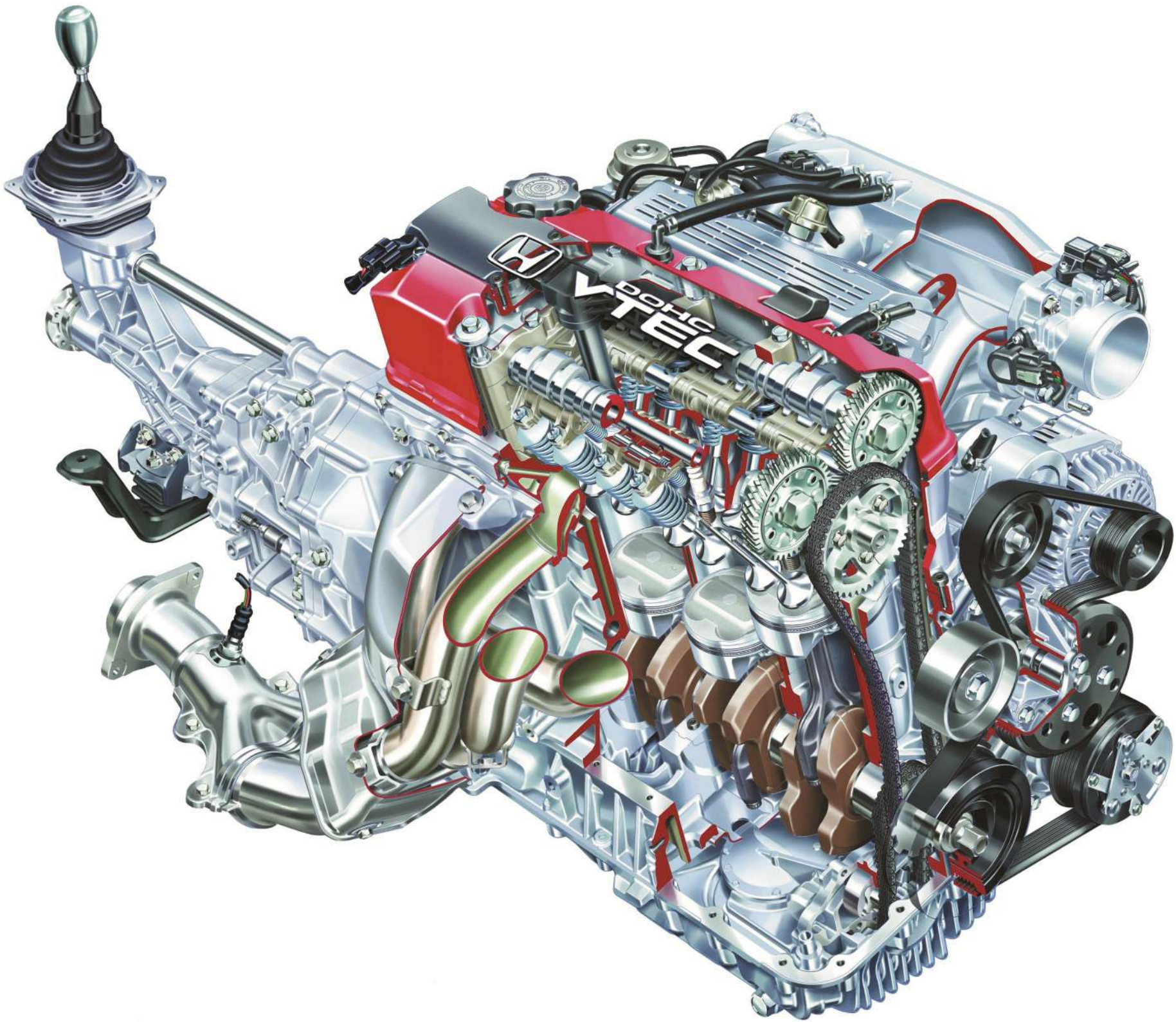

160 LWA 47

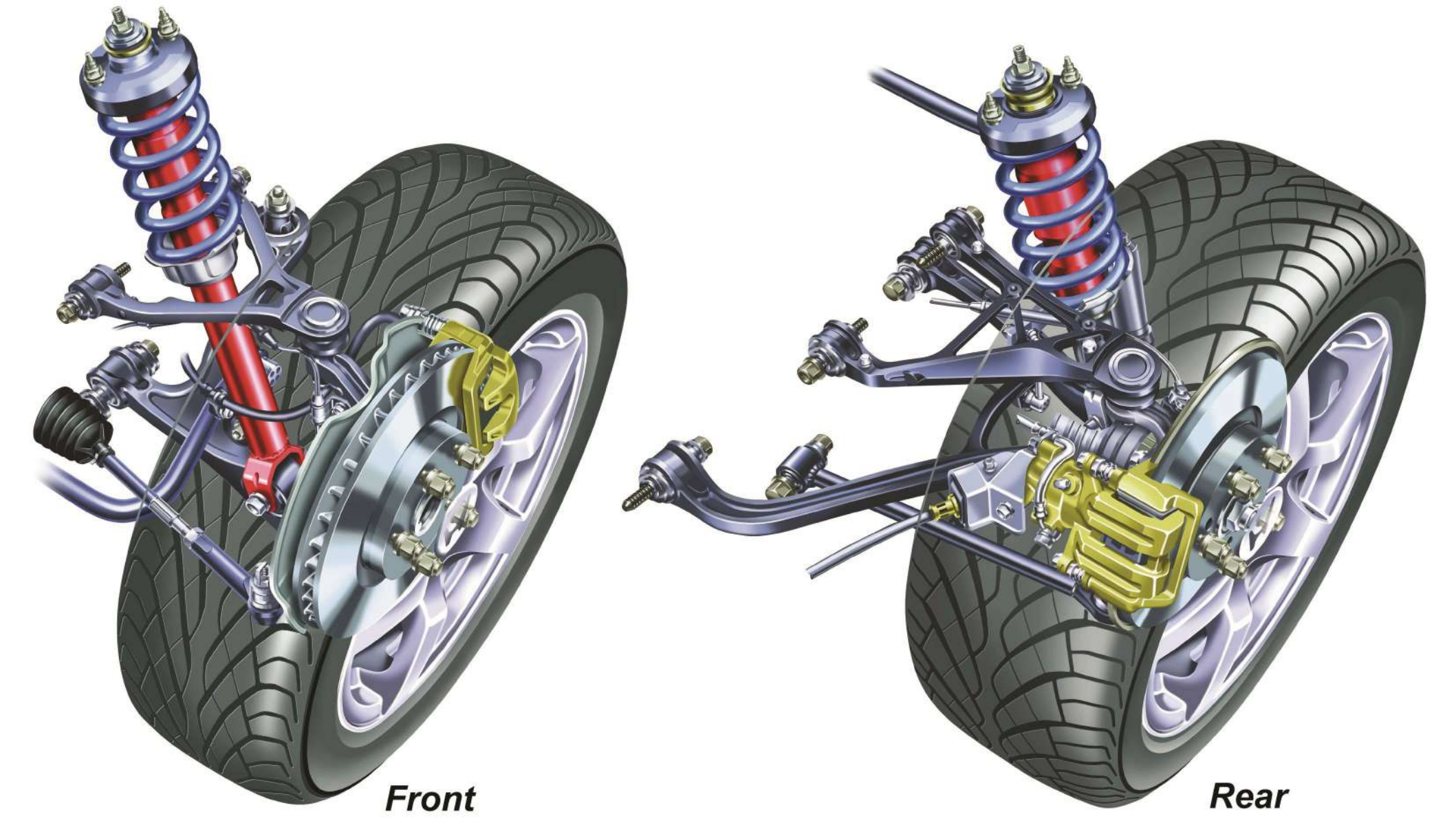

CLOCK CONTROL
MODE PUSH
ENGINE START
OFF
C
H
E
F
A/C

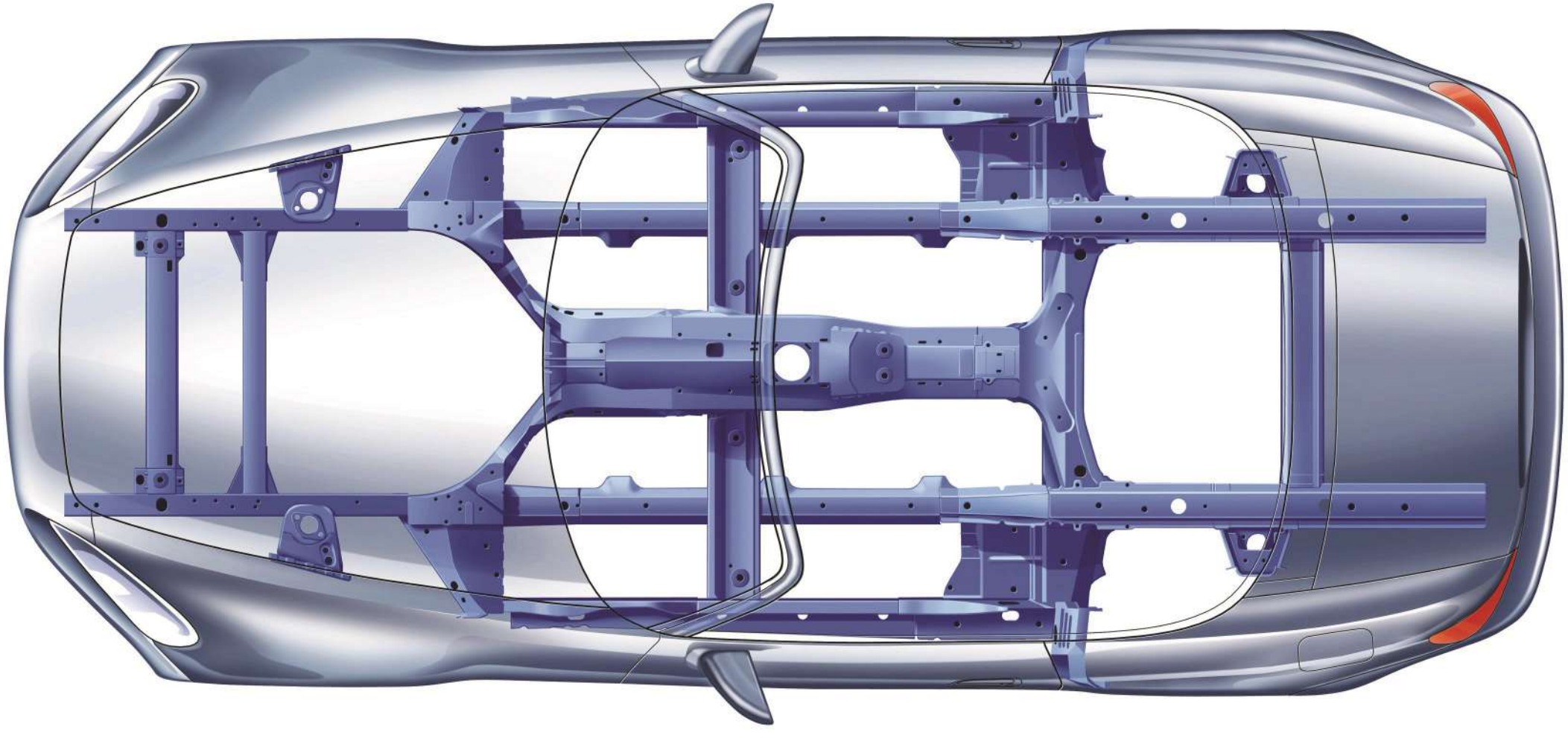

HONDA


HONDA


DOHC
VTEC
SPARE FUSES
SPARE FUSES
BATTERY


DOHC
VTEC


Front
Rear




AUDIO CONTROL
CH
MUTE
MODE PUSH
ENGINE START
VOL
PUSH CANCEL
VSA
A/C
SRS AIRBAG
S 2000
ROOF


MANUFACTURED BY
HONDA MOTOR CO.


HONDA
DOHC
VTEC
A 2174