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BMW Programm 1984

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IAA Frankfurt 1983

50. International
Motor Show
IAA Frankfurt 1983

50. Salon International
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IAA Frankfurt 1983

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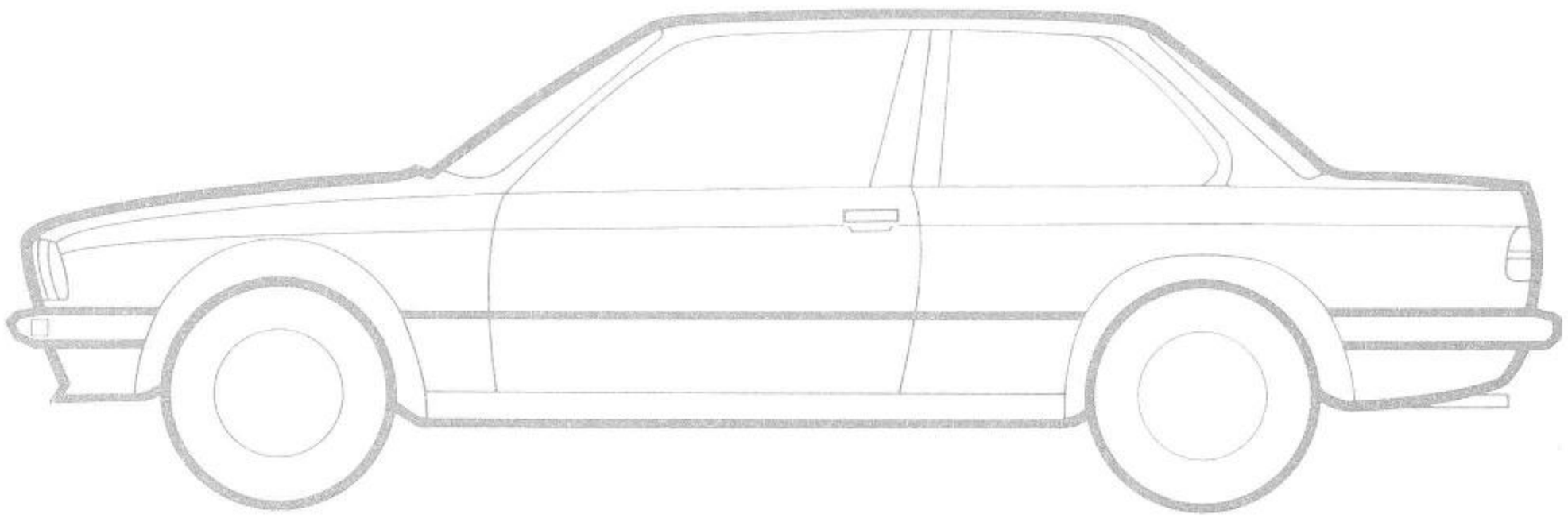
IAA Frankfurt 1983



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BMW Model Year 1984

News at a Glance

50th IAA in Frankfurt, September 1983

3 Series

All the cars of the new 3 Series, that is, models 316, 318i, 320i and 323i will also be available as four-door versions as of model year 1984. The technical data are identical to those of the two-door versions except for the weight: 25 kg more unladen weight and payload.

The power of the 323i has again been increased: 110 kW (150 HP has raised the top speed to 204 km/h and has cut acceleration from 0 to 100 km/h to 9.0 sec.). Response in the direct gear has been improved markedly, namely by 7 percent. Acceleration from 80 to 120 km/h is now 10.3 sec.

The four-speed automatic is optionally available for the six-cylinder models. It increases the unladen weight of the vehicle by about 10 kg, but lowers fuel consumption by more than 8 percent in the 323i (average 8.9 1/100 km) and in the 320i by 9.4 percent (average 8.7 1/100 km).

The BMW 316 (66 kW/90 HP) - like the 518, since both are fitted with the same engine - has received a new Pierburg electronically controlled carburettor, which cuts fuel consumption by a further 5 percent below that of the predecessor models, and which embodies state-of-the-art design with fuel cutoff on the overrun and idling control.

Mileage of the BMW 318i has also been boosted considerably by the L-Jetronic system newly introduced in this model: by up to 5 percent, depending on the transmission system used. Taking into account important criteria such as power, consumption and handling the 318i is thus unsurpassed in its class.

For all the four-cylinder models, that is, the 316, the 318i and the 518, the Energy Control System (fuel consumption indicator) is available as an optional extra.

5 Series

Although already introduced and fairly well known, they had not appeared before at a major car show: the 524 td (turbo-diesel) and the 525e (eta). These two models add much to the 5 Series, for their up-to-date designs can hardly be assessed high enough.

The press has hailed the 524 td as the most powerful and smoothest running diesel in the world. With 85 kW/115 HP it delivers a performance that had been thought impossible from a diesel. It extends the sporty, dynamic i-line of the 5 Series, until 1982 the only models available, to include reliable diesel alternatives, just as the 525e introduces to the Series the principle of optimized efficiency. The performance and smooth running characteristics of the 5 Series models are achieved by the sophisticated level of engineering typical of all BMWs. They not only give driving pleasure, but also provide the related dynamic behaviour and driving safety.

The four-cylinder 518 has been upgraded with an electronically controlled Pierburg carburettor which, as in the 316, boosts mileage by about 5 percent. Here too fuel cutoff on the overrun and idling speed control are provided, with Energy Control (fuel consumption indicator) available as an option.

In the 520i with the BMW four-speed automatic the rear-axle ratio has been reduced to 3.91, which, among other things, improves acceleration by 0.2 sec (0 to 100 km/h in 13.9 sec) and improves mileage by about 10 percent.

7 Series

The innovations in the 7 Series are concentrated in the 745i. As a premiere at the car show the turbocharged BMW flagship is offering the electronic-hydraulically controlled four-speed transmission in combination with Motronic II engine electronics. This system not only controls gear changing automatically, it is also intelligent enough to know whether city driving, mountain driving or brisk acceleration on the motorway is requested. In addition, it offers the driver an extra manually controlled program for individualized driving.

The engine is based on the 3.5 litre six-cylinder power plant with turbocharging and a compression ratio of 8:1. ABS and electronically controlled hydropneumatic level control of the rear axle are standard. Average consumption is 12.2 1/100 km, which is impressively low in view of the performance data: 0 to 100 km/h in 7.9 sec with a top speed of 228 km/h.

6 Series Coupés

A newcomer at the IAA '83 is the M 635 CSi coupé, which, equipped with a refined version of the earlier M1 engine, is now appearing on the market. The engine with two inlet and two exhaust valves per cylinder and two overhead camshafts features digital engine electronics, delivers 210 kW/286 HP and provides its maximum torque of 340 Nm at 4500 rpm. The compression ratio is 10.5:1. The coupé reaches a top speed of 255 km/h and accelerates from 0 to 100 km/h in just 6.4 sec. A 5-speed sport gearbox, sporty chassis tuning, forged light-alloy rims with TRX 220/55 VR 390 tyres and a newly designed front spoiler are all standard.

The BMW 3 Series

BMW AG

The BMW 3 Series

New: now in a 4-door version

BMW 316 BMW 318i	4-cylinder
BMW 320i BMW 323i	6-cylinder

The 3 Series BMW has met the demands of those who want a high technical standard in a high-performance car of the compact class and who regard manoeuvrability and a sporty character as more important than just distinguished appearance. Nevertheless, sporty performance need not conflict with features appreciated in a family car, and design for everyday use need not be at odds with the demand for individuality, for the 3 Series cars are now available not only in the classical 2-door versions but also as elegant 4-door models.

How close the 3 Series comes to the engineering standards of the larger saloons can be seen from the standard equipment of the cars: L-Jetronic, fuel cutoff, Service Interval Indicator, Energy Control and Check Control. Furthermore, ABS and the on-board computer are available as optional extras.

In refining the engine the BMW technicians placed stress on reducing consumption, lowering noise and emission levels and facilitating maintenance and service. Thus, the 4-cylinder 318i and the two 6-cylinder engines were fitted with electronic fuel injection (L-Jetronic), the compression ratio was increased and the entire load change was adapted to these conditions. The 316 was also equipped with the new Pierburg electronic carburettor, which brings about a further increase in mileage.

Gear-changing in the 6-cylinder models has been facilitated by the introduction of a 5-speed gearbox with short-travel synchronisation, while the weight of the gearbox itself has been reduced by compact design. The rear axle has the advantage of low oil temperature and increased installation space for higher transmission ratios.

The chassis: The single-joint front axle was given a new sickle-shaped control arm with a broad base for precise tuning with respect to longitudinal damping and comfort. The slightly positive wheel offset eliminates disturbing forces in the steering system during braking. The 15^{o} sweepback angle of the rear-axle semi-trailing arms, which corresponds to that of the larger model series, helps to reduce frontend dive and ensures stability independent of payload.

The springs and shock absorbers of the rear axle are separate for quick response to road irregularities. The extra space gained has been used to increase the size of the boot.

All of the models are fitted with 14-inch wheels, which permits the use of larger brake discs in front. The fixed calipers of the disc brakes have been replaced by space-saving floating calipers, which, thanks to the smaller quantity of heat generated, can be fitted with non-asbestos brake linings. In the 6-cylinder models low-profile tyres are standard (195/60 HR 14 in the 320i and 195/60 VR 14 in the 323i).

The interior, more attractive and practical than ever before, was designed to correspond to the harmonious lines of the bodywork.

As a standard feature the front seats can be adjusted in height. When the back is tipped forward, the front seat also moves forward automatically, leaving ample room for passengers to climb into the back of the car. Knee room in the rear is more generous than ever. The seat belt latches in the rear are integrated into the seat back.

The harmonious contours are also reflected in the exemplary cockpit design. Instruments include the Service Interval Indicator and in the 6-cylinder models Energy Control and Check Control.

Passenger comfort and driver concentration are ensured by the air-flow regulated heater with fresh-air temperature control of the 7 Series. Heat output and fresh-air delivery are independent of speed and engine revs.

The Individual Models

BMW 316

Body

- Streamlined frontend
- Air dam with spoiler-shaped plastic lip, controlled entry of air for cooling the brakes
- Bonnet recessed on sides with sweepback scoop hinged and projecting in front, with 2 torsion springs and a gas-pressure spring to facilitate opening
- Windscreen wiper shafts and air vent grilles partly covered by an upswept front flap
- Low wedge-shaped continous belt line
- Thick rubber protector strips on side
- Directional indicators in front integrated in the bumper
- Black, ribbed plastic dummy panels for the integrated installation of fog lights (optional) in the air dam
- Side windows nearly flush with the exterior body panels

Interior

- Exemplary instrument panel
- Interior 40 mm longer and 18 mm wider
- Driver and passenger seats with automatic entry mechanism and height adjustment
- Tunnel with ashtray in the back
- Spacious door panels with integrated grips, armrests, storage compartments
- Armrests in the rear in side panels
- Air vents individually controllable, separate side-window defrosters

- Cylindrical fresh-air vents with large vertical and horizontal pivoting range
- Recessed belt latches in rear seat backs
- Interior recessed door-lock lever

Engine

- 1.8 litre inline 4-cylinder
- New Pierburg 4/2 BE electronic carburettor
- Hydraulic engine vibration dampers
- Single-pipe dual-silencer exhaust system
- Power 66kW 90 HP
- Contactless hybrid transistor ignition system
- Temperature-controlled 8-vaned fan with Visco fan clutch

Gearbox/Chassis

- Differential of spheroid cast iron, higher transmission ratio
- 175/70 tyres on 5 J x 14 steel rims
- Sinnle-joint front axle with small wheel offset and brake-diving compensation, stabilisator curved towards rear
- Rear-axle carrier and semi-trailing arms in monococque construction with 15^{o} sweepback angle
- Rear springs and shock absorbers separate
- Safety steering column
- Dual-circuit brake system with front and rear-axle grouping, 10-inch brake booster
- Floating caliper disc brakes in front, self-adjusting drum brakes in back
- 55-litre fuel tank below rear seat
- Steering dampers
- Self-locking filler cap

Electrical System

- Double headlights with stepped reflectors for dipped beam
- Instruments: electronic rev counter,large analogue clock, control lamp array below and control lamps for blinkers and high beam above the round instruments
- Service Interval Indicator (SI)
- Parking light switch integrated in blinker stalk
- Two interior side lights
- Airflow-controlled heater independent of speed and engine revs
- Windscreen-wiper switch with single-stroke switch

The upgraded BMW 318i vs the BMW 316

Engine

- L-Jetronic injection
- Electric fuel pump
- Power 77 kW/105 HP

The upgraded BMW 320i vs the BMW 318i

Interior

- Check Control
- Velour carpet on the floor and rear-window shelf

Engine

- 2-litre 6-cylinder
- L-Jetronic injection with fuel cutoff on the overrun
- Radiator with separate remote expansion tank
- Brake booster with suction jet pump
- Power 92 kW/125 HP
- 9-vaned fan, 420 mm in diameter
- Large reverberation silencer

Gearbox/Chassis

- 5-speed overdrive-type gearbox with synchronised reverse
- 195/60 HR 14 tyres on 5 1/2 J x 14 steel rims (low-profile)
- heavy-duty clutch
- Air-cooled disc brakes in front
- High rear-axle transmission ratio

Electrical System

- Active Check Control, central indicator lamp in instrument array, rev counter with integrated Energy Control (EC)
- Digital clock
- Double fanfare horns
- Boot light

Upgraded BMW 323i vs the BMW 320i

Body

- Rear spoiler

Engine

- 2.3 l inline 6-cylinder
- Dual exhaust system with 2 silencers and 2 tail pipes
- Power 110 kW 150 HP

Gearbox/Chassis

- Heavy-duty rear-axle housing, higher transmission ratio
- Clutch control with over-centre spring to reduce pedal force
- Sporty chassis tuning with rear stabiliser curved backward
- Floating caliper rear disc brakes with auxiliary drum brakes for the handbrake
- Brake lining wear sensor in right rear wheel
- VR low-profile tyres

Electrical System

- Fog lights integrated in front dam, second rear fog light

All models 316 through to 323i are also available as 2-door convertibles (conversion by Baur, Stuttgart).

BMW 315

The BMW 315 with 1573 cc and 55 kW/75 HP will be retained in the 3 Series in its traditional form with the usual equipment.

The BMW 5 Series

BMW 518 Four Cylinders

BMW 520i
BMW 525i
BMW 528i

BMW 524td
Six Cylinders
BMW 525e

With the 5 Series a model line has been created that must be ranked as a new generation of cars. The 5 Series appeals to the active driver who sees the present and future in progressive high-quality technology and craftsmanship in combination with a suitable car size and select equipment. It shows that high performance need not be contrary to economy. The cars of the line are sportier and yet thriftier than ever before.

BMW 518

The basic model is the BMW 518 with a 1.8 litre 4-cylinder engine rated at 66 kW (90HP) for low insurance rates. The initial model offers high-quality engineering, craftsmanship and the driving characteristics of the larger models. New in the 518 is the use of an electronically controlled Pierburg carburettor, which cuts fuel consumption by about 5%, not least of all with the help of fuel cutoff on the overrun and idling control.

BMW 520i

The next largest model, the BMW 520i, unites in its 6-cylinder injection engine with 92 kW (125 HP) economy and outstanding performance (0 to 100 km/h: 11.4 s, top speed: 185 km/h). The wide range of standard equipment, already apparent in the 518, has been extended in the 520i to include power steering, a 5-speed gearbox, consumption display and electronic heater control. In the version with the new 4-speed automatic, the rear axle ratio was reduced to 3.91 which gives an acceleration improvement of 0.2 s (0 to 100 km/h in 13.9 s) and a mileage increase of about 10%.

BMW 525i

To take advantage of insurance classifications the power of the large 6-cylinder engine with electronic injection has remained at 110 kW (150 HP) (0 to 100 km/h: 9.9 s; top speed 197 km/h). The 525i meets high demands for equipment and comfort, suffice it to mention the active Check Control unit in the upholstered part between the sun visors, the driver's seat with height and rake adjustment, axial adjustment of the steering wheel and a fuel display unit (EC = Energy Control), which in conjunction with the standard 5-speed gearbox permits an especially economic style of driving.

BMW 528i

The top model of the 5 Series is the 528i with L-Jetronic injection. With the same extensive interior equipment as the 525i, a chassis specially tuned to the car's power output and a 5-speed gearbox, the BMW 528i appeals to those drivers who expect the performance of a sports car but the comfort and roominess of a luxury saloon (0 to 100 km/h: 8.4 s, top speed 212 km/h).

In the BMW 528i comfort attained through effortless achievement of performance is complemented by fuel consumption that is 15% below that of the predecessor model.

BMW 524 td

The BMW Diesel: A New Chapter in BMW History

In 1973 only four percent of cars and vans in West Germany and West Berlin were diesel powered. By 1982 this portion had risen to over 15 percent. Similar developments took place in other European countries and the USA; between 1973 and 1982 the number of new registrations increased tenfold (including West Germany).

The main reason behind the success of the diesel engine is its proverbial economy. However, this economy was purchased at the expense of a marked reduction in performance as compared to petrol engines of the same capacity.

With the 524 td BMW now makes its appearance on the diesel market. Besides the i-series (injection) and the e-series (eta design) there is thus now a third range, the diesel series. The decision was crucially determined not only by the conditions on today's and tomorrow's car market, but also by the fact that BMW, as a classical engine manufacturer, set itself the task of developing a diesel engine which united the virtues of the diesel design with the most striking BMW qualities: smooth running and high performance. Furthermore, precisely for the BMW diesel it is essential that driving pleasure and sportiness do not run counter to the qualities demanded by the customers' practical considerations and changing market conditions.

Moreover, the BMW 524 td combines the advantages of durability, reliability and high resale value with the dynamic and exclusive image of BMW.

The tried and tested six-cylinder M20 engine, which is used at present in the 3 and 5 Series with a displacement of 2.0 to 2.7 litres was chosen as the point of departure. Turbo-charging and large-bore inlet and exhaust valves ensure the high performance typical of BMW. The refined swirl chamber facilitated increased mileage and low engine noise levels.

With a capacity of 2.4 litres, an output of 85 kW (115 HP) and a maximum torque of 210 Nm at 2400 rpm, the BMW diesel has an unusually high power-to-weight ratio of 0.426 kW per kg and a power to displacement ratio of 34.8 kW per litre.

Thus the 524 td achieves truly outstanding performance. It needs just 12.9 seconds to accelerate from 0 to 100 km/h, and covers a kilometre in 34.3 seconds from a dead start. In fourth gear it climbs from 80 to 120 km/h in 13.7 seconds and reaches a top speed of 180 km/h. And yet the 524 td consumes only 7.1 litres per 100 kilometres (DIN).

Thanks to a 6-cylinder turbo-charge design and an overall vehicle concept specially tailored to diesel operation, it was possible to create a diesel car which in terms of its performance characteristics is the most economic diesel of its class.

The BMW Diesel - a Logical Step

In 1982 BMW produced and sold more than 377,000 cars - a success that began in 1962 with the introduction of the "new series", the BMW 1500, and which continued with the 02 Series and the 3, 5, 6 and 7 Series.

In 1982, the sporty, dynamic i-Series was supplemented by the 525i, the first representative of a completely new range of cars. A third line now makes its debut with the 524 td (turbo diesel).

The demands BMW places on itself and its products explains why the designers were concerned to do more than just get another conventional diesel running. BMW's appearance on the diesel market with the "new class" represents a milestone both for the market and for BMW itself. BMW intends to set new standards by combining the typical BMW qualities of sportiness, craftsmanship and driving comfort with the advantages of the diesel. At the same time BMW is responding to the fact that the share of diesel cars on the national and international markets will continue to increase for a considerable time.

In other words, the BMW diesel must be distinguished by speed, low noise level, exclusiveness and dynamic handling while at the same time exploiting the diesel's potential for economy, durability, low fuel consumption, high resale value and reliability.

BMW's reputation rests on its skill as an engine manufacturer, and this aspect is still emphasized today. BMW intends to live up to this reputation with its move onto the diesel market. All the attributes which have always made BMW a cut above the rest of the market place the BMW diesel in a class of its own.

A sophisticated, high-power turbo-charged six-cylinder engine and an overall vehicle design developed over a long period to meet the special requirements of diesel operation give the lie to the misconception that a diesel cannot be sporty and that diesel and BMW are mutually exclusive terms. Nothing could be further from the truth, as a quick glance at the performance data will show or, better, a short test drive. Experience in building refined six-cylinder engines and freedom from preconceptions were the foundations on which the first BMW diesel range was based.

A BMW diesel will always be a BMW to the core, with economy not being achieved to the detriment of performance. It must be superior in performance to other diesel cars and at the same time must be comparable to petrol engines.

For this reason it was clear that BMW would enter the diesel market with a turbo engine. Thus a wealth of experience in building six-cylinder engines could be combined with state-of-the-art power output by employing turbo-charging. In this way BMW was able to realize its aim of producing a car that in terms of its performance is one of the most economic diesels available today.

The BMW Diesel Design

The decision to build a diesel engine was based on the desire to achieve fuel consumption impossible in a petrol engine and to combine this with high performance, reliability and comfort all in one engine.

In addition, lower noise levels, reduced emissions of pollutants and fumes and better starting from cold were called for.

In designing the engine, those factors had to be taken into account that are caused by variability in fuel quality and by climatic and geographic differences. A further important consideration was to guarantee long-term uniformity of engine performance.

To unite the demand for smooth running with compactness, the engineers took the series of small 6-cylinder engines as their starting point, since these have long since proved their reliability, comfort and enduring performance.

The power-to-weight ratio and power-to-displacement ratio were to be comparable to those of a petrol engine with roughly the same capacity. Since this could only be realized by means of a supercharged engine, the BMW diesel was conceived as a turbo engine from the very outset.

In a turbo-charger the exhaust gases, which are under high pressure, drive a turbine wheel at a speed of 100,000 rpm. A second wheel rotating on the same shaft compresses the in take air and pumps it into the cylinders. This ensures better charging of the cylinders and increased power output, which in turn allows a higher final transmission ratio with lower engine speeds. The design permits the driver to drive at high average speeds without leaving the economical partial load range. On the other hand, even at low engine speeds high torque is available, which drops only marginally at higher revs. This makes it possible to drive smoothly and with little gear changing and allows these advantages to be exploited to the full in combination with the BMW four-speed automatic transmission.

BMW opted for a refined design of the swirl chamber combustion technique. This approach, in which the fuel is injected into a precombustion chamber linked to the combustion chamber itself and is then swirled around with highly compressed air during the compression stroke, offers an attractive combination of low fuel consumption, low emissions and high power output. Combustion is controlled and engine noise is reduced.

The compression ratio was set at 22:1. It was particularly important to achieve optimum efficiency and trouble-free starting while at the same time taking into consideration production aspects and reliability.

The BMW turbo diesel is provided with a quick-start system to shorten the starting delay usual for diesel engines when cold. Even at a temperature of $0^{o}C$ the engine can be started after as little as six to seven seconds. Approx. 10 seconds after the "ready to start" lamp lights up the heater plugs are turned off in order to avoid unnecessary wear on the plugs and battery.

Thermal load on the supercharged engine is low thanks to an elaborate cooling system based on the longitudinal flow principle with a high flow rate and low power consumption, and thanks to efficient cooling of the cylinder head and the piston crowns. Absolute durability, which has been put to the test over millions of kilometres, is guaranteed by the reinforced crankcase and by choosing dimensions and materials for engine components that have been adapted to diesel operation.

Modern design aids, such as the finite element method of calculation and holographic measuring techniques, have been used to determine the optional dimensions of components.

BMW Diesel Engineering

The basis of the turbo diesel engine is the series of tried-and-tested 6-cylinder petrol engines which is used in the 3 and 5 Series with capacities of 2.0 to 2.7 litres marked by high performance, smooth running and reliability. Because of these properties and because of the engines' compact dimensions, the BMW engineers thought them suitable for development into a diesel engine that would marry all these advantages with the economy typical of the diesel design.

The crankcase of grey cast iron with a cylinder bore spacing of 92 mm is very similar to the one used in the petrol engines. A water jacket between the cylinders was considered necessary to avoid heat problems. This results in a cylinder bore of 80 mm.

The crankcase is designed with the joint passing under the middle of the crankshaft in order to provide as much rigidity to the engine as possible, as it has to operate under high pressure. Since a diesel engine requires a greater piston height the crankcase had to be higher as well. The cover plate is reinforced in order to withstand the forces of the cylinder head bolts. Channels for the return of oil from the cylinder head are integrated in the crankcase.

Like that of the petrol engines, the cylinder head has opposing inlet and exhaust guides. The cross-flow principle used brings advantages in terms of valve size and guide design. The valves are arranged parallel to the vertical axis of the cylinders with the combustion chamber on the inlet side.

The water jacket in the cylinder head is so arranged that the coolant can flow freely over the valve land, which is subjected to high thermal load.

The combustion technique was chosen for its high efficiency together with its economy, low emissions and quietness. Using these criteria, the swirl

chamber combustion process was further developed to incorporate optimized combustion chamber geometry. The swirl chamber represents 50 percent of the compressed volume. The injection nozzle is mounted tangentially to the contour of the swirl chamber. This fact, together with the geometry of the injection channel in the swirl chamber insert, leads to a combustion process that is both economical and low in pollution.

The heater plug system is mounted next to the injection channel and thus allows undisturbed swirling for improved combustion at low noise levels.

The volumes of the charge air collector and the timing of the inlet and exhaust valves were optimized; in particular, the closing times of the inlet valves were set to ensure good charging and good cold-starting behaviour.

The outstanding possibilities offered by the exhaust system of the 6-cylinder inline series were taken full advantage of for the operation of the turbo-charger. The exhaust from cylinders one to three and four to six is collected and led separately to the turbine intake. The excellent dynamic properties of the system result in high efficiency.

The exhaust-gas turbo-charger is designed to produce high torque even at low revs, and engine responsiveness as well as economy at high revs. Even at an engine speed of 2200 rpm the unit develops full pressure with the vehicle stationary. Whenever the maximum permissible pressure is exceeded, a safety device lets off pressure by releasing some charge air and thus prevents excessive strain on the engine.

A distributor injection pump was chosen for the injection system because it is small and light. The quantity of fuel injected at full load is increased as a function of charge pressure. The pump also has an injection advance mechanism with a thermostatically controlled device to increase idling speed, which improves running behaviour after a cold start. The pump also has a high potential for further development with the help of electronics.

The water pump in the cooling system was designed to provide maximum throughflow of the coolant while consuming as little power as possible. Constrictions were avoided as far as possible and the coolant is channeled parallel to the axis of the engine to the rear and from there via two ports in the rear end to the cylinder head. From there the coolant flows to the front and guarantees adequate cooling of all areas subjected to high thermal load.

Crankshaft, connecting rods, bearings and pistons have all been adapted for diesel operation. In view of the high pressure, it was decided to use a steel crankshaft with high surface quality, reinforced connecting rods, wide bearing shells and pistons that are cooled by a ring channel. For the top piston ring a double keystone design was used, because it offers excellent reliability both at full load and when low-quality oils are used.

The gear-type oil pump, which is driven from the back of the toothed belt via a secondary shaft, has been upgraded to cope with the increased demand placed on it by piston cooling and oil supply to the turbo-charger. To prevent slippage in the oil pump drive even under extreme conditions, the outer side of the toothed belt has a multiple V profile.

The BMW 524 td: the fastest production diesel in the world

The BMW 524 td is a happy synthesis of dynamic response and reliability, the low consumption typical of a diesel, and uncompromisingly high performance - characteristics formerly thought mutually exclusive. It offers the driver more than just economical and comfortable transportation.

Since diesel engines produce rougher noise than petrol engines, special measures were taken to soundproof the bodywork. Noise-critical places were reworked; thus, for example, in the area of the instrument panel an additional sound absorbing layer was provided. In addition, the junction between engine and clutch housing was stiffened, and the belt cover was acoustically isolated to reduce noise. Thanks to these measures the 524 td comes up to the exemplary standards of the 520i.

Engine mountings and the connections between the chassis and bodywork were strengthened. The chassis itself is the same as that of the 520i and thus offers the 524 td driver the degree of safety and driving pleasure a BMW driver demands.

The rear-axle ratio and the ratios of the individual gears are such as to couple fuel consumption and performance in the best possible way under the normal range of driving conditions.

The optional four-speed automatic combines the strong points of automatic transmissions with those of overdrive-type manual gearboxes. The fourth gear, as in overdrive, is reduced, and the converter bypass clutch that is in operation in this gear removes the slippage normally present in an automatic transmission. Thus, not only is consumption low, but nearly the same performance is attained as with a manual gearbox.

There can be no doubt that the excellent mileage for the performance offered is the hallmark of the 524 td. However, it is the grand total of all

the car's virtues, namely quality, reliability, safety, durability and high resale value, and their harmonious combination which make the 524 td a dynamic BMW car and driving a pleasure.

BMW 525e

BMW eta: a new concept in the pursuit of optimal efficiency

The Greek letter eta is used in engineering as a symbol for efficiency. Efficiency is understood to be the ratio of energy input to energy output. In automotive terms, this boils down to the question "How far will a car run and what performance will it give on the energy obtained from a given amount of fuel? The eta symbol was therefore chosen to signify the new concept because it reflects the underlying philosophy of the design: optimisation of efficiency. A BMW eta car is distinguished by markedly reduced fuel consumption without loss of performance superiority and driving comfort.

In keeping with this philosophy, BMW is introducing a totally new line of products alongside the classical range. Brisk, dynamic handling is complemented by a relaxed driving style. Even in heavy traffic the driver remains above it all.

Such a concept presents itself at a time in which top speed is of declining priority for many as a result of speed limits and increasing traffic density all over the world. Response and flexibility, on the other hand, are becoming more and more important precisely because of the continously increasing traffic density and because driving pleasure and experience need not fall by the wayside under such conditons.

The BMW 525e: the beginning of a new product line

The 525e incorporates the BMW eta design, presented at the BMW Engineering Conference in 1978 and since then used successfully in the USA and Japan, for the first time in a product intended for the European market.

The designation 525e departs from the traditional system of naming models in the 5 Series strictly according to engine displacement. There is good reason for this: The new car does not fall neatly into any category of conventional thinking in terms of displacement. Its 2693 cc power plant offers completely new performance characteristics with high torque at low revs (240 Nm at 3250 rpm) in the interest of the best economy possible. In order to reduce the rated power of the 2-litre engine (the 525e, like the 520i, has a rated output of 92 kW/125 HP) and its large displacement to a common denominator, the model designation "525e" was chosen as being the middle of the road, as it were.

BMW eta: superior performance despite high economy

For the engineer, saving fuel by improving engine efficiency primarily means reducing internal friction and thus power losses within the engine. It is easy to see that such losses are greater at high engine speeds than at low revs. Consequently, the point of departure must be an engine with improved efficiency that operates at lower revs. In other words, the range of engine speeds has to be shifted downward.

It should, however, be recognized that in engines of conventional design low engine speeds go hand in hand with low torque and thus with inadequate tractive power. Displacing the operating range by raising the overall transmission ratio for example, could boost mileage considerably, but always in connection with markedly impaired performance, especially in terms of response. Orientation to top speed by minimising drag also reduces fuel consumption at high speeds, but not at normal road speeds. The demands made on the eta engine could thus be formulated as follows: It should consume substantially less fuel, especially at normal driving speeds, without loss of performance superiority.

Thus, measures are called for that effect an increase in torque at low revs. For this purpose the BMW inline 6-cylinder lent itself especially well, since the operation of an engine at low revs demands extremely smooth running, a virtue of the M 20 (company designation) that experts have always recognized. However, it is necessary to abandon the usual concepts of displacement categories. The departure from engines having a high power-to-weight ratio, that is, a high power output from a small capacity, makes it necessary to exploit displacement as an additional parameter for optimal efficiency. Even when the potentials of the BMW eta concept in the area of fuel saving are placed in relation to displacement-related costs (such as road tax), it is obvious that this re-thinking process is more than justified in economic terms.

Despite large displacement and, at least from the traditional point of view, low rated power, the eta engine is not to be classified with the throttled engines, which have been used chiefly in the US. Other reasons underlay the development of such engines. They were intended to be simple to design and cheap to construct. Thus, the performance advantages of large displacement were not put to use, nor did they serve to save fuel.

So much for the changes in engine characteristics: higher torque at lower engine speeds. This feature, however, can be put to full advantage only in connection with a suitably high rear-axle ratio chosen for good acceleration and response. It is by means of this gear ratio that the engine-operating range is shifted to lower revs. The same speeds and, thanks to the high torque, sometimes even better performances are achieved at markedly lower engine speeds.

In addition, the overall eta concept includes adaptation of the individual vehicle components, the use of digital engine electronics with fuel cutoff on the overrun and lower idling speed, reduced weight and a 5-speed manual gearbox or 4-speed automatic transmission. These are all measures that combine to exploit the optimisation of engine efficiency and to preserve what is indispensable to BMW, namely driving pleasure.

BMW 525e: Another 5-Series BMW

The BMW 525e rounds off the BMW range in general and the 5 Series in particular with an alternative that is distinguished by high economy without forfeiting performance. Its overall design and special engine characteristics constitute an alternative to the other cars of the 5 Series.

At the heart of the eta concept, and thus also of the 525e, is the efficiency-optimised engine. Its most prominent attribute is its high peak torque of 240 Nm, which is available at an engine speed of only 3250 rpm.

In order to realize the desired performance characteristics the displacement (2693 cc) was used as an optimisation parameter. Thus, the tractive power of the 525e is at least equal to that of the 520i at all speeds and in all gears. In this way it is ensured that the fuel saving attained with the eta design is not nullified by frequent use of low gears. This also means tractive power for changing into higher gears earlier and remaining in higher gears when one would normally downshift, for example on hills or against a strong wind.

The be-all and end-all of the eta design: low friction losses and efficient cylinder charging

The prime measures for realizing the eta design are minimisation of friction losses and efficient charging of the cylinders with fuel-air mixture.

The eta concept is based on the fact that friction losses in the engine increase as the square of the engine speed but only linearly with increasing displacement. This explains the low friction of the eta engine. Since the overall lower engine operating range goes hand in hand with a reduction of the top engine speed (5000 rpm), the engine also has a lower valve flutter

speed, which indicates the revs at which the valve tappets no longer follow the contours of the cams and oscillate uncontrollably. Thus, valve springs having a low spring coefficient can be used, resulting in reduced friction between the rocker arm and the cams.

Friction losses were further cut by decreasing the number of camshaft bearings from 7 to 4, again thanks to the lower operating range of the engine. And, for the same reason, the spring force of the piston rings was also diminished, which also reduced friction.

Valve timing was selected in such a way that the inlet valves close early to provide good cylinder charging at low engine speeds. At the same time, the valve overlapping period was shortened. A decisive contribution to the outstanding charging behaviour of the eta engine is the length of the intake tubes, which is responsible for what is known as the dynamic aftercharging effect. The air-fuel column moves in front of the open inlet valves in such a way that an especially large quantity of mixture is "oscillated" into the cylinders. In the eta engine, the goal was to amplify this effect to improve charging, especially at low revs. For this reason especially long intake tubes are used, which with the same diameter are 20 % longer (491 mm) than those of the 520i and which clearly distinguish the eta engine in appearance.

The Compression Ratio

Like the improved efficiency of cylinder filling and the reduction of friction losses, the 525e's compression ratio of 11:1 also contributes toward saving fuel. It represents the optimal figure for super-grade fuel. A further increase would no longer result in an appreciable fuel saving, while the exhaust emission levels would rise. This relatively high compression ratio was made possible by the use of state-of-the-art carburation and ignition systems based on digital electronics.

Digital Engine Electronics

The eta engine marks the entry of second generation digital engine electronics with a supplementary warm-engine control grid, as used since 1983 in the 3.2 and 3.5 litre natural induction engines of the 5 Series. For the 525e it has been extended to include cold-start control for better mileage and easy starting in cold weather.

As in the 520i, fuel cutoff operates down to 1200 rpm, and the idling speed was lowered to 700 rpm (in the warm-engine phase up to a coolant temperature of 45^{o} = about 950 rpm). Despite this, smooth idling is ensured thanks to the short valve overlapping times. In addition, engine speed is maintained constant by a pneumatic idling speed regulator, even in conjunction with the use of an automatic and air conditioning.

Rear-axle ratio

The eta design is necessarily associated with a very high rear-axle ratio, which alone makes it possible to make practical use of the engine design and to realize the displacement of the engine's operating range. In concrete terms this means considerably lower revs at the same vehicle speeds. Thus, the rear-axle ratio of the 525e is 25 % higher than that of the 520i. Nevertheless - and here the features of the eta engine come to the fore - the 525e's acceleration and response are even better: the payoff for raising torque and displacement.

Mileage Advantages

Retaining performance superiority was only one of the demands made on the 525e. The other was low fuel consumption. The overall eta design has enabled the 525e to attain the same mileage figures (DIN) as the smallest BMWs, the 315 and the 318i of the new 3 Series.

Noise Levels

The considerable reduction in engine speed is also reflected in a substantially lower noise level. Comparative measurements with vehicles of conventional engine design based on the ISO drive-by test have revealed a 3.0 dB noise level drop for the automatic and a 2.0 dB drop for the manual version. At the same time, the much quieter interior means greater comfort for driver and passengers alike.

Four-Speed Automatic

The qualities of the eta design are particularly advantageous in combination with the 4-speed automatic, recently introduced in the 6 and 7 Series and, with the 525e, now optionally available in the 5 Series.

This 4-speed automatic transmission unites the virtues of an automatic with those of a manual with overdrive. The positive influence of this automatic on mileage is due to the stepped-down overdrive-type fourth gear and the converter bypass clutch, which reduces slippage losses in fourth gear and is controlled as a function of temperature and gear.

The harmony between the eta concept and the four-speed automatic has resulted in the fact that the differences in performance have become smaller and the consumption of the automatic version has been lowered to match that of its manual counterpart.

Vehicle adaptation

Adaptation of the vehicle to the conditions of the 525e were carried out in the following main areas:

- The gearbox, clutch and drive train are heavy-duty.
- The front disc brakes are ventilated; rear disc brakes are used instead of drum brakes in order to increase brake performance in keeping with overall driving performance of the car.

- The rear-axle suspension has been adapted to the slightly increased weight and the altered weight distribution.
- Both the battery and alternator have higher capacities for sure starting with the lower engine speed range.

The BMW 7 Series

BMW AG

The BMW 7 Series

BMW 728i
BMW 732i
BMW 735i
BMW 745i

The first year in which standard European guidelines (ECE) were applied to the measurement of fuel consumption, the automobile industry promised the West German government a 15 % fuel reduction by 1985. That was in 1979. Today BMW has already more than met that goal with the entire model programm and, indeed, has even surpassed it with the third generation of the 7 Series. (728i: -20.1 %; 735i: - 15.3 % automatic versions - 23 %). This progress was achieved through a number of far-reaching measures:

- Weight reduction of 120 kg
- Aerodynamic improvement of 13 %
- Improvement of engine efficiency
- Improvement of the efficiency of the gearbox and power train

This progress was achieved largely by the consistent application of electronics. With the 7 Series, and particularly with the 745i, BMW have taken the decisive step from mechanics to electronics.

The success of this development is obvious: a higher traffic safety level, reduced pollution, highly increased economy coupled with an even better performance.

The BMWs of the new 7 Series are progressive saloons of the luxury class, incorporating all the useful and feasible innovations that modern technology has to offer.

The result is a synthesis of high performance and economy - formerly two opposing concepts brought together today by the achievements of electronic engineering.

The 7 Series cars from BMW with a tuned chassis, electronic control for engine and transmission, comprehensive information systems and superb dynamic driving characteristics reflect the present state of the art in automotive engineering. A practical comparison clearly shows what this means for the large BMW saloons: the 735iA of today consumes less than the smallest automatic BMW of 1978, the 318 (11.2 as compared to 11.5 l/100 km).

BMW 728i

The 728i, as the basic model of the 7 Series, incorporates all the general product improvements of the third generation, for example the 5-speed overdrive-type gearbox, the option of a 4-speed automatic transmission, and the new semi-trailing arm rear axle with a 13^{o} sweepback angle and positive anti-dive compensation. In combination with auxiliary arms this results in minimal camber and track changes and neutral steering behavior irrespective of the payload. Greater spring travel provides for increased driving comfort. Thanks to this chassis and the tuned front axle, driving pleasure and safety are the salient features of the 7 Series. As for the other models of the 7 Series, the new, exclusive interior is available in three versions.

BMW 732i

From 1984 on, the engine of the 732i will also be available with the Digital Engine Electronics of the second generation, the Motronic II. This will ensure better fuel economy (a further 5 % reduction) - especially in city traffic, during short winter trips and during the warming-up phase - and

lower exhaust emission. The Motronic II computer controls ignition timing and the quantity of injected fuel, taking into account engine temperature, engine speed and accelerator position.

The fuel-air mixture is kept as lean as possible to ensure complete combustion. The standard 732i will be equipped with 205/70 VR 14 tyres on 6.1/2 inch steel rims. The Check Control and Energy Control systems as well as the Service Interval Indicator are also standard on this BMW model.

BMW 735i

The 735i engine has a displacement of 3.5 l and a compression ratio of 10.0 : 1. The Motronic has been extended to include a warming-up control graph lowening the engine speeds for idling and reactivation after automatic fuel cut-off.

Standard equipment on the 7 Series model with the most powerful normal-induction engine includes newly designed 6.1/2-inch light-alloy rims.

A central locking system and an emergency impact switch are also standard on the 735i as well as a heated outside rear-view mirror and door lock on the driver's side.

BMW 745i

Première of the intelligent 4-speed automatic

In the course of further development the latest research findings have been incorporated in the flagship of the BMW fleet, the 745i. The new 1984 model appears in a form that is sure to satisfy every wish for an exclusive automobile and contains all the essential features such as power, comfort, equipment and safety. It would be virtually impossible to embody more modern engineering.

With its new drive unit, the electronically controlled engine and automatic 4-speed transmission, the 745i achieves its remarkable performance on considerably less fuel - namely between 10 an 18 % less than its predecessor. It offers exclusivity as a standard: ABS, electronic level compensation of the rear axle, power steering, light-alloy rims, central locking mechanism, insulated glass, heated mirror and doorlock on the driver's side, heavy duty windscreen washer system and a whole series of other extras at no extra cost.

Of course, the introduction of the electronic-hydraulic 4-speed automatic transmission, the first of its kind in automobile history, is the most prominent event.

In this electronic-hydraulic control system the electronic control unit of the transmission is combined with that of the engine. This automatic system can do more than any other technical solution, more than any conventional automatic, more than any manual gearbox. It makes it possible to realize individual gear-change programmes, taking into account the various gear-change points needed for fast acceleration, driving over mountain passes with a trailer or city driving. Together with the Motronic II of the turbo engine it does away once and for all with prejudices against automatic transmissions. This combination consumes less fuel and adapts to every driving situation and power requirement

conceivable. Apart from the automatically controlled programmes, the driver can manually select another programme that is geared to his individual driving habits, operating conditions and car usage.

A further technical highlight of the BMW 745i is the new engine. The supercharged power unit is no longer based on the 3.2, but rather on the 3.5 litre engine with an effective capacity of 3430 cc. This means an increase in engine displacement of 220 cc and a compression-ratio increase from 7.5 :1 to 8.0 : 1 for improved thermal efficiency. The turbo engine of the BMW 745i is equipped with the Motronic II system.

A charge-air control unit with its own computer regulates the charge-air pressure as a function of the momentary power requirements. In this way, stress on the charger in the partial-load range and the charge-air temperature have been reduced. As a consequence, pinking tendency has been decreased and the engine can be operated with a lean mixture to ensure optimal fuel economy. Together with the increase in displacement and compression the torque curve was raised markedly at low revs so that the engine develops maximum torque at only 2200 rpm.

A special anti-pinking system features two sensors that measure the vibrations of the crankcase. As soon as an increase in vibration due to engine pinking is detected, the anti-pinking system responds by retarding the ignition and, if necessary, reducing the charge pressure. This feature protects the engine, especially if inferior fuel is burned or the engine is run in very hot weather.

Standard electronic equipment on the 745i also includes the Anti-Brake-Locking System (ABS) and the Information Centre with the Service Interval Indicator (SI), Energy Control (EC), Check Control with active display and the on-board computer. The virtues of microelectronics have been consistently applied to the 745i. The reliability of electronic components far surpasses that of any mechanical system.

The performance of the 745i speaks for itself: with 252 HP (185 kW) the car accelerates from 0 to 100 km/h in 7.9 seconds. 1 kilometer with standing start is reached in 28.2 seconds. Top speed is over 228 km/h. At 90 km/h consumption is 8.4 litres, at 120 km/h 10.4 litres and in city driving 16.6 litres.

New Turbo engine with electronic-hydraulic control of the standard four-speed automatic transmission

The aim of reworking the engine and introducing the electronic-hydraulically controlled automatic transmission was to increase economy by further boosting mileage, without, however, sacrificing performance. The measures carried out on the engine resulted not only in reduced consumption and improved response and acceleration, but also in connection with the new automatic transmission in a hitherto unknown standard of safety and comfort.

The essential features of the engine changes are an enlarged displacement from 3.2 to 3.4 l and an increased compression ratio from 7.5:1 to 8:1. The adoption of digital engine electronics, which essentially corresponds to the 3.4 l engine in the induction version, makes it possible to extend the graph control for operation with engaged converter bypass clutch and to make use of the optimal ignition point without any risk of pinking.

Both measures help to reduce fuel consumption. In addition, a marked increase in comfort and safety has been made possible by the "soft", barely perceptible gear changes. Digital engine electronics also assumes further safety functions, such as sensing of the maximum permissible charge air pressure or the maximum permissible coolant temperature. Stored programs prevent the occurrance of critical operating conditions.

For supercharging a new control system for charge-air pressure has been introduced, the foremost advantage of which is improved adaptation of the charge-air pressure to the momentary power requirements.

To reduce thermal load on the engine a spray-oil cooling system for the pistons is employed, this being controlled via a spray nozzle with a pressure valve. The exhaust valves are of a special heat-resistant molybdenum and nickle alloy (Nimonic).

Charge-air pressure control

Charge-air pressure and antipinking control are accomodated in a single control unit. Conventional charge-air pressure regulation by means of an exhaust bypass valve led to undesired charge-air temperatures over broad areas of the control graph with considerable amounts of residual gas in the combustion chambers and an increased pinking tendency. The delayed ignition thus required and the extra enrichment of the fuel mixture diminished the efficiency of the engine.

With the charge-air pressure control system now realized in the BMW 745i it is now possible to adapt the charge-air pressure to actual needs as dictated by the operating condition of the engine.

By precisely setting the required charge-air pressure at any given moment, the charge-air temperature drops by up to 55°C in front of the intercooler and the turbocharger speed is reduced by more than 30,000 rpm. The resulting cooler air in the cylinders permits operation with more efficient ignition points and leaner mixtures.

The optimal charge-air pressures are stored in a graph in the control unit. This unit sends pulses to a solenoid valve, which corrects the position of the exhaust bypass valve until the programmed charge-air pressure has been achieved. The response of the BMW 745i during acceleration, unusually good for a turbo engine, is achieved by keeping the bypass valve closed until the graph-controlled charge-air pressure has been reached.

Antipinking control

In designing the control graph for ignition control, technical tolerances in sealing and in the ignition system require a good margin between the operating condition of the engine and the pinking threshold. With the BMW antipinking control system it has been possible to minimize this margin for a graph design that favors high efficiency.

Vibrations in the crankcase caused by combustion pressure are monitored by two sensors and are then evaluated by the control unit. Both the magnitude and the frequency of pinking are taken into consideration.

In the case of slight, infrequent pinking only the ignition point is retarded in steps. If pinking is pronounced and frequent, the charge-air pressure is also reduced, the charge pressure control being bypassed.

As soon as no more pinking occurs, the setpoint operating condition, as calculated from the control graph, is restored.

Power and torque

Despite its lower revs, the new BMW 745i reaches the same power and torque levels as its predecessor, so that the changes go towards cutting fuel consumption and improving response. The peak power output of 185 kW (252 HP) is now reached at only 4900 rpm instead of at the previous 5200 rpm. The maximum torque of 380 Nm is available at 2200 rpm (formerly at 2600 rpm).

With the realization of the engine changes described above and the introduction of the four-speed automatic transmission mileage on the road has been boosted by 10 to 18 percent. Even under extreme climatic conditions and when burning fuel of less than optimal quality the engine is protected from pinking damage. Furthermore, thermal load has been reduced by the piston cooling system, by a beefier water pump and by thermally insulating the turbine wheel of the exhaust-gas turbocharger.

Electronic-Hydraulic Transmission Control in Conjunction with Engine Electronics

In the BMW 745i engine electronics (Motronic) has for the first time been combined with transmission electronics. The result is a sophisticated interplay between the engine and the transmission that delivers the right engine power and driving performance with remarkable economy. The possibility of alternative transmission programs was made possible by electronics:

- o The economy program: It makes it possible to drive in all speed ranges with minimum consumption coupled with optimal comfort.

- o The performance program: It enables the driver to draw on the full performance of the engine and drive train, that is, to accelerate as quickly as desired for a brisk style of driving.

- o The manual gear-change program: It permits the selection of individual gears as desired. In difficult situations, especially in winter, unwanted gear changing can thus be avoided.

Converter bypass clutch

In conventional automatic transmissions converter slip leads to power losses and increased consumption of 5 to 9 percent. In the BMW 745i a converter clutch bypasses the hydraulic torque converter in third and fourth gears from a certain speed on. The electronic control then finds the optimal point for activating the bypass clutch in the selected program. The entire process is imperceptible to the occupants of the car. To achieve all this, the system processes a barrage of information: engine speed, air intake rate, butterfly valve position, kick-down, transmission speed, selected program, selected gear and oil temperature.

Ignition point adjustment during gear changing

An ignition point adjustment to reduce torque during gear-change operations enhances comfort and reduces wear. Within a few milliseconds the ignition timing is retarded to throttle torque during the gear-change operation and then returns to the setpoint value just as quickly. Apart from the ease of gear shifting that this affords the driver, the gear-changing time is also shortened by 30 to 40 milliseconds. In addition, this control system provides still better transmission of power, and the transmission itself can be subjected to greater power loads.

Hydraulic modulation pressure for engagement of the clutch in the transmission is a significant factor for gear-changing comfort. For every specific engine output or vehicle speed there is an associated clutch pressure curve. This pressure must be adapted with extreme care and precision to the momentary operating conditions. BMW regulates the valves of the hydraulic system electronically in accordance with the stored graph. Never before has it been possible for an automobile transmission to adapt to operating conditons as exquisitely as is now possible with the help of multiple stored data curves.

The common misconception that electronics is unreliable can certainly no longer be applied to modern systems. Intelligent failsafe circuits keep a running check on the operating state and actuate emergency back-up programs when needed so as to maintain absolute reliability of the car. In the future this will even lead so far that the driver, aside from receiving a display indication of the failure, will not notice any change in operation whatever. In the BMW 745i the number of selectable programs is reduced to one in the case of a system failure, this being indicated to the driver.

Equipment

The 745i has been consistently tailored to the demands of drivers of this car class. This applies not only to the high standard of comfort, but equally to all aspects of safety.

This has been realized through the use of high-quality materials in the interior, by a practical scope of standard and optional equipment and, not least of all, by the performance of the engine and chassis.

As soon as the ignition is switched on the driver is informed by the Active Check Control whether all components essential for operational reliability are in functional order. The Service Interval Indicator displays the mileage remaining before the next service inspection is due.

Thanks to the multiple adjustments of the seats and the axial adjustment of the leather-covered steering wheel the driver and passengers are sure to find the best sitting position for optimal safety and comfort. Seat adjustment is further facilitated by the optional electric seat adjusting system, available both for the driver's and for the passenger's seat. Even the height of the headrest can be changed by means of an electric drive.

An even bigger step towards safety and comfort is possible with the electric adjustment system for the driver's seat with memory. By storing up to three individual seat positions, including headrest height, the system offers an added convenience when a new driver takes the wheel, and, indeed, upgrades safety by ensuring the safest seat position at all times. Furthermore, it is possible to prevent fatigue on long trips and maintain driver alertness with a minimum of adjustment effort.

Efficient air conditioning, low interior noise level, which has been further cut by the use of special stiffening between the engine and the transmission, and easy, trouble-free operation of the car have all contributed towards the well-being of the occupants.

ABS, part of the standard equipment, electronic level control for the rear axle, the on-board computer, the additional intensive windscreen washer system, the brown-tinted insulated glass and the heated driver's mirror are all features which, together with the high-performance chassis, provide an unparalleled standard of active safety.

The central locking mechanism now includes an extra security feature that prevents the doors from being unlocked except via the lock on the driver's side. By turning the key a bit further in this master lock the central locking mechanism can be blocked. Unlocking of the driver's door is then mechanically blocked. This effectively prevents the lock plungers or even the inside door levers from being lifted with a wire loop, for example.

An impact switch integrated in the central locking system ensures that in the event of an accident the doors can be opened from outside, even if they are locked.

In addition to this comprehensive scope of equipment BMW offers a large range of useful optional equipment and accessories permitting the customer to compose his individual BMW.

The BMW 6 Series

The BMW 6 Series

The Coupés

BMW 628 CSi
BMW 635 CSi
BMW M 635 CSi

Concentration on the essential, namely further improvement in function, was the goal in the further development of the 6 Series of coupés. The series represents a technology that permits great distances to be covered without excess demand on the driver, passengers or the car itself. Easy-to-control braking, precise, responsive steering, effortless overtaking and superb road holding keep energy costs down. Passengers are spoiled by the high standard of comfort, which includes quietness, pleasant air conditioning and a smooth ride. The car itself saves energy during acceleration and braking thanks to its low weight, and at high speeds thanks to its streamlined design.

The BMW coupés offer an unusually broad range of modern automobile engineering:

- Double-jointed spring strut front axle, a BMW contribution to active driving safety
- 13^{o} rear axle with auxiliary trailing arms to optimise comfort and driving characteristics
- ABS Anti-Brake Locking System, standard in the 635
- Hydraulic brake booster, diagonal grouping, floating caliper disc brakes
- 5-speed gearbox
- Digital engine electronics (Motronic) of the second generation in the 635 CSi
- Fuel cutoff on the overrun down to 1000 rpm
- Idling speed drop to 750 rpm

- SI, Service Interval Indicator, the first use-dependent service display system
- EC, Energy Control, the precise fuel-consumption display
- Active Check Control for automatic monitoring of functions
- On-board computer, an information system at the driver's beck and call
- Electronically controlled automatic temperature unit for the heater
- Stepped reflectors for the low beam to ensure intense illumination of the road
- TRX-super low-profile tyres on forged light-alloy rims as an optional extra.

Engine, Gearbox and Chassis

Both the increase in compression to 10:1 (635 CSi) and the use of digital engine electronics (Motronic) serve the goal of achieving the best possible use of energy. The second-generation Motronic with an extra mixture control grid permits fuel cutoff while coasting and idling speed reduction for strikingly low consumption. Even more economic,although not at the same high performance level, is the 628 CSi with the 2.8 l engine. The 5-speed gearbox has certainly done its share in reducing consumption.

Besides the engine, it is especially the chassis that imparts to the BMW coupés their distinguishing features, namely driving safety and driving comfort. The pleasing agility of the cars combined with the necessary precision has been further refined. The reason is the BMW patented principle of the double-joint front axle with slanted spring struts and a small positive wheel offset. With outstanding straight running and exacting precision, tracking is excellent, even on different road surfaces. Large floating caliper disc brakes laid out diagonally provide for optimal deceleration. The ABS system is standard on the 635 CSi and optional on the other models.

The rear axle features a trailing arm sweepback angle of 13^{o}. In conjunction with supplementary trailing arms this minimises changes in camber and track and guarantees neutral steering behaviour independent of the payload. Increased spring travel enhances driving comfort. The result: driving pleasure and driving safety will remain the hallmark of the 6 Series coupés.

With mileage values of 10.6 (635) and 10.0 l/100 km (628) (ECE average), the BMW coupés fall into the range of economic mid-class saloons, while their performance is even equal to that of thoroughbred sports cars. The magic sports car figure, 1 km in 30 s from a dead start, is already achieved by the 2.8 l coupé (30.1 s). Its top speed is 212 km/h. The BMW 635 CSi is unequalled, especially when you consider its performance as a function of engine and car size: (0 to 100 km/h: 7.4 s, 1 km 28.0 s, top speed 229 km/h).

Première at the 1983 IAA: BMW M 635 CSi

The 50th IAA experienced the première of the BMW M 635 CSi. The "M" in the model designation stands for motor sports. That also has a deeper meaning, since the car's power plant originated on the drawing boards of the same engineers that developed the BMW Formula 1 engine: Paul Rosche, technical head of BMW Motorsport GmbH, and his team.

With the M 635 CSi, to be released on the market in spring 1984, BMW is supplementing the 745i saloon with a second equally powerful, top-of-the line model with the accent on sportiness. Where the power curve of the one is characterised by high torque over a wide range of engine speeds, the other is distinguished by the racing-tested, spontaneous generation of power of the inline 6-cylinder with a 4-valve cylinder head.

This high-performance engine, which has proved its mettle both in racing and in the road version of the BMW M 1, is the heart of the M coupé and at the same time the essential difference of this model to the 635 CSi. With it BMW intends to demonstrate in the market segment of the "dream coupé" that performance superiority is not a question of cylinder number.

The M 635 CSi is many things all rolled into one without being a compromise: an elegant, classical coupé combined with an intriguing extra margin of performance and pure driving pleasure.

The distinction of the M coupé from the outwardly nearly identical 635 CSi is facilitated by its lower front spoiler which extends farther forward, specially forged rims fitted with Michelin TRX 220/55 VR 390 tyres and the "M" insignia with BMW motor sports colours on the front and back. For the rest, a new heavy-duty 5-speed sports gearbox (the car was not fitted with overdrive or an automatic transmission in order to do justice to the character of the exclusive high-performance coupé), special chassis tuning, reinforced and enlarged disc brakes in front and an M-style leather steering wheel accentuate the car's performance and sportiness.

The essence of the M 635 CSi design is the modified M 1 engine. Its technical data: inline 6-cylinder engine (installed at a 30^{o} angle owing to the flat front part), light-alloy cylinder head with two inlet and two exhaust valves per cylinder and two overhead camshafts, central spark plugs, 3453 cc displacement, 210 kW (286 HP) at 6500 rpm, maximum torque 340 Nm at 4500 rpm. The 9 HP power increase as compared to the M 1 road version was achieved through the new design of the entire induction and exhaust systems together with the use of digital engine electronics. The engine's power-to-displacement ratio is 61 kW/l, and its torque to displacement ratio is 98 Nm/l. It accelerates from 0 to 100 km/h in 6.4 seconds and has a top speed of 255 km/h.


BMW AG

BMW Progress Exemplified by Electronics

In order to adapt to the traffic situation of tomorrow cars will depend on electrical and electronic systems even more than today. BMW has always been a pioneer in this field. Electronic fuel injection, digital engine electronics, Check Control and the on-board computer are just a few examples.

The 3, 5, 6 and 7 Series models incorporate a host of new electronic systems:

- Service Interval Indicator (SI)
- Energy Control (EC), the fuel-consumption indicator
- Active Check Control system
- Electronic heater control
- Modified electronic fuel injection
- Anti-Brake-Lock System (ABS)
- On-board computer
- Electronic rev counter
- Electronic transmission control and Motronic

The BMW Service Interval Indicator
Up to 40% longer inspection intervals

The BMW Service Interval Indicator has proved to be a resounding success. As up-to-date polling by Customer Service has shown, inspection intervals have been extended substantially since the introduction of the system in the new 5 Series in July 1981. Here are some of the results in detail:

The interval between oil changes has been prolonged from 7500 km to 10,500 km on average, i.e. by about 34 %. The inspection interval has been lengthened from 15,000 km to 21,000 km, corresponding to an increase of about 40 %. Furthermore, the run-in check is no longer carried out after

1000, but after 2000 km - and even then the scope of work has been reduced.

These results were even attained during the winter months, despite greater engine wear, for example due to cold starting. In the yearly average, therefore, a further increase of the service interval is expected.

The use of conventional instruments, such as an odometer or running-time meter, to determine inspection intervals fails to take into consideration the actual strain put on the vehicle. This usually means that the service inspection is carried out sooner than necessary and that components are replaced which could have remained in use considerably longer, since they were not subjected to as much wear as anticipated.

The Service Interval Indicator is an electronically controlled load- and use-dependent system. It replaces the usual generalised intervals by individual ones. In this way, the driver can determine the intervals himself by the way he drives instead of adhering to the rigid periods prescribed so far - oil change every 7,500 km, service inspection every 15,000 km.

The parameters engine speed, engine temperature and distance covered are mathematically processed to arrive at the "equivalent distance covered". This mathematical processing is the result of protracted experiments and gives precise information on the actual wear of the car. The longer the vehicle is used, the closer the calculated value approaches that which determines the time of the next inspection.
Customer service then goes over the car with a fine-tooth comb - engine, brakes, steering, heater, bodywork, in fact everything that must be checked in an inspection to guarantee safety, reliability and a high resale value.

The Service Interval Indicator was introduced in the 5 Series models when production began in July 1981, then in September in the 7 Series and since May 1982 in the 6 Series coupé models and since November 1982 in the new 3 series. The system meets economic demands placed on the car today. The

customer himself determines the maintenance costs of his car by the way he drives and by the purpose for which he uses the vehicle.

Energy Control, the Fuel Consumption Indicator

The EC is a precise display unit, which will eventually be standard equipment in all BMWs. In this way, drivers will become more energy conscious and will contribute towards reducing fuel consumption.

The system processes information on vehicle speed and fuel supply to the engine. The latter is precisely obtained by measuring the opening times of the injection valves. These data are then processed and the momentary fuel consumption is displayed in litres per 100 km.

Active Check Control System
(Check Control II)

As early as 1976 BMW introduced an information system in the 6 Series coupé, Check Control I, which informed the driver as to the condition of important vehicle components even before he set off. The further development of this system pursued the following goals:

- Enhancement of reliability and safety by the automatic display of important functions and fluid levels.
- Use of self-diagnosis of electronic systems in displaying information so that the driver is not distracted by a flood of details.

In the BMW Check Control system employed so far it was possible to check various functions before driving off by pressing a button. Thus, it was essentially a passive system. By contrast, the new Check Control II keeps a constant watch on all functions and actively displays the following trouble spots:

- Tail lights
- Number plate light
- Brake lights
- Dipped beam
- Coolant level
- Windscreen washer reservoir level
- engine oil level, statically and dynamically.

Special mention should be made of the dynamic oil level check. The new system not only checks the oil before the car is put in motion, but also monitors the level while the vehicle and engine are in operation If the level reaches the minimum mark, the driver is informed immediately.

All in all, the new system offers advantages that markedly increase active safety.

- Active display
- Concise information
- Extended range of functions.

Electronic Heater Temperature Control

The 5 Series includes electronic heater control as part of the standard equipment with the following advantages:

- Heater temperature is largely independent of engine and vehicle speed.
- The desired interior temperature is maintained constant.
- Initial heating, for example after starting, takes place automatically with a higher heater output so that re-adjustment of the temperature setting is no longer necessary.

The electronic control system compares the actual temperature with the desired temperature by means of a temperature sensor and a second sensor, which measures the temperature of the hot air emerging from the heater.

If the two valves do not agree, the heater valve is adjusted electromagnetically.

This electronic control system is activated via a temperature rotary switch calibrated between 16^{o} and 32^{o} C.

For the rest, the heated air is distributed in the interior in accordance with the proven BMW concept: "Keep a cool head and warm feet".

Electronic Fuel Injection

All the engines as of the 318i with the exception of the 518 have been given a new electronic injection system.

A special feature is fuel cutoff above 1200 rpm. This alone cuts fuel consumption by 3 to 5 %.

All of the engines are fitted with contactless transistor ignition systems in hybrid design.

Anti-Brake-Locking System (ABS)

Until now ABS has been reserved for the larger cars. By making ABS optionally available from the 320i onwards, BMW has introduced this system, so important for active safety, in the upper mid-class as well.

How ABS works:

- The speed of rotation of each wheel is relayed to a processor. If a wheel is about to lock its speed drops sharply.
- The processor transmits this information to a hydraulic unit in the form of electrical pulses. This unit consists of electromagnetically controlled valves for each of the wheel brakes. If one of the wheels is in danger of locking, the brake pressure to that wheel is reduced and the wheel turns more easily.

- The wheel then increases its speed of rotation. This too is monitored by the sensor, and the processor relays the signal to the hydraulic unit.

The driver can brake in a curve or even steer around an obstacle, and the car remains manoeuvrable even if the brakes are applied with full force. The processor always brakes in the optimum range with 10 to 30 % slippage of the wheels. This feat cannot be matched by any driver.

ABS is intended for emergencies. It can react in the best possible way to a given situation and the prevailing road conditions but cannot surmount the physical limits.

On-board Computer

The on-board computer is available as an optional extra in the models with electronic fuel injection. The unit serves the interests of

safety
economy
comfort.

It represents an extra display system, apart from the classical instrumentation with rev counter and speedometer, which distinguishes top BMW cars.

Safety functions:

- Sensing of outside temperature, automatic gong and LED warning display at temperatures below $+3^{o}$ C (danger of black ice) (TEMP)
- Driving range with the fuel supply in kilometres on the basis of average consumption (RANGE)
- Anti-theft feature by means of a keyed-in code (CODE) with fuel-supply cutoff and acoustic warning.

Economic functions:

- Possibility to specify a speed limit, whereby a warning signal is given whenever that limit is exceeded (SPEED)
- Average consumption. Possibility to specify fuel consumption with warning signal if that value is exceeded (MILEAGE).

Comfort functions:

- Display of distance to specified destination (DIST).
- Predicted arrival time based on the distance and the last calculated average speed (ARR)
- Average speed since setting off (SPEED)
- Possibility to specify distance to next exit, service station or rest; gong and LED warning (EXIT) are given in time.
- Basic display with time
- Stopwatch with non-reset stop/start function (START/STOP)
- Timer with gong signal (TIME)
- Constant monitoring and display of any desired function (LOCK)

Electronic Speedometer

Unlike conventional mechanically driven speedometers, the electronic speedometer operates with electrical pulses emitted by a sensor in the rear axle in synchronisation with the speed of rotation of the driveshaft.

The pulse frequency is transmitted electrically to a moving-coil instrument and is then displayed in analogue form by the speedometer needle. Distance covered is measured by means of a roller counter that drives a 2-chamber stepper motor.

Electronic speedometers are not only more accurate but are also more reliable and easy to service. Furthermore, without the speedometer cable, which is subject to mechanical failure, they produce absolutely no noise. As opposed to conventional speedometers, electronic speedometers depend only on tyre size and not on the rear-axle ratio.

BMW is the only manufacturer that equips its upper midclass cars with electronic speedometers as standard items.

Electronic transmission control for the first time in the BMW 745i

The prime development goal of reducing consumption made it necessary not only to reduce transmission losses and optimise transmission ratios, but also to give consideration to transmission control. This should allow the engine to operate in the economically most favourable range and should also offer the full performance of the engine when needed.

In view of the increased (and still increasing) demands placed on transmission control, an electronic system was developed, which was used for the first time in the 745i.

The foremost advantages of electronic transmission control include:

- The realization of any desired gear-change curves
- Precise adherence to the selected curves
- High degree of adaptability
- Inclusion of the engine in the control system (Motronic)
- High potential for further development

The automatic transmission with electronic control was designed in such a way that three functions - gear-change points, gear-change operation, backup functions are controlled electronically, while actuation of the transmission clutches is assumed by the hydraulic control unit.

Sensors measure the transmission speed, the load state of the engine and the engine speed. Further, the positions of the selector lever, the program and the kick-down switch positions are measured and relayed to the electronic control unit as electrical parameters. The electronic system processes all this information in accordance with a program, selects the optimal gear and makes sure that the gear-changes are carried out smoothly under all driving conditions.

Gear selection is performed automatically, chiefly as a function of vehicle speed and engine load. The driver can chose between three programs:

- economy
- sport
- manual program 3.2.1,

depending on whether he wants optimum mileage or the best possible performance of his vehicle.

Thanks to the Motronic system engine torque is reduced precisely and for a precisely calculated period of time during the gear-change operations.

The influence of the engine depends on the type of gear-change (kick-up and kick-down, under load and while coasting) and the selected gear.

The reduction of engine torque results in extremely smooth gear-changes and shortening of the clutch slip times. It also cuts energy losses or permits the transmission of higher powers without increasing transmission size.

In addition to optimising the gear-change programs and comfort, BMW engineers devoted considerable attention to the realization of various backup functions.

Transmission control is integrated in the central digital engine electronic system (Motronic). On the one hand this minimises initial expenditure and on the other affords the possibility of optimising the system.

A further advantage of electronic transmission controls its potential for the realization of future-oriented goals.

Thus, the gear-change points could be shifted in accordance with driving resistance determined by road gradient, vehicle load, drag(e.g. with mounted roof rack), whereby in addition to engine load and vehicle speed any deviation from the car's normal acceleration curve is also taken into account. It is also possible to integrate a driver's responses on hills, in curves, while coasting or while accelerating in the control circuit in order to obtain a criterium for suppressing undesired gear-changes and initiate desired gear-changes in such situations. The car would then react exactly as the driver intends and no manual gear-changes, which defeat the actual purpose of an automatic transmission, would be required.

By including the engine in the control system a wide variety of modes - kick-up and kick-down, under load and while coasting - can be better taken into account, so that a broad field of structures for automatic transmission can be considered, including those that require switching of several friction elements in a single operation. This can hardly be mastered with conventional hydraulic control.

It can be said that electronic transmission control not only meets today's high demands, but also represents a pace-setting solution for tomorrow.

Digital Engine Electronics (Motronic)
in the BMW 525e, 732i, 735i, 745i, 635 CSi

Digital engine electronics represents a microcomputer system, i.e. an integrated electronic system for controlling the ignition point and the fuel delivery in an internal combustion engine. The heart of the system is a

microcomputer, consisting of a microprocessor, a memory and an input and output circuit.

Digital engine electronics controls ignition as well as fuel injection of the L-Jetronic. In this way

a) power
b) consumption and thus efficiency
c) exhaust-gas composition
d) driving performance

can be optimised.

For control of ignition point, dwell angle and injection time (fuel quantity), suitable sensors measure electrical, electro-mechanical or electromagnetic quantities under all conceivable operating conditions and send pulses to the control unit. A microcomputer processes the data, also taking into consideration air pressure and outside temperature.

The ignition control graph resident in the computer has two axes, one for load and the other for engine speed. Multiplying these points (16 x 16) we obtain 256 memory locations. Each of these locations can contain an individual value for ignition timing.

The stupendous speed at which microprocessors operate make it possible to process the parameters and effect control of the engine with every revolution of the crankshaft. In this way, optimal ignition timing and injection delivery are maintained at all times.

Motronic II with Lambda Factor Graph

The lambda factor expresses the number representing the delivered air volume and the air volume required for complete combustion of the fuel.

The lambda factor graph contains the factors for the optimal lambda values with respect to the momentary operating condition. From the stored values, the load signals delivered by an airflow meter and the signal for the momentary engine speed derived from the basic injection time, the processor calculates the optimal injection time.

The control unit was designed with an eye toward the vehicle design (automatic or manual) so that use for cars with automatic gearbox is achieved through leaning of the mixture. (Cars with automatics can operate on leaner settings, since jolting is compensated by the automatic transmission and the converter.

Motronic II and Charge-Air Pressure and Pinking Control in the BMW 745i

The 745i turbo-engine has been fitted with digital engine electronics (Motronic II) in place of the L-Jetronic system and a combination charge-air pressure/pinking control unit which effectively prevents the engine from passing the pinking threshold. It operates as a function of the momentary engine speed and the desired output determined by the position of the accelerator, both of which are measured by sensors. In this way, a more favourable torque curve at low engine speeds is obtained (the maximum is now only 2200 rpm), and operation at the pinking limit is ensured for top efficiency.

Advantages of Digital Engine Electronics

Today an engine is tuned, even at service inspections, for average operation over extended periods. Owing to variations in driving conditions (cold starts, city traffic, etc.) and temperature, a car cannot achieve the best possible exhaust and consumption values automatically. Electronic control, however, can adapt the ignition and fuel delivery to the given conditions at any moment and does so with virtually no wear. The result is lower concentrations of exhaust pollutants and superb mileage.

BMW Four-Cylinder Engine with Electronically Controlled Carburation for the BMW 316 and BMW 518

As of model year 1984 the BMW 316 and 518 (ECE versions) will be equipped with the electronically controlled 2B-E carburettor system of Bosch and Pierburg System oHG. This system will not only provide further advantages for the customer, it will also help to protect the environment.

The principle of the system, which has been made possible by the use of electronics, is based on the fact that more parameters can be taken into consideration than ever before to ensure precise metering of fuel.

The design of the mechanical parts of the carburettor has been simplified. An electronic control unit processes the data that characterize the operating point and then adjusts the fuel quantity by setting the correct positions of the upstream throttle valve and the main throttle valve. This also applies to the control of idling speed and fuel cutoff during coasting. These parameters are:

- Engine speed
- Throttle valve angle
- Throttle valve opening speed
- Engine temperature
- Position of the idling switch
- Position of the throttle controller

A further advantage of the system is the possibility it affords of using a precise fuel consumption gauge, which can help the driver to modify his style of driving to improve mileage even more.

Electronically controlled carburation permits a leaner basic setting of the engine and thus promotes good mileage in this way as well. This is possible, because all fuel-enrichment measures necessary for normal operation and idling can be performed within very narrow tolerances in accordance with the momentary operating conditions of the engine. Thanks to this further development it has been possible to boost the mileage of the carburettor models with electronics by more than 6 percent, while at the same time decreasing emission levels.

BMW Reliability and Customer Service

The manufacturers and users of products that are subject to technological change see their ideal in a product whose components are maintenance-free and all have the same service life. This ideal cannot be achieved in the car, which consists of several thousands individual parts. Nevertheless, modern engineering does permit a step in the right direction, and BMW has exploited the possibilities offered, especially in the field of electronics.

BMW took a decisive step in 1981 by introducing the Service Interval Indicator in addition to the active Check Control System, a new safety system that automatically keeps a permanent check on essential vehicle functions, and a precise fuel consumption gauge. The function and implications of the Service Interval Indicator were described above.

Another future step in the direction of this ideal will be the precise measurement of the actual wear on vehicle components. It will then become possible to reduce the scope of service inspections even further and adapt the service interval even more closely to the individual car and the way the customer uses it, thus counteracting the generally increasing rate of accidents due to technical or service faults. Sensors associated with the engine control graph as well as sensors in the filters, brake linings, clutch, shock absorbers, battery and headlights will measure directly the degree of wear of the parts. This will include spark plugs and compression, etc.

The computer in the Service Interval Indicator determines the time and scope of the next service inspection, with the interval being determined by the component with the greatest wear. As today, the time for the next inspection will be displayed by the Service Interval Indicator in the combination instrument.

The scope of inspection and the parts replaced depend on the assessed degree of wear. As soon as the customer gives the order for inspection, the BMW Service Tester establishes the exact degree of wear for the exchange of parts not yet up for replacement. The test program is then run and gives the degree of wear and the possible mileage left. Components not yet due for inspection or replacement are designed in such a way that they will at least reach the mileage of the last interval. The next inspection interval is then determined by the element having the greatest degree of wear.

Electronics also permits customer order processing to be simplified. Today, before the order is ready for signing the customer must describe the technical problems. Sometimes a test run is even necessary for an accurate diagnosis. Model-specific catalogs must then be consulted to determine the labour time. The customer's address and vehicle data have to be entered on the order form. Thus, especially during busy periods the customer often faces long waiting times when he brings his car in for inspection.

With the help of the Customer Service Card held by the customer, which contains the customer's address as well as the chassis number of the car, the processing of orders in the future will be greatly simplified. The scope of service and repair will be established directly and immediately right on the car by plugging a pocket-sized diagnosis computer into a corresponding socket on the engine. The diagnosis computer and the Customer Service Card are then coupled with a computer-linked printer, which then writes

out the entire order with details on the order numbers of replacement parts, the price of replacement parts, hours of labour and when the car will be ready to pick up.

For the BMW customer the realization of this system means a further reduction in maintenance and repair costs thanks to shortened service and inspection times. The time required today during peak periods for preparing and processing orders will be substantially reduced by automation. The use of microelectronics offers not only an elegant, economic solution for existing functions, but also the possibility of introducing new functions and increasing reliability to boot. This system-related improvement is complemented by increased reliability thanks to constant improvements in the manufacturing process of highly integrated semiconductor elements.

Besides the further development of the service system, a goal is on-board vehicle diagnosis. This new dimension in car electronics will not only be very insusceptible to disturbances thanks to system-related improvements, but will also monitor itself and generate standby functions in the event of any irregularities in the electronic systems. These will prevent a complete breakdown and store the error for rapid diagnosis at the service centre. Any disturbances that arise - they may also be due to temporary shifts of operational values - are located with the help of self and mutual monitoring and stored in a diagnosis memory. The diagnosis results are then available on a common diagnosis line in the form of a serial data telegram, which can then be queried for further evaluation via a diagnosis plug, much as in the engine compartment today. The BMW Service Tester will then give detailed information on the error and instructions for testing. The driver will be instructed by an electronic text display as to the nature of the fault and how to react to it.

The advantages for the customer at a glance:

- Even greater influence of how the individual car is used on the service interval.
- A more individual service scope oriented to the actual wear to take full advantage of the service life of each component.
- In the event of a fault, avoidance of vehicle downtime by standby functions within the electronic system.
- Faster order processing and shorter repair and inspection times thanks to rapid diagnosis of service and repair caused by wear, as well as an instant breakdown of expected costs.
- Clear reduction of repair and maintenance costs.

BMW AG

TD Wheel/Tyre Concept

TD Rim/Tyre Concept

Low-Profile Tyres with Emergency Running Features

As of 1984 BMW will be offering a new rim-tyre combination for the 3 Series. It consists of the 150 TD 365 cast light-alloy rim in the unmistakable BMW styling and Michelin or Dunlop tyres of size 200/60 R 365 H 88 or 200/60 VR 365.

This new concept, designated TD, unites the well-known design and performance advantages of the BMW light-alloy rims and wide tyres with the safety advantage of a tyre that permits emergency running if pressure is lost. This feature is made possible by the Denloc groove in the rim and the mating Denloc bead on the tyre, a system patented by Dunlop. Even if tyre pressure is lost completely the tyre remains on the rim without slipping onto the well base. Thus the danger of the rim destroying the side walls of the tyre is eliminated. This rim-tyre combination makes it possible to drive "on a flat tyre" at a speed of up to 60 kpm on the straightaway and even in gentle bends. The steering behaviour of the car changes only inappreciably, and the driver still has the feeling of being in full control. Distances of about 30 km (loss of pressure in front tyre) or about 9 km (loss of pressure in rear tyre) with bends are possible, as long as a top speed of 60 km/h is not exceeded. This is more than twice the distance that can be covered with normal tyres under such circumstances.

This new feature offers true advantages for the customer. If a tyre is damaged, the driver can still leave dangerous situations without trouble (in a tunnel, along construction sections on the motorway, on high-speed roads without an emergency lane, in heavy city traffic, etc.). At night in sparsely populated areas a filling station, the next town or a garage can be reached. The tyre can then be changed in a safe place, such as a car park or layby.

The TD rim-tyre concept is a further step taken towards greater driving safety.

Technical Data
and Drawings

Technical Data BMW Cars 1/1984

Body | **Engine** | **Electrical system** | **Power train** | **chassis** | **Weights and dimensions** | **Performance date** | **Acceleration man. (autom.)**

Model	2-door Seats	Cylinder no.	Eff. displacement cc	Bore/stroke mm	Compression ratio : 1/ Fuel grade	Power kW (HP) at rpm	Max. torque in Nm at rpm	Carburettor/ injection	Ignition	Generator output A/W	Battery/Ah	Transmission ratios	rear-axle ratio	Front suspension Rear suspension brakes front/rear steering	Tyre size/rims	Turning circle	Wheelbase mm	Track front/rear mm	Length/width/ height mm	Unladen weight kg Power-to-weight ratio kW/kg	Payload kg	Perm. gross vehicle weight kg	Trailer load braked/ unbraked kg	Roof load kg	Boot volume (l) abs/VDA	Fuel consumption at 90 km/h at 120 km/h city cycle 4-speed/autom./5-speed (l/100 km)	Tank capacity (l)	0–100 km/h	80–120 km/h (in direkt gear)	Top speed km/h
315	2- and 4-door	4-cylinder	1573	84/71	9.5/S	55/(75) 5800	110/3200	1B2 downcraft carburettor	Contactless transistorized ignition in hybrid technology	45/630	44	I = 3.76 II = 2.04 III = 1.32 IV = 1.00 R = 4.10	4.10	Inclined spring struts with coil springs, torsion-bar stabilizer doubling as tension strut, Independet doubling as tension strut. Independent suspension on semi-trailing arms. 2-piston fixed caliper disc brakes/ drum brakes.	165 SR 13 5 J x 13 Steel	10.3	2563	1366/ 1373	4355/ 1610/ 1380	1010 18.4	430	1440	1200/ 500	75	460/ 404	6.8/–/ 6.0 9.0/–/ 8.2 10.5/–/10.5	58	14.8 (–)	18.8	154 (–)
316			1766	89/71	9.5/S	66/(90) 5500	140/4000	2B4-electronic carburettor		65/910	"	"	3.64	Single-joined spring-strut axle with negative caster, reinforced lateral-force compensation, anti-dive control.	175/70 TR 14 5 J x 14 Steel	10.5	2570	1407/ 1415	4325/ 1645/ 1380	990 15.0	460	1450	"	"	485/ 425	6.3/ 7.0/ 5.8 8.4/ 9.2/ 7.6 9.8/ 9.8/ 9.8	55	12.4 (14.2)	14.4	175
318i		"	1766	89/71	9.5/S	77/(105) 5800	145/4500	L-Jetronic		80/1120	"	"	"	Independent suspension on semi-trailing arms (sweepback angle 15°), separate spring an shock absorber, anti-squat control.	175/70 HR 14 5 J x 14 Steel	"	"	"	"	1000 13.0	"	1460	"	"	"	6.3/ 7.0/ 5.8 8.3/ 9.2/ 7.6 9.6/ 9.8/ 9.6	" (13.1)	11.2	13.6	184 (179)
320i	2- and 4-door	6-cylinder	1990	80/66	9.8/S	92/(125) 5800	170/4000	"		"	50	I = 3.72 II = 2.02 III = 1.32 IV = 1.00 V = 0.80 R = 3.45	3.45	Single-piston floating caliper disc brakes/ drum brakes, from the 320i onward: ventilated in front, 323i: disc brakes front and rear, integrated drum handbrake.	195/60 HR 14 5½ J x 14 Steel	"	"	"	"	1060 11.5	"	1510	"	"	"	–/ 6.3/ 6.2 –/ 8.2/ 8.1 –/11.5/11.9	"	10.4 (12.0)	12.8	196 (191)
323i		"	2316	80/76.8	9.8/S	110/(150) 6000	205/4000	"		"	"	I = 3.83 II = 2.20 III = 1.40 IV = 1.00 V = 0.81 R = 3.46	"	Rack-and-pinion steering 21.4 : 1/4 revolutions.	195/60 VR 14 5½ J x 14 Steel	"	"	"	"	1090 9.9	"	1550	"	"	"	–/ 6.5/ 6.5 –/ 8.4/ 8.4 –/11.7/12.2	"	9.0	10.3 (10.7)	204 (200)
518		4-cyl.	1766	89/71	9.5/S	66/(90) 5500	140/4000	2B4-electronic carburettor		65/910	44	s. 315	4.27	Double-jointed spring-strut axle, small positive wheel offset, displaced negative caster, ideal turning axis on 2 guide joints, torsion-bar stabilizer.	175 SR 14 5½ J x 14 Steel	10.9	2625	1430/ 1470	4620/ 1700/ 1415	1140 17.3	510	1650	1200 /500	75	640/ 460	6.8/–/ 6.2 9.0/–/ 8.2 10.4/–/10.4	70	14.0 (–)	15.2	164 (–)
520i		6-cylinder	1990	80/66	9.8/S	92/(125) 5800	170/4000	L-Jetronic		80/1120	55	s. 320i	3.91	Independent suspension on semi-trailing arms (sweepback angle 20°), spring struts. 528i: (13°), supplementary control arms.	175 HR 14 5½ J x 14 Steel	"	"	"	"	1220 13.3	"	1730 500	1400/	"	"	–/ 6.5/ 6.5 –/ 8.5/ 8.5 –/11.8/12.2	"	11.4 (13.9)	14.0	185 (179)
525e	4-door		2693	84/81	11.0/S	92/(125) 4250	240/3250	Motronic		"	66	s. 525i	2.93		"	"	"	"	"	1250 13.6	"	1760	"	"	"	–/ 5.9/ 5.9 –/ 7.5/ 7.6 –/11.5/11.4	"	10.7 (12.3)	12.6	185 (180)
525i		"	2494	86/71.6	9.6/S	110/(150) 5500	215/4000	L-Jetronic		"	55	s. 323i	3.45	518, 520i, 524td: single-piston floating caliper disc brakes/drum brakes. 525e, 525i, 528i: ventilated disc brakes, integrated drum handbrake.	"	"	"	"	"	1280 11.6	"	1790 /500	1500	"	"	–/ 6.7/ 6.8 –/ 8.6/ 8.6 –/13.7/13.6	"	9.9 (12.5)	13.5	197 (190)
528i		"	2788	86/80	9.3/S	135/(184) 5800	240/4200	L-Jetronic		"	"	"	3.25		195/70 VR 14 6 J x 14 Steel	"	"	1430/ 1460	"	1300 9.6	"	1810	"	"	"	–/ 6.8/ 6.8 –/ 8.6/ 8.6 –/15.1/14.7	"	8.4 (11.2)	12.6	212 (206)
524td		"	2443	80/81	220/D	85/(115) 4800	210/2400	Distributor injection pump		"	90	I = 4.35 II = 2.33 III = 1.39 IV = 1.00 V = 0.81 R = 3.73	3.15		175 HR 14 5½ J x 14 Steel	"	"	1430/ 1470	"	1300 15.3	"	"	1400/ 500	"	"	–/5.2/5.2 –/7.0/7.0 –/9.5/9.0	"	12.9 (13.6)	13.7	180 (175)

5-seat saloons, all-steel monocoque body, allround rigid safety cell, programmed crush zones in front and rear, integrated overturn protection. Cavity sealing, underfloor protection: 6-year warranty against corrosion. Water-cooled inline engine, longitudinally inclined, light-alloy cylinder head, cross-flow principle, spherical combustion chamber, overhead camshaft, counterweighted crankshaft, speed-dependent viscose fan with additional thermostatic control.

Diesel, exhaust-gas torbocharger, swirl chamber

Technical Data BMW Cars 1/1984

Model	Doors Seats	Cylinder no.	Eff. displacement cc	Bore/stroke mm	Compression ratio : 1/ Fuel grade	Power kW (HP) at rpm	Max. torque in Nm at rpm	Carburettor/ injection	Ignition	Generator output A/W	Battery/Ah	Transmission ratios	rear-axle ratio	Front suspension Rear suspension Brakes front/rear steering
728i	5-seat saloon, 4-door	6-cylinder	2788	86/80	9.3/S	135/(184) 5800	240/4200	L-Jetronic	Contactless transistorized ignition in hybrid technology	80/1120	55	I = 3.83 II = 2.20 III = 1.40 IV = 1.00 V = 0.81 R = 3.46	3.64	Double-jointed spring-strut axle, small positive wheel offset, displaced negative caster ideal turning axis on 2 guide joints, torsion-bar stabilizer. Independent suspension on semi-trailing arms and spring struts with coil springs (sweepback angle 13°, supplementary control arms), 745i: hydropneumatic level control. Single-piston floating caliper/single-piston floating caliper disc brake, ventilated in front, integrated drum handbrake. Speed-independent ball-and-nut steering with common hydraulic system for steering and brake boosters, ratio 15.7 : 1/3.8 revolutions.
732i		"	3210	89/86	10.0/S	145/(197) 5500	285/4300	Motronic		"	66	I = 3.82 II = 2.20 III = 1.40 IV = 1.00 V = 0.81 R = 3.71	3.45	
735i		"	3430	92/86	10.0/S	160/(218) 5200	310/4000	"		"	"	"	3.25	
745i		Exhaust-gas turbocharger	3430	92/86	8.0/S	185/(252) 4900	380/2200	Motronic		"	"	I = 2.48 II = 1.48 III = 1.00 IV = 0.73 R = 2.09	2.93	
628 CSi			2788	86/80	9.3/S	135/(184) 5800	240/4200	L-Jetronic		"	"	I = 3.83 II = 2.20 III = 1.40 IV = 1.00 V = 0.81 R = 3.46	3.45	
635 CSi	4-seat 2-door coupé, All-steel monocoque body, allround rigid safety cell, programmed crush zones in front and rear, integrated overturn protection. Cavity sealing, underfloor protection: 6-year warranty against corrosion. Water-cooled inline engine, longitudinally inclined, light-alloy cylinder head, cross-flow principle, spherical combustion chamber, overhead camshaft, counterweighted crankshaft, speed-dependent viscose fan with additional thermostatic control.	"	3430	92/86	10.0/S	160/(218) 5200	310/4000	Montronic		"	"	s. 732i	3.07	See 518 Single-piston floating caliper disc brakes, air-cooled/Single-piston floating caliper disc brakes, integrated drum handbrake.
M 635 CSi*		DOHC, 4-valve	3453	93.4/84	10.5/3	210/(286) 6500	340/4000 4500	"		"	90	I = 3.51 II = 2.08 III = 1.35 IV = 1.00 V = 0.81 R = 3.71	3.73	

* Planned availability: spring 1984

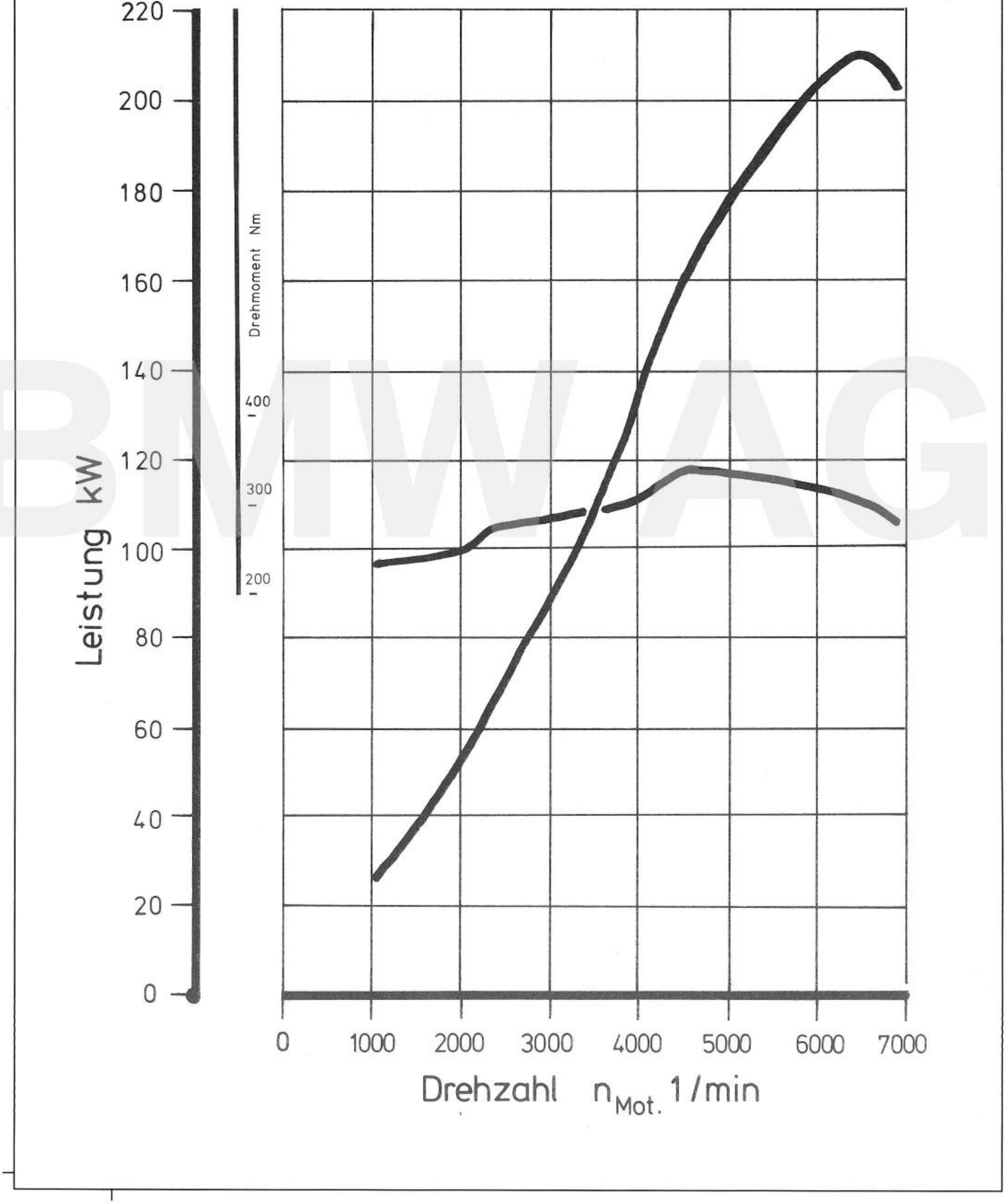
Model	Tyre size/rims	Turning circle	Wheelbase mm	Track front/rear mm	Length/width/ height mm	Unladen weight kg Power-to-weight ratio kW/kg	Payload kg	Perm. gross vehicle weight kg	Trailer load braked/ unbraked kg	Roof load kg	Boot volume (l) abs/VDA	Fuel consumption at 90 km/h at 120 km/h city cycle 4-speed/autom./5-speed	Tank capacity (l)	Acceleration man. (autom.) 0–100 km/h	80–120 km/h (in direkt gear)	Top speed km/h
728i	195/70 VR 14 6½ J x 14 Steel	11.6	2795	1502/ 1524	4860/ 1800/ 1430	1470 10.9	510	1980	1600 /650	100	640/ 480	–/ 7.8/ 7.9 –/ 9.9/10.2 –/14.5/15.1	100	9.5 (11.4)	11.6	201 (195)
732i	205/70 VR 14 6½ J x 14 Steel	"	"	"	"	1500 10.3	"	2010	"	"	"	–/ 7.8/ 8.4 –/ 9.8/10.2 –/16.1/16.8	"	8.6 (10.5)	10.7	208 (202)
735i	205/70 VR 14 6½ J x 14 Alu	"	"	"	"	1500 9.4	"	"	"	"	"	–/ 7.9/ 8.1 –/ 9.8/10.0 –/16.0/16.8	"	7.9 (9.4)	10.2	217 (211)
745i	"	"	"	"	"	1590 8.6	"	2100	"	"	"	–/ 8.4/– –/10.4/– –/16.6/–	"	– (7.9)	–	– (227)
628 CSi	"	11.2	2630	1430/ 1460	4755/ 1725 1365	1410 10.4	420	1830	1600/ 650	75	530/ 413	–/ 6.8/ 6.8 –/ 8.8/ 8.8 –/14.4/14.3	70	9.1 (10.9)	12.0	212 (204)
635 CSi	"	"	"	"	"	1430 8.9	"	1850	"	"	"	–/ 6.8/ 7.2 –/ 8.7/ 8.8 –/14.8/15.7	"	7.4 (9.0)	10.1	229 (221)
M 635 CSi*	220/55 VR 390 165 TR 390 Alu	11.6	2625	1430/ 1464	4755/ 1725 1354	1500 7.1	350	"	–	"	430/ 335	–/–/ 8.2* –/–/10.2 –/–/16.5		6.4 (–)	10.7 (5.6)	255 (–)

* Planned

BMW M 635 CSi

Leistungs- und Drehmomentdiagramm

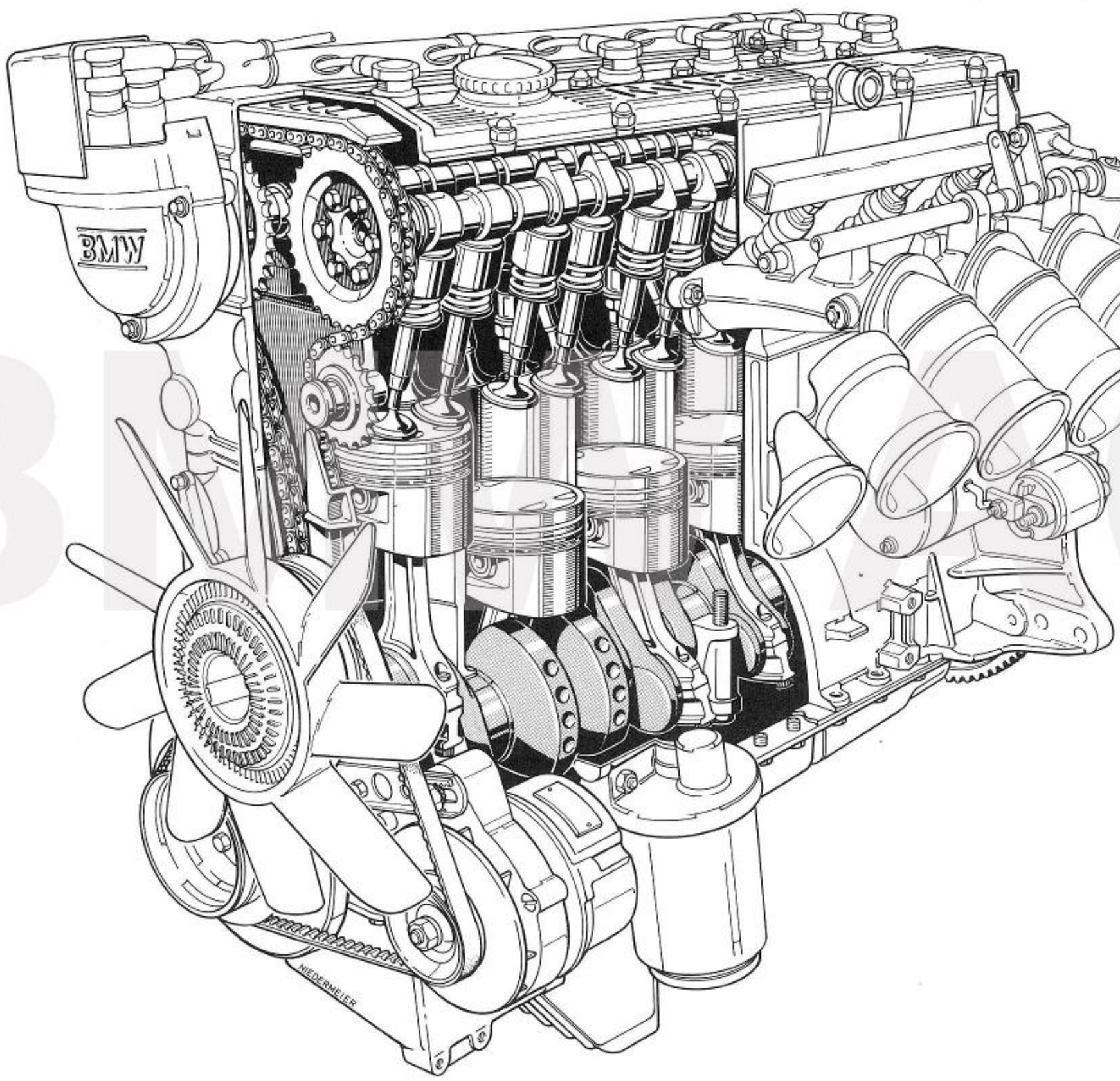
A 83/7



BMW M 635 CSi

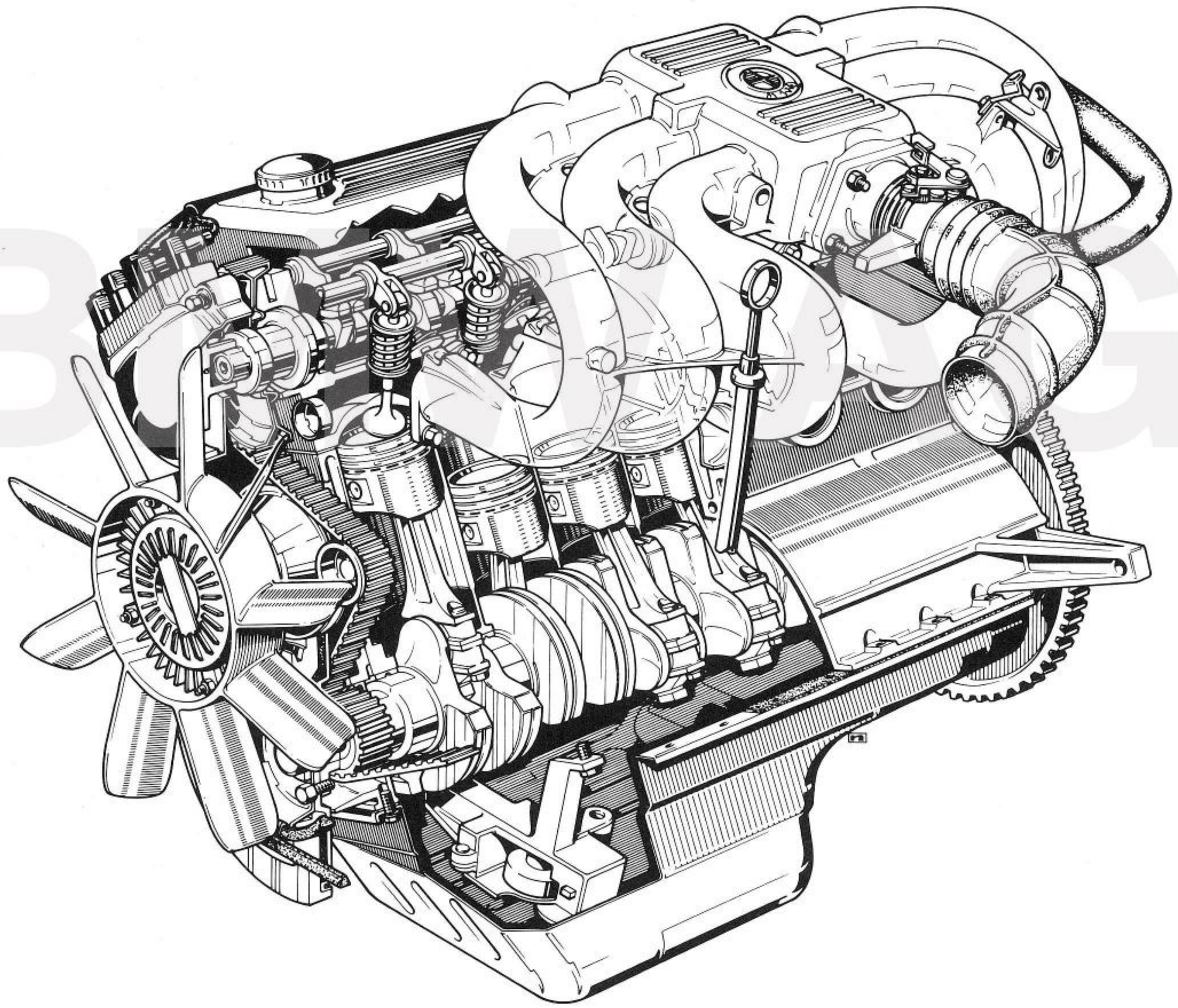
6-Zylinder-Reihenmotor mit jeweils zwei Einlaß- und Auslaßventilen pro Zylinder und zwei obenliegenden Nockenwellen

A 83/8



BMW 525e
6-Zylinder-Einspritzmotor, Schnittbild

A 83/1



BMW 525e
6-Zylinder-Reihenmotor mit Benzineinspritzung, wassergekühlt, obenliegende Nockenwelle mit Zahnriemenantrieb, Viskose-Lüfter, Alu-Ölwanne, neue Leistungscharakteristik

BMW 525e
6-cylinder inline engine with fuel injection, watercooled, overhead camshaft with belt drive, viscous fan coupling, aluminium oil sump, new performance characteristics

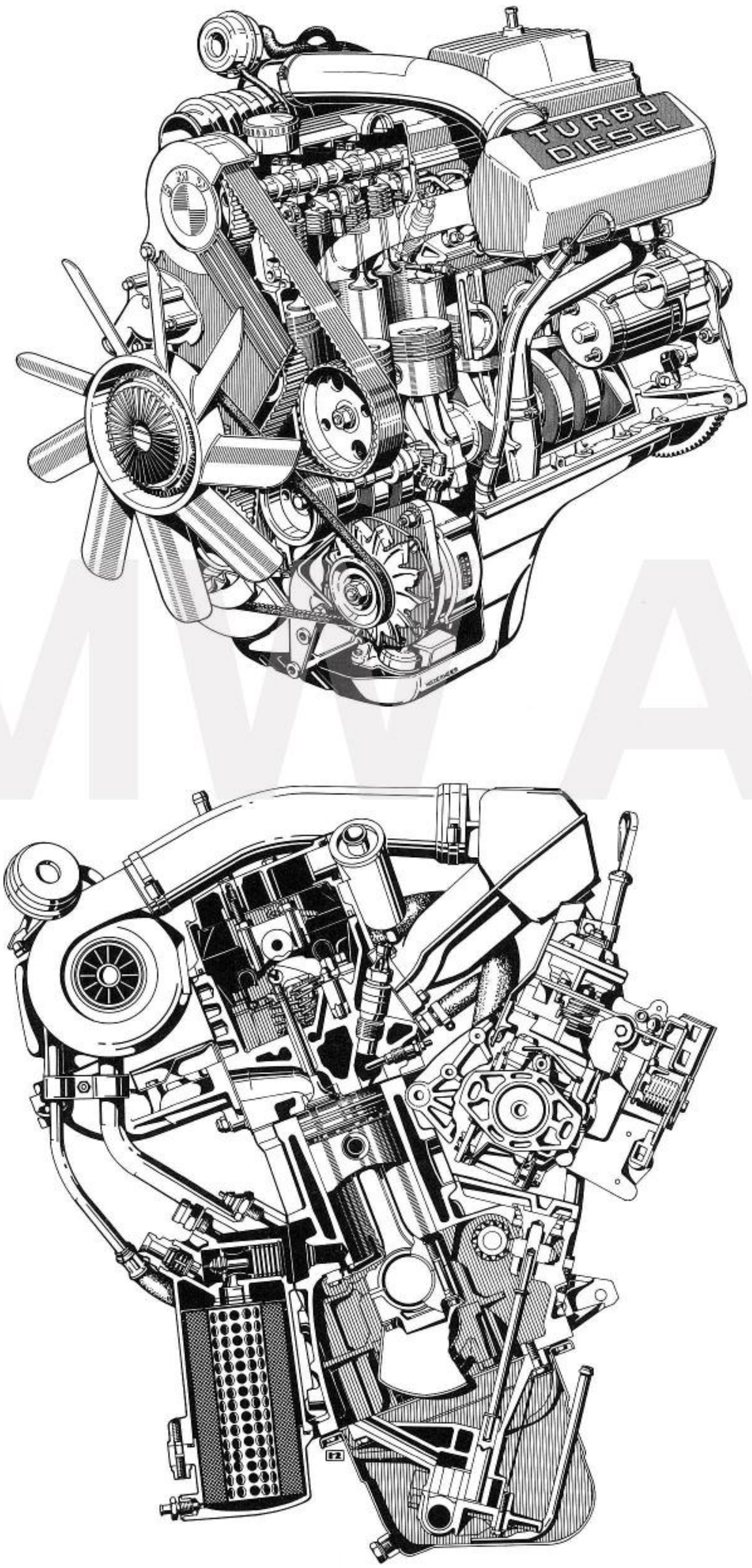
BMW 525e
Moteur 6 cylindres en ligne à injection du carburant, refroidi par eau, arbre à cames en tête entraîné par courroie dentée, ventilateur viscostatique, carter d'huile en aluminium, nouvelle caractéristique de puissance

BMW 525e
Motore ad iniezione con 6 cilindri in linea, raffreddato ad acqua, albero a camme in testa comandato da cinghia dentata, ventilatore a giunto idraulico, coppa in alluminio, nuova caratteristica di potenza

BMW 524td

6-Zylinder-Einspritzmotor, Schnittbild

A 83/3



BMW 524td
6-Zylinder-Reihen-Dieselmotor, wassergekühlt,
obenliegende Nockenwelle mit Zahnriemenantrieb,
Viskose-Lüfter

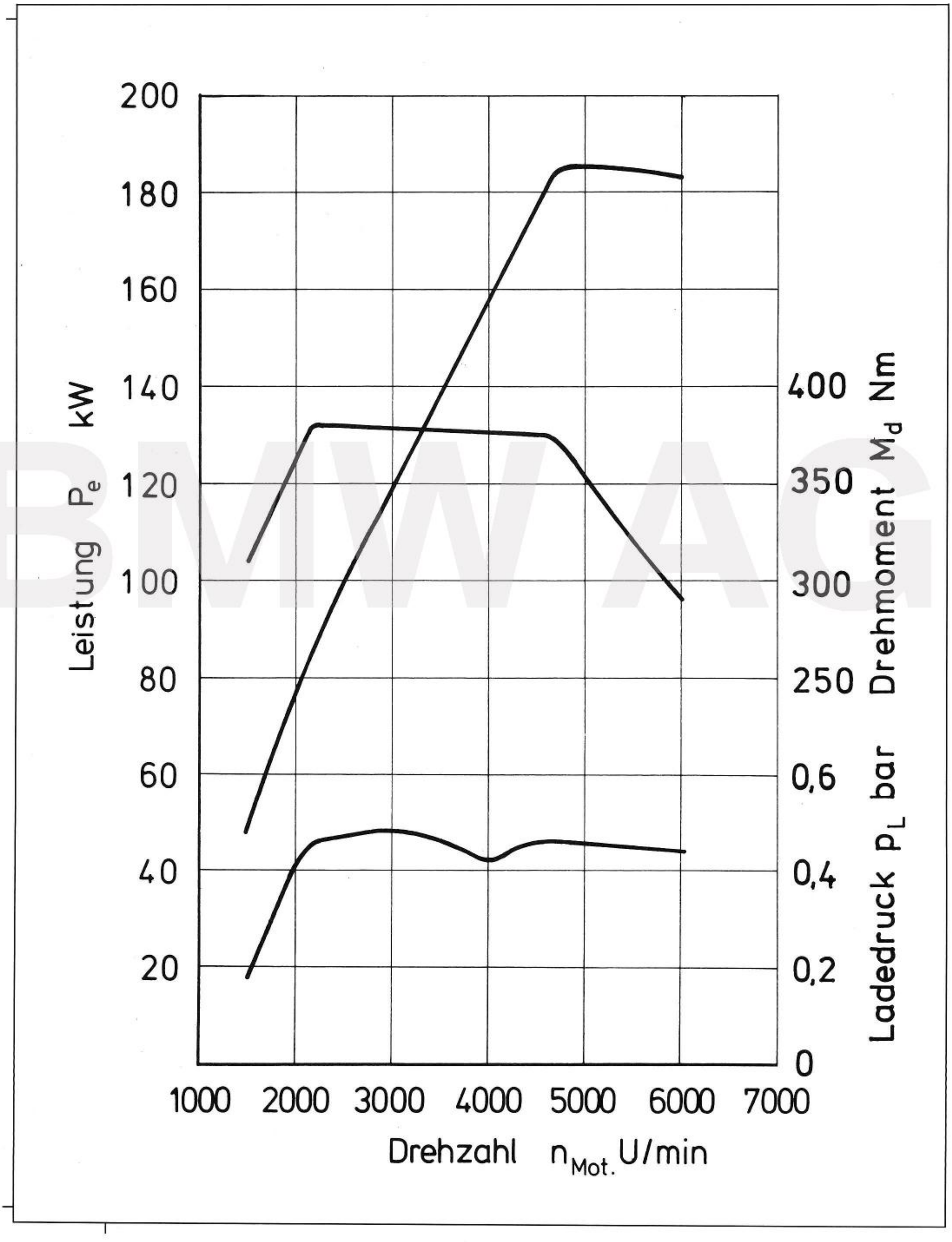
BMW 524td
6-cylinder inline Dieselengine, watercooled, overhead
camshaft with belt drive, viscous fan coupling

BMW 524td
Moteur Diesel à 6 cylindres en ligne, refroidi par eau, arbre
à cames en tête entraîné par courroie dentée, ventilateur
viscostatique

BMW 524td
Motore Diesel con 6 cilindri in linea, raffreddato ad acqua,
albero a camme in testa comandato da cinghia dentata,
ventilatore a giunto idraulico

BMW 745i
Leistungsdiagramm

A 83/6



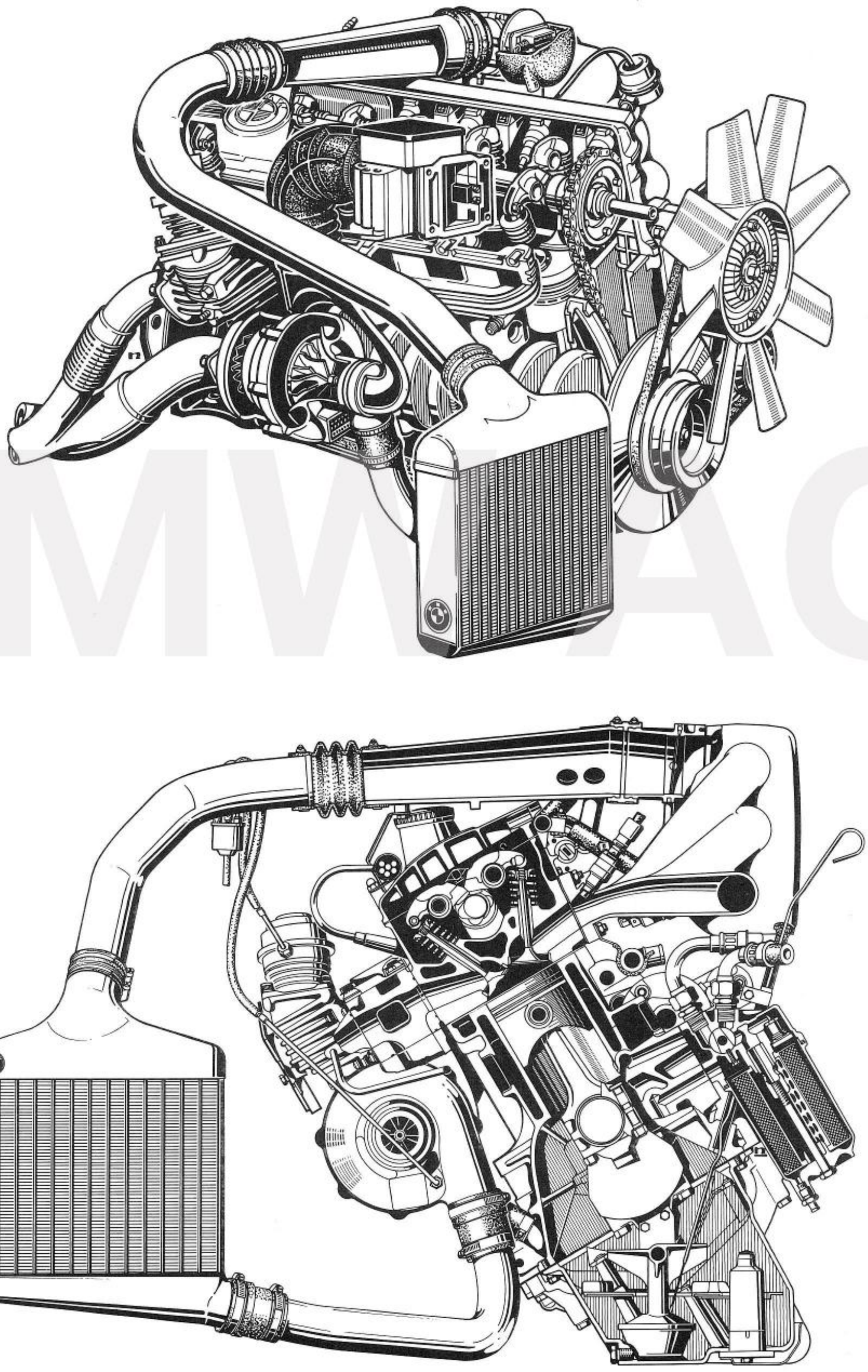
BMW 745i
Performance chart

BMW 745i
Courbes caractéristiques

BMW 745i
Diagramma della potenza

BMW 745i
Schnittbild des 6-Zylinder-Einspritzmotors
mit Abgasturbolader

A 83/5



BMW 745i
6-Zylinder-Reihenmotor mit Abgasturbolader
und Digitaler Motorelektronik

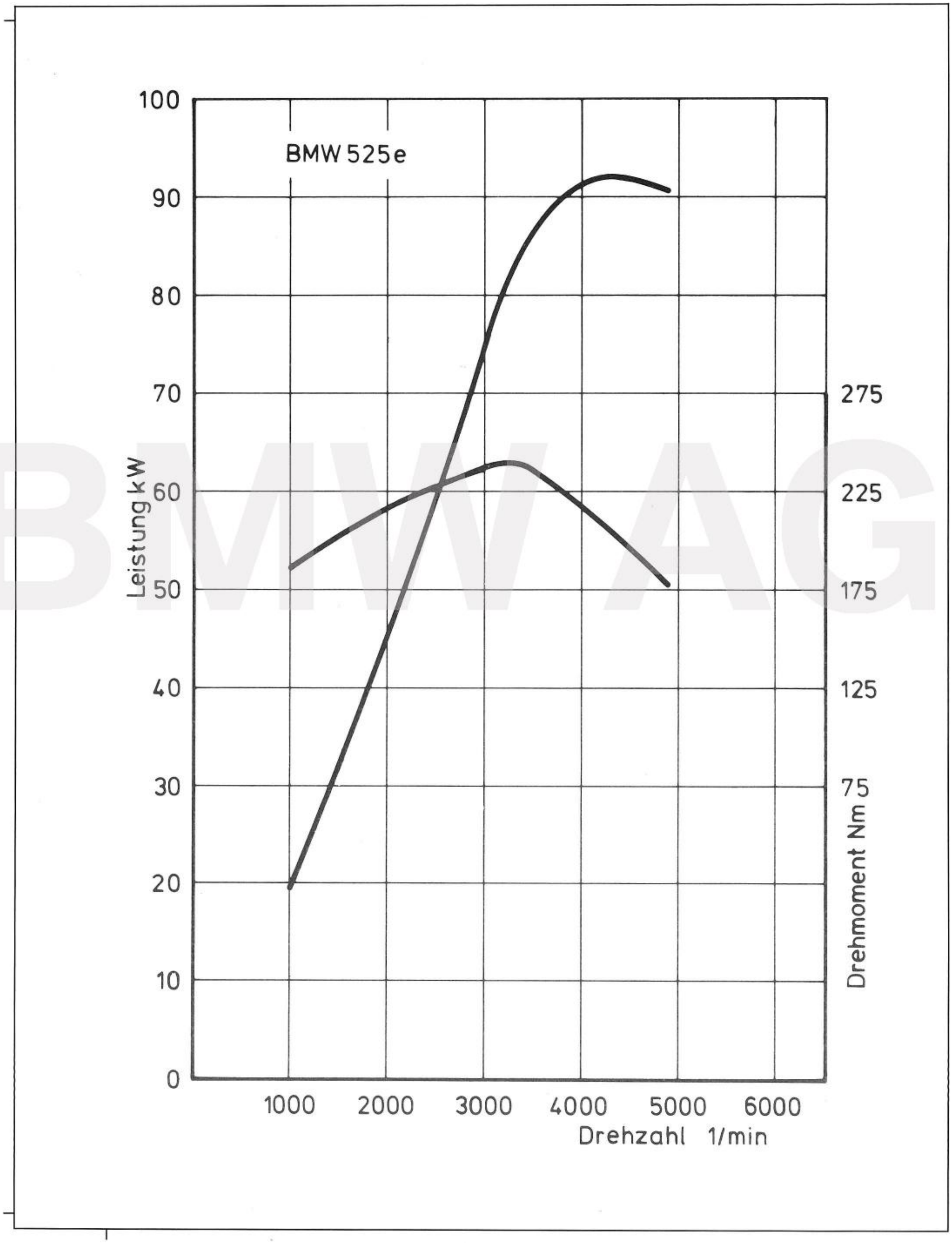
BMW 745i
Sectional view of the 6-cylinder injection engine.
6-cylinder in-line engine with exhaust
turbocharger and digital motor electronics

BMW 745i
Vue en coupe du moteur 6 cylindres à injection
Moteur 6 cylindres en ligne avec turbocompresseur
et unité eletronique digitale du moteur

BMW 745i
Spaccato del motore 6 cilindri a iniezione
Motore 6 cilindri in linea con turbocompressore e elettronica digitale

BMW 525e
Leistungs- und Drehmomentdiagramm

A 83/2

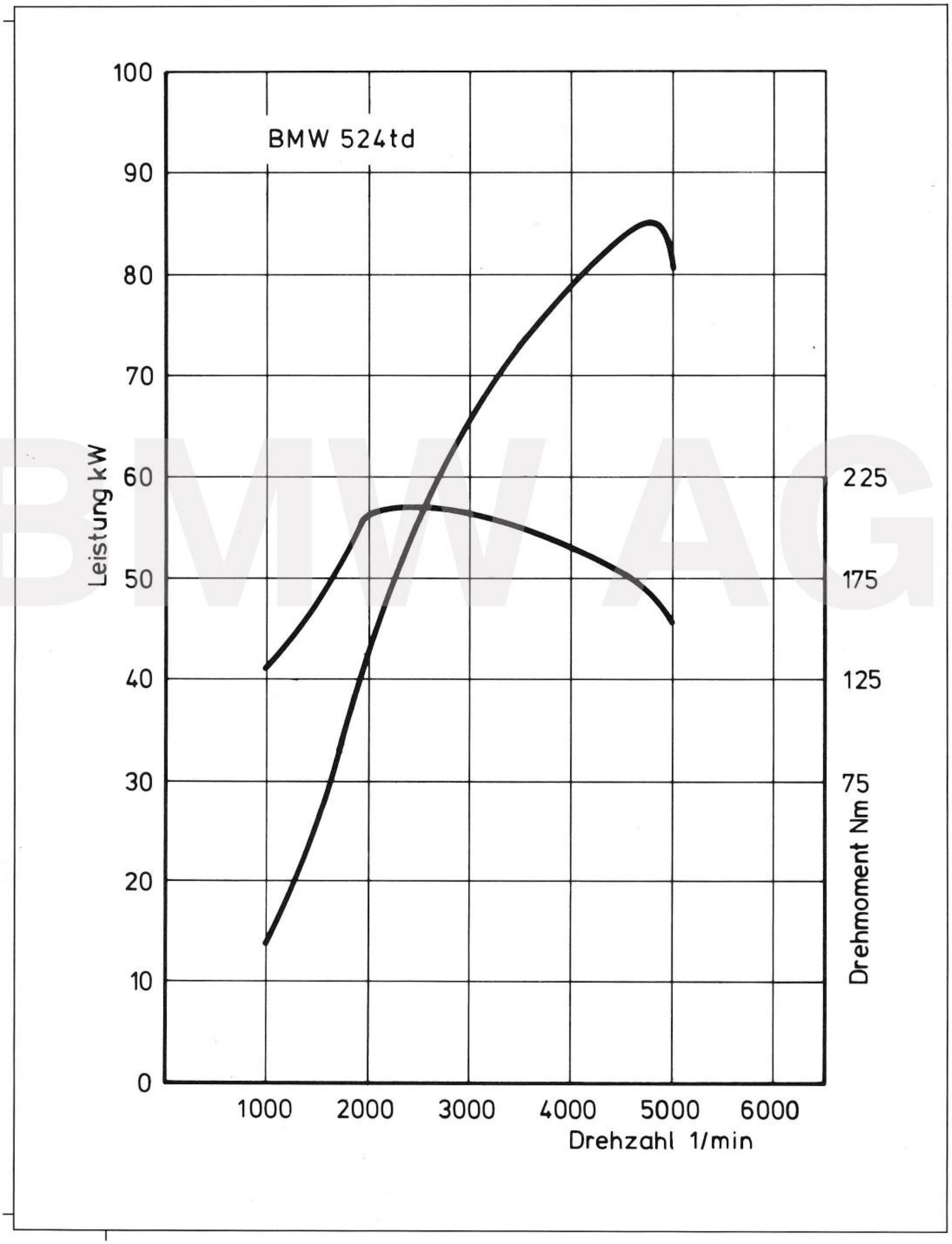


BMW 525e
Performance diagrams

BMW 525e
Courbes caractéristiques

BMW 524td
Leistungs- und Drehmomentdiagramm

A 83/4



BMW 524td
Performance diagrams

BMW 524td
Courbes caractéristiques

BMW AG

BMW in facts and figures

1st half 1983

Course of business:

Once again, the first half of 1983 provided very satisfactory results for BMW AG. With the market expanding in general, the Company's data have continued to develop at an above-average rate. Production in the first half of this year amounts to 210,000 cars, which, in line with BMW's production capacities, is 5 % more than in the same period last year.

BMW registrations in the Federal Republic of Germany amounted to 90,000 units in the first half of this year, thus exceeding the corresponding figure for the first half of 1982 by 23 %. At well over 130,000 cars, exports remained at the same level as in the first half of last year.

This positive development is largely attributable to the new BMW 3 Series, but is also the result of successful sales of BMW's other models. About 6 months after the new 3 Series had gone into production, no less than 100,000 units had already been produced and sold, half of them with 6-cylinder engines. Registrations of the BMW 3 Series were approximately one-third over the previous year's figure in the first half of this year.

The flow of incoming orders is also characterized by the substantial demand for the new BMW 3 Series. In all, the number of orders received in the first half of this year exceeded BMW's enlarged production capacities by far and was also higher than the corresponding figure for last year.

The motorcycle business remained difficult in the first half of 1983. The demand for motorcycles has once again decreased all over the world. While the Japanese manufacturers dominating the market have continued to limit

their production, excessive capacities and extremely large stocks of unsold motorcycles have kept competition just as ruinous as before.

As a result of slackening demand, BMW's production output has been reduced by 17 % to 14,700 motorcycles. Im BMW's primary market segment above 750 cc, we nevertheless became the No 1 manufacturer in the Federal Republic of Germany in the first half of 1983. From autumn of this year, a new generation of BMW motorcycles will supplement our traditional flat-twin concept and add new stimulus to our business.

BMW's subsidiaries and business interests have continued to develop positively. The factory of BMW Steyr Motoren Gesellschaft was officially inaugurated on 10 March 1983. The supply of diesel engines to Ford USA/Canada will soon begin according to plan.

On account of increased sales and changes in the model mix, the turnover of BMW AG increased in the first half of 1983 by 20 % to DM 5.8 billion. Turnover of the BMW Group has gone up to DM 6.9 billion.

In consideration of the data available so far, we have every reason to judge both the rest of the year and the whole of 1983 in a positive sense. Given the development of business so far, the number of orders already received and the development of new orders coming in, we have every reason to believe that production, sales and turnover in 1983 will considerably exceed the previous year's figures. In all probability, the Company's result will once again develop satisfactorily.

Investments:

BMW's outstanding investment last year was the completion of the Steyr engine factory. Since the beginning of 1982, this factory - BMW Motoren Gesellschaft - has been wholly owned by BMW. By the end of 1982, our investments in Steyr amounted to approximately DM 570 million. The

additional engine-production capacities thus provided of 150,000 units per year in the initial phase allow us to meet the greater demand for BMW engines. This demand is not limited, incidentally, to the use of such engines only in BMW cars. Our production capacities in Steyr are to be expanded to 300,000 units/year in the second half of this decade.

With additions to fixed assets amounting to DM 753 million (above all for the new 3 Series), 1982 was a relatively normal year for BMW AG in terms of investments and capital expenditure. The Company's investments will however increase considerably in the years to come: A new factory is to be built in Regensburg and a research and development centre is planned in the north of Munich. Both of these projects are of outstanding significance in securing the future of the Company.

BMW will require larger capacities in the foreseeable future in order to meet the growing demand in existing and new markets. With our existing factories already working to capacity, it will prove essential to move to a new site in order to provide the moderate but steady increase in capacity required in the years to come. In Regensburg BMW will start production towards the end of 1986 with a small daily output in the initial phase, which is to be increased step by step to a production output of 400 units per day. It is currently estimated that 10 to 15 years will be required for the completion of the Regensburg factory. With annual investments averaging about DM 150 million, the Regensburg project will account for roughly 15 % of BMW's total investments per year.

Model policy:

The highlight in BMW's model policy in 1982 was the introduction of the new BMW 3 Series. With this new car, BMW again sets the standard for automotive engineering in this category for the third successive generation

of models. The new BMW coupé and the substantially improved BMW 7 Series had already been launched earlier in 1982.

Two new BMW engine series were launched in spring 1983 in the BMW 525e and the BMW 524td. Both of these engines are optimized for maximum fuel economy, while nevertheless providing typical BMW performance. BMW's traditional engines were supplemented first by the eta concept: With its high torque above all at low and medium engine speeds, the BMW 525e is a particularly economical car. And by launching the BMW diesel in the 524td, we have now taken a historical step into a new market.

BMW's future models will continue to excel by their technical leadership over other cars. As an example, BMW is quite clearly the leader when it comes to the sensible use of electronic systems within the entire power train. The 745i is the first car to combine the engine and transmission electronics in forming one uniform system. The success of the Company proves that BMW's customers accept and appreciate this model policy and technological concept.

In all, more than 4 1/2 million BMW cars have come off our production lines in the last three decades - two-thirds thereof in the last 10 years alone. At an average annual growth rate of 7.5 %, BMW's production has increased faster in this period than that of the Japanese car industry when seen as a whole. From this perspective, therefore, BMW has been the world's fastest-growing car company in the last 10 years.

This development is attributable above all to BMW's exports, which have tripled since the beginning of the 70s as a result of the Company's consistent sales and marketing policy. Today, BMW is represented by its own sales and marketing subsidiaries in the 12 most important foreign markets. This allows BMW to obtain a better balance of the individual markets and a broader spread of risks. With the exception of the West German market, no individual market takes up more than 15 % of BMW's car production.

On the other hand, however, 90 % of BMW's car exports go to just 15 countries. While the total registrations of new cars continued to decrease in these countries in 1982 for the fourth year running, BMW once again achieved two-digit growth rates overall.

Within just 5 years, BMW's market share has increased from 2.2 % to 2.7 % in Western Europe and 1 % to 1.5 % worldwide.

Last year, BMW's car sales in the USA passed the 50,000-mark for the first time. Sales also increased to more than 30,000 units in France and over 20,000 units in Great Britain. Within a few years, BMW's sales have doubled in these and other foreign markets - and in some cases the increase has even been three- or fourfold. Although availability of the new 3 Series has been limited so far in 1983, BMW has succeeded in all in reaching the very high standard already achieved last year.

The 3 Series is the most successful BMW model series since the war: Since its introduction in 1975, it has made up for about 60 % of BMW's overall production. The overall production output of the 3 Series has been approximately 1.5 million units so far; including the previous model launched in 1966 - the 02 series - the total production output has even been 2.3 million units.

Registrations of the BMW 3 Series in the Federal Republic of Germany amounted to approximately 53,000 units in the first half of 1983 - which is more than ever before in a 6-month period. The class share of the 3 Series in its market category once again exceeded the 10 %-mark, although this was the fastest-growing part of the market due to the introduction of many new models.

The BMW 5 Series has also been a success throughout its entire history. Since its introduction in 1972, the 5 Series has been produced more than one million times. At 145,000 units, 5 Series production in 1982 was more

than one-third higher than the previous record. In the first half of 1983, every 10th car registered in this category in the Federal Republic of Germany was once again a BMW 5 Series. This proves the lasting success of BMW's medium-size model.

Demand for the 7 Series and the BMW coupés has also picked up considerably following last year's model improvements. In the first half of 1983, registrations in Germany were up by a two or even three-digit percentage over last year's figures. In all, more than 200,000 7 Series have been produced and sold since 1977, while production and sales of the BMW coupés amount to approximately 50,000 units since 1976.

Given the positive response from customers so far as well as the growing purchaser potential for compact and high-performance cars all over the world, BMW is confident in estimating a substantial future demand for BMW cars and the capacities required far beyond the year 1983. An expression of this positive outlook is BMW's decision to build a new car factory in the Regensburg area.

BMW IN FIGURES

1st half 1983

			January to June 1983	1982	Change in %
Sales					
BMW Group	(worldwide)	DM million	6,894.5	5,956.2	+ 15.8
BMW AG	Overall	DM million	5,755.3	4,794.7	+ 20.0
	Germany	DM million	2,364.9	1,851.2	+ 27.7
	Exports	DM million	3,390.4	2,943.5	+ 15.2
Production					
Cars		units	210,683	199,967	+ 5.4
Motorcycles		units	14,706	17,659	- 16.7
Car sales					
Overall		units	215,320	201,690	+ 6.8
Germany		units	84,536	68,464	+ 23.5
Exports		units	130,784	133,226	- 1.8
Motorcycles sales					
Overall		units	14,913	17,813	- 16.3
Germany		units	5,619	7,701	- 27.0
Exports		units	9,294	10,112	- 8.1
Workforce on 30 June					
BMW Group	(worldwide)		48,206	45,426	+ 6.1
BMW AG			41,552	39,427	+ 5.4