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BMW AG Presse

Programm '93

Bayerische Motoren Werke
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SUMMARY OF BMW's INNOVATIONS FOR THE 1993 MODEL YEAR

The new K 1100 RS, the Boxer engine of the future, and the unique C 1

Today, tomorrow and the day after tomorrow - this might be the motto applicable to the three most important motorcycle innovations BMW is introducing in the 1993 model year, all of which will be making their world debut at the International Cologne Bicycle and Motorcycle Show in autumn 1992.

The new K 1100 RS is entering the market today, that is before the end of this year. Tomorrow - that is next year - BMW will be launching an all-new generation of motorcycles still secret today. As a kind of sneak preview, however, the new four-valve Boxer engine will already be on display at the 1992 International Bicycle and Motorcycle Show. Representing the day after tomorrow - and you might indeed call it a vision for the year 2000 - there is the BMW C 1, a design study of a new means of transport for the future intended to preserve our mobility on the road.

The new K 1100 RS: Facelift and extra power for BMW's successful sports tourer

Almost exactly one year after the launch of the K 1100 LT, the successor to BMW's very popular K 100 RS sports tourer now comes with a new engine: The ultra-dynamic 1100-cc power unit of the K 1100 LT luxury tourer is replacing the 1000-cc four-valve engine of the K 1, giving the new model a new name - the K 1100 RS. While the K 1100 RS develops the same maximum output as its predecessor (100 bhp or 74 kW), this power is now avail-

able at 7500 rpm instead of 8000 rpm as in the past. In addition, the increase in engine capacity boosts maximum torque from 100 Nm or 74 ft/lb at 6750 rpm to 107 Nm or 79 ft/lb at 5500 rpm.

The K 1100 RS also looks quite different at first sight: Blending style with elegance, the almost classic upper section of the fairing is now supplemented by new side panels and an engine spoiler. Together with the new battery panels, this creates an - almost - new, highly attractive appearance, at the same time providing even better protection from wind and weather around the rider's and passenger's legs.

The suspension has also been modified to match the new fairing and engine features, the Marzocchi telescopic fork and Showa spring strut on the rear wheel being re-tuned for perfect smoothness and behaviour on the road. To ensure even better riding stability, the entire frame is reinforced by v-shaped tie-bars on the handle-bar centre point and the rear support rod.

In a nutshell, therefore, the K 1100 RS combines brand-new looks with even more power and riding stability. Which, as the bottom line, means even better all-round riding qualities.

The world's one and only sports tourer
available as an option with ABS and catalytic converter

The K 1100 RS is the world's only sports tourer currently available as an option with ABS (like all BMW K models) and fully controlled catalytic converter (as on all K 100 models).

Celebrating 70 years of BMW motorcycles: A new generation of Boxer machines

Although the technical details have been kept secret so far, the fact as such is not a secret that in 1993, the 70th year of BMW motorcycles, BMW will be launching an all-new generation of Boxer machines. On the occasion of the Cologne Bicycle and Motorcycle Show BMW will already be revealing part of this fascinating secret to the motorcycle world, presenting the engine of the new Boxer on the occasion of this largest and most important motorcycle exhibition.

BMW's new Boxer engine: Combining a proven concept with the most advanced technology

The new power unit is based on the technical concept of the R 32 Boxer which has proven its merits since 1923, when becoming BMW's first-ever motorcycle to see the light of day. In other words, the new engine comes with all the inherent fortes of the flat-twin design concept, such as very good compensation of moving parts and masses, air cooling, direct drive, ease of maintenance, as well as the practical benefits provided in this way, such as superior reliability, robust design, and high torque at low engine speeds.

Like BMW's new generation of motorcycles with the internal development code R 259, the new Boxer engine nevertheless reflects the state of the art in motorcycle technology in every respect.

90 bhp from 1100 cc

The air- and oil-cooled four-valve power unit displaces 1100 cc, churns out a superior 90 bhp (66 kW) at 7200 rpm, and develops a maximum torque of 95 Nm (70 ft/lb) at 5500 rpm. For comparison, the two-valve Boxer engine of the R 100 R has a capacity of 1000 cc, a maximum output of 60 bhp (44 kW) at 6500 rpm, and a peak torque of 76 Nm (56 ft/lb) at 3750 rpm.

New valve control

To keep the Boxer engine as slender as possible, in this way allowing the new Boxer motorcycle to be ridden at very low angles in bends, and to provide air cooling to the valve outlets with additional oil cooling for extra efficiency, BMW's engineers have opted for a new kind of valve control on the new engine: There is a separate camshaft in the right and left-hand cylinder head not above, but rather next to the valves, each of these two camshafts being driven by a chain from a central lay-shaft. The valves themselves are then driven via cup tappets, push rods and rocker arms.

Meeting the requirements of the future:
Motronic, fully-controlled catalytic converter, and ABS

BMW's new Boxer reflects the state of the art not only in terms of output, performance, torque and free-revving riding characteristics, but also when it comes to fuel economy, noise and emission control, where again the engine meets all the requirements of the future. It therefore almost goes without saying that the new Boxer

features Digital Motor Electronics 2 (Motronic), a unique technology so far exclusive worldwide to BMW's K 100 models, and, as an option, a fully controlled catalytic converter. Like all BMW K models, the new Boxer generation will also come with ABS for extra safety on the road.

A new concept throughout: BMW's new Boxer

Like the new Boxer engine, BMW's new Boxer motorcycle whose other technical details are to remain secret until 1993, is a genuine expression of a new philosophy. It is a motorcycle perfectly attuned to our new age - a successful combination of rational and emotional features, of common sense and riding pleasure. In simple terms, it is once again a genuine BMW conceived, designed and built for sheer riding pleasure wherever you go.

A synthesis of car and motorcycle as a means of transport for the future

The BMW C 1 design study

Looking for new solutions to preserve mankind's mobility on the road, BMW is focusing not only on new traffic concepts such as the Cooperative Transport Management or Blue Zone projects, but also on an all-new means of transport for the future. Now, on the occasion of the 1992 Cologne Bicycle and Motorcycle Show, BMW has developed a truly revolutionary design study for the future: the C 1.

Common sense and fun all in one

The BMW C 1 is a joint development by BMW Technik GmbH, which provided the idea and concept, and BMW Motorrad GmbH responsible for the actual design and ergonomic features of this new machine.

The C 1 attempts to combine the advantages of car and motorcycle in one synthesis, at the same time eliminating their disadvantages as far as possible. To put it in a nutshell, you might define the C 1 as an exceptionally agile, environmentally oriented and economical vehicle able to save a lot of space, providing reasonable protection from wind and weather as well as active and passive safety, and at the same time still offering lots of riding pleasure despite its common sense and rational concept.

Safety

One of the primary objectives in developing the C 1 was to give the rider the same kind of safety as in a car, without forfeiting the advantages of a single-track vehicle.

The objective to provide superior passive safety has been achieved by giving the C 1 a special frame made of extruded aluminium profiles surrounding both the rider's seat and the front and rear wheel. Further protection is afforded to the rider by a rollover bar, the entire concept thus providing crumple zones helping to minimise the risk of injury in an accident.

In providing this new concept BMW Technic GmbH has been able to draw from its experience in the design of the E 1 electric car. In simulated computer tests, therefore, the C 1 fulfills front-crash safety standards fully in line with US requirements. The rider's seat designed for optimum ergonomic comfort comes with four-anchor safety belts, the handlebar is individually adjustable. To enhance active safety to the highest possible standard, the C 1 naturally comes with ABS anti-lock brakes.

Ample protection from wind and weather plus lots of storage space

Fully enclosed in longitudinal direction, the cabin made of a special transparent material at the front and top offers good protection from wind and weather. The storage compartment behind the rider's seat has a capacity of approximately 50 litres or 1.75 cu ft.

Drive system

The C 1 might be driven by a single-cylinder four-stroke power unit displacing at least 250 cc or a two-stroke engine with a displacement of 125 cc. Engine noise can be reduced to a minimum by full encapsulation of the drive system beneath the rider's seat. Again, it is only natural that the engine comes complete with catalytic converter.

A new concept for preserving man's mobility

The BMW C 1 does not claim to solve all transport problems in one go. As mentioned, it is a design study, a kind of new vision for further deliberation in future. And it is a rendition of a new means of transport serving one purpose in particular: To maintain man's mobility in an increasingly congested world, in this way preserving an important part of the freedom we all enjoy in life.

Other innovations for the 1993 model year

Hailing the advent of the 1993 model year, BMW is supplementing the best-selling R 100 R by a new, somewhat smaller roadster: the R 80 R. With the exception of the oil cooler not required for the 800-cc power unit, this new machine offers all the features of the R 100 R in virtually every respect.

A further innovation concerns the K 75 RT, which is now available as an option with the electrically adjustable windshield of the K 1100 LT.

FROM THE R 32 TO THE R 259

70 years of Boxer history at BMW
A dynamic past with a great future

Bayerische Motoren Werke was established in 1916, initially concentrating on the production of aircraft engines. The history of BMW as a manufacturer of road-going vehicles - and today BMW is the only manufacturer of both cars and motorcycles in the Western hemisphere - began in 1923 on two wheels. The car only followed in 1928, meaning that in 1993 BMW motorcycles are celebrating their 70th anniversary.

The first motorcycle with the white-and-blue stylised propeller on the tank was the R 32 launched at the 1923 Paris Motor Show. The great-grandfather of all BMW motorcycles, the R 32 featured a 500-cc two-cylinder power unit developing 8.5 bhp later to become world famous as the BMW Boxer. The name "Boxer", incidentally, comes from the simple fact that the two pistons "punch" against each other, like fighters in a ring.

Max Friz and his ingenious idea

In creating the R 32, Max Friz, BMW's chief designer, introduced an ingenious idea: Instead of fitting the two-cylinder Boxer longitudinally into the frame, he installed the engine in flat, transverse arrangement to the direction of travel, placing it within an extra-strong double-tube steel frame and connecting it via a direct drive shaft to the rear wheel.

The particular advantages of this concept were obvious from the beginning:

- The Boxer is the only two-cylinder engine able to offer very good compensation of masses and moving forces without requiring an equalisation shaft. Accordingly, the engine does not suffer from any unsmoothness otherwise caused by free first- and second-order mass forces.
- Intentionally exposed to the flow of air, the cylinders have optimum air cooling, avoiding the need to use a water cooling system and thus saving both weight and the extra parts otherwise required.
- Fitted longitudinally, the crankshaft provides a direct flow of power to the adjacent gearbox, from where drive force is further transmitted without any power-consuming pivots or joints through an easy-to-service propeller shaft straight to the rear wheel.
- The flat arrangement of the cylinders provides a low centre of gravity beneficial to the motorcycle's handling on the road.
- With all parts and components of the engine being very easily accessible from virtually all sides, service is very easy and efficient.
- The entire drive unit of the R 32 was simple in design and very compact, all sensitive components being protected by full encapsulation of the engine.

Robust and reliable

This new concept provided two virtues in particular, which riders and engineers alike could only dream of at the time: robustness and reliability. And it was no coincidence that Max Friz, the "father" of the BMW Boxer, was out to reach these objectives first and foremost - after all, he had previously spent all his time working on aircraft engines.

The concept of the R 32 as a guarantee for ongoing success

All BMW Boxers built to this very day have followed in the footsteps of the concept introduced for the R 32. In all, this means more than 650,000 machines with over 60 different models and variants ranging from 450 to 1000 cc. And from 1925 to 1966 there were also some 230,000 single-cylinder machines with an engine capacity between 200 and 400 cc.

Successful coexistence of the Boxer and K-generation

In 1983 BMW moved over from the Boxer-only strategy to a dual product strategy, successfully launching the K Series as an entirely new generation of motorcycles. In terms of its concept, the patented BMW Compact Drive System featured for the first time on the K 75 and K 100 models with their liquid-cooled three- and four-cylinder power units fitted in flat, longitudinal arrangement, was just as unique as the Boxer engine, while again providing the essential advantages of BMW's two cylinder through the low centre of gravity, direct drive, torque-oriented performance, and convenient access for exceptional ease of service. Total production of K models so far amounts to approximately 160,000 units.

However, even these more modern and far more powerful models never meant the end of the road for the Boxer. On the contrary - the R Series and K Series have developed a successful coexistence in the meantime, both concepts benefitting from one another. This is also why the Boxer's share in BMW's overall motorcycle production has remained consistently between 40 and 50 per cent in recent years.

The BMW Boxer writes motorcycle history

BMW's indefatigable Boxer can now look back at an exciting history of almost 70 years - a period in which this unique machine has written motorcycle history itself. The BMW Boxer was one of the first reliable means of transport on two wheels. It was the subject of research and ongoing development for numerous engineers and pioneers, broke the world speed record time and again, and has scored innumerable successes in motor racing. It made the post-war generation mobile and has become the No 1 police motorcycle the world over.

On the occasion of its 60th birthday in 1983, the BMW Boxer gave itself the most wonderful present when winning the Paris-Dakar Rally the second time (out of a total of four wins). Once again, it showed greater endurance than all its competitors in the treacherous deserts of Africa.

BMW is the Boxer - the Boxer is BMW

Riding the Boxer, great men have become famous the world over - men such as Ernst Jakob Henne, Schorsch Meier, Hubert Auriol or Gaston Rahier. The inimitable blend of history, heritage and unmistakable character has indeed made the BMW Boxer a legend in its own time; many already refer to the Boxer as nothing less than a myth. The truth of the matter certainly is that BMW and the Boxer now represent a symbiosis of make and product: BMW is the Boxer - the Boxer is BMW. One can rightly claim that the Boxer has more "soul" than any other BMW vehicle on two and four wheels. It is one of the most important roots of BMW's image and heritage.

Forever young

The BMW Boxer has not only outlived nearly all European and German motorcycle manufacturers, but is still extremely popular today - a machine which is truly forever young in every respect. As an example, the off-road GS models have been absolute best-sellers in recent years, particularly in Germany. And the most recent "conventional" Boxer, the classic R 100 R, has already been sold about 4,000 times in 1992 in the German market alone, thus becoming BMW's best-selling individual model ever since the R 45 in 1980. One of every four machines coming off the production lines at BMW's Berlin factory in 1992 is an R 100 R, every second motorcycle produced being a Boxer.

A centennial event in the history of BMW
The birth of a new Boxer generation in 1993

While the BMW Boxer looks back at a great heritage and an equally strong position in today's market, its future has already begun. For it is no secret that under the internal development code R 259 BMW is working on an all-new generation of Boxer motorcycles. Scheduled for introduction in 1993, these new machines will certainly mark a centennial event in the history of BMW motorcycles.

Following the launch of the R 32 in 1923 and the K models in 1983, BMW is now presenting an entirely new generation of motorcycles for the third time. While all Boxer machines introduced in the past were further developments of their predecessors, the R 259 generation comes from a clean sheet of paper in every respect, having been designed as an all-new machine from the ground up by BMW's Motorcycle Development Division.

Combining a proven concept with up-to-date technology

The new Boxer as an expression of a new philosophy

BMW's fundamental principle in business has always been action, not actionism. Accordingly, the new Boxer generation combines the best of two worlds: On the one hand it is based on BMW's proven technical concept and traditional philosophy, featuring all the well-known strengths of the Boxer such as reliability, robust design, unique character, ease of service, and lasting value. On the other hand, however, BMW's new Boxer generation also represents the latest state of the art in motorcycle technology, for example when it comes to performance and the running gear. And not least, this new generation of Boxers by BMW guarantees the future of the motorcycle in its ability to meet the strictest demands in terms of the environment and road safety. Just one example in this context is the reduction of noise, fuel consumption and exhaust emissions, the new Boxer naturally coming with innovations such as four-valve technology, Digital Motor Electronics, and, as an option, fully controlled catalytic converter and ABS, just like BMW's K 100 Series.

It is therefore quite appropriate to regard BMW's new Boxer as the expression of a new spirit. It is a motorcycle attuned to a new age - a successful blend of rational and emotional features, of common sense and riding pleasure. In a nutshell, it is once again a genuine BMW designed and built for the joy of motoring.

Prior to the official launch in 1993:
The presentation of the new Boxer engine

Prior to the official launch of the new Boxer generation in 1993, BMW has decided to partly remove the shrouds of mystery, presenting the "heart" of the new Boxer at the International Cologne Bicycle and Motorcycle Show in autumn 1992: the engine of the R 259.

Planning from a clean sheet of paper

Shortly after the successful introduction of the K 75, BMW's motorcycle managers and engineers started considering in the mid-eighties what an all-new BMW Boxer for the future should look like. And naturally, this also meant an all-new engine.

Even if it's a Boxer, an entirely new engine at BMW means planning and designing every detail from a clean sheet of paper - you might say developing everything from the ground up. The engineers and technicians follow the guidelines provided by the development specialists, the marketing and sales experts, as well as the standards set by the competition, by BMW's own experience and the official rules and regulations to be observed. And at the same time all these specifications and requirements have to be constantly updated to reflect the latest demands and customer expectations.

One point obvious from the very beginning was that the new Boxer was to offer more power and torque than its predecessor. Accordingly, there was no doubt that it had to have four - and no longer two - valves per cylinder. Top priority was also given to the improvement of fuel economy, the minimisation of exhaust emissions and engine noise, as well as the ease of maintenance offered by the new machine.

90 bhp from 1100 cc

The new, air- and oil-cooled Boxer comes with impressive specifications: 1100 cc capacity, 90 bhp (66 kW) at 7200 rpm, maximum torque 95 Nm (70 ft/lb) at 5500 rpm.

A DETAILED LOOK AT THE NEW BOXER ENGINE TECHNOLOGY
GRAPHS AND SPECIFICATIONS

Engine design and configuration

The engine housing

The engine housing consists of two cast aluminium shells joined together in the middle. BMW's engineers decided quite deliberately not to use a single-piece tunnel housing as on the old Boxers, since the two shells can be cast economically and with maximum efficiency.

The shells are almost identical, the only difference being that on the right side there is a flange for the oil pressure check valve, while the oil level inspection window is on the left. The two shells are sealed by an elastic, silicon-based compound offering the advantage of being temperature-resistant and easy to remove. The oil sump is integrated into the two halves of the two-piece shell housing and has a capacity of approximately 4.5 litres or 1 Imp gal.

Drive unit with load-bearing function

Opting for the design just described, BMW's engineers have ruled out the possible problem of oil leakage, which might present itself if the oil sump were simply connected to the engine block. Similarly, the responsible engineers decided not to use the time-consuming chill-casting procedure with sand moulds, since the middle-pressure aluminium casting process used in this case serves to substantially reduce the reject rate.

With the drive unit being the motorcycle's main load-bearing component - you might even call it the motorcycle's "backbone" - the engine and transmission components have been designed for optimum strength and rigidity with the help of the computer-based finite-element method (FEM).

The front end of the engine is sealed off by the alternator cover made of pressure-cast light alloy and housing the alternator itself driven by a poly-V-belt. Another cover then comes right at the end, integrating the engine and alternator and forming the final section at the front.

Four valves per cylinder it had to be!

With the engine being required to fulfill demanding standards, there was no doubt from the very beginning that only a four-valve power unit would be able to provide the superior performance, emission management and fuel economy taken for granted in this case. Accordingly, two intake valves in each cylinder guarantee an optimum cylinder charge and fuel/air flow.

Thanks to the symmetrical arrangement of the two outlet valves, the spark plugs with their three electrodes have ample room in the middle of the cylinder head. Featuring specially contoured pressure edges at the sides, the roof-shaped combustion chambers are extremely compact.

Through its very design, a four-valve power unit offers far more output and torque than a two-valve engine. Providing a better cylinder charge, a four-valve engine capitalises on the energy yield provided by the fuel, thus helping to maximise engine output or, alternatively, reduce fuel consumption for the same output.

Three- or five-valve power units cannot do the trick

A three-valve engine is not able to offer these advantages - and tests carried out by BMW with five-valve cylinder heads also failed to provide any benefits worth mentioning. Almost inevitably, therefore, the final choice was a cylinder head with two intake and two outlet valves.

Oil cooling along the cylinders between the outlet valves

To ensure optimum cooling particularly of the hot exhaust section, the outlet valves in the cylinder head are tilted to the front in the direction of travel, thus having the full benefit of the air flowing around the cylinders. For even greater efficiency, the cylinder bank developing temperatures up to 300°C (570°F) is cooled by oil flowing between the two outlet valves.

Longer adjustment intervals

The advantage of this additional oil cooling is that both the valves and valve seat rings now have a much longer service life. In addition, the intervals between valve adjustment are up from 7500 to 10000 km. To avoid coking along the hot cooling ducts after switching off the engine, the ducts are designed to remain filled with cooling oil at all times.

Thanks to this efficient combination of air and oil cooling, the engine is far more resistant to high temperatures and hot weather, runs more quietly, and offers an even longer service life.

New valve control keeping the engine slender and compact in design

Since the valve control system used on the former Boxer (featuring a central camshaft, tappets, very long push rods and rocker arms) would have been quite unsuitable for a four-valve power unit on account of its inadequate strength and stiffness, BMW's engineers had to take a new approach in designing the valve drive system.

Classic valve drive systems with one overhead camshaft (OHC) or a double overhead camshaft (DOHC) and cup tappets, as used on BMW's K Series engines, had to be ruled out from the start since they would have increased the width of the Boxer engine by approximately 4 centimetres, in this way making it quite impossible for the rider to take bends at an angle of up to 49°, as required by BMW's specifications. A further drawback is that a valve control system of this kind would have made it impossible to air-cool the outlet section of the engine.

A vertical drive shaft, in turn, would have been too elaborate, difficult to service and expensive. Accordingly, BMW's engineers eventually opted for the following solution:

One auxiliary shaft and a separate camshaft on either side

Via a chain, an auxiliary shaft with a reduced ratio of 2:1 is driven directly from the crankshaft. Located deep within the engine beneath the crankshaft, this auxiliary shaft running at half the crankshaft speed incorporates a further chain on either side driving the respective camshafts running within the right and left-hand cylinder heads at the back next to the inlet valves.

The decision to use chains for this purpose was based on their strength and endurance, the precision a chain is able to offer and, in particular, the slim, compact design of such a drive chain taking up very little space.

While the use of an auxiliary shaft may appear to be a kind of "detour", the advantage in this case is that the sprocket within the cylinder head is smaller than usual and therefore keeps the cylinder head slender (although even so, space within the cylinder head is very limited). A light-alloy sub-frame is bolted directly to the cylinder head to accommodate the valve drive.

The camshaft: a steel structure with sintered cams

The camshaft and rocker arms run directly on the sub-frame. Contrary to the conventional design, the camshaft is no longer made in one single piece - instead, the cams are sintered and forced on to the specially hardened and heat-treated steel shaft.

Working against the cup tappets, the rotating cams transmit the forces converted from a rotary to an up-and-down motion via push rods to the forged rocker arms. The rocker arms, in turn, transmit this drive force to the valves to be opened with a pressure of 27 kg or 59 1/2 lb. They also feature adjustment bolts for the pivoting slides driving the valves in pairs.

The engine even looks dynamic

This special valve control system sometimes referred to as a high-camshaft design offers yet another advantage with the new Boxer: It makes the engine look particularly dynamic with its wedge-shaped cylinder heads pointing downwards like an arrow.

The cylinder cooling fins - unconventional in every respect

The two typical Boxer cylinders sticking out at the sides are made of cast light alloy. To obtain a larger outside surface and thus to dissipate heat more efficiently, they have cooling fins on the outside specially

designed to avoid the usual hissing noise such fins often cause on other motorcycles. As a further feature, the fins are reinforced by connection pieces obviating the need to subsequently instal rubber silencing blocks. The fins and connection pieces are as long as necessary to provide optimum heat dissipation, at the same time preventing vibrations and eigenfrequencies otherwise audible as a distinct noise around the engine.

Friction reduced to a minimum inside the cylinders

Inside, the cylinders are finished with a high-strength, low-wear, extra-smooth layer of Gilnisil, a special nickel silicon lining ("Gil" stands for the manufacturer, the Italian company Gilardoni) minimising frictional losses on metal surfaces running against each other. Further advantages of this design are minimum oil consumption, high strength and stability also at high speeds and, as a result, a long running life.

Modern piston design

Each featuring three piston rings (one for removing the oil, two for compression and sealing), the two pistons are made of cast light alloy. Measuring 99 mm (3.9") in diameter, the pistons weigh almost a third less than the former pistons in the old Boxer. This slim design reduces mass forces and allows higher running speeds, a pleasant side-effect being the reduction of vibrations.

The low weight of the pistons also results from their modern sectional structure with a much shorter piston skirt. While the piston pin used to be supported by a reinforced skirt, the new pin reduced in length is held in position by two fins.

Sintered connecting rods for less vibration

The connecting rods link the pistons with the crankshaft and are made of sintered and forged steel with BMW's new R 259 power unit. Compared with the old steel conrods merely forged but not sintered, the new conrods have much more accurate dimensions, a better surface contour and, quite generally, a higher standard of quality at the surface. Precisely this gives the connecting rods one of their main advantages, sintered conrods having virtually exactly the same weight following production, without any deviation from one rod to another. While the old steel connecting rods had to be subsequently machined and then categorised in 7 weight groups, the new far more precisely manufactured sintered rods all come in one and the same weight group. Thanks to this almost perfect balance of weight from one connecting rod to the other, the counterweights on the crankshaft ensure optimum compensation of all mass forces.

A world innovation in motorcycle technology: the intentionally fractured conrod boss

The connecting rods of the new Boxer are made with the fracture or crack technology introduced for the first time on BMW cars. Accordingly, this is the first time in the history of motorcycle engine production that the large conrod boss encompassing the crankshaft is intentionally fractured and not simply sawn in half.

The advantage is that the two surfaces along this intentional fracture fit together perfectly when subsequently re-joined.

Indeed, when subsequently bolted together the fracture lines provided by this cracking technology form a larger

common surface with even better alignment of the two halves than with a sawn conrod. Unlike the former design, there is no need for adjustment pins or bolts to provide a perfect fit. The substantial advantages of this new crack technology are therefore greater precision, a better fit, lower weight, quicker machining, and easier fitting.

The crankshaft running in two bearings

Representing the "heart" of the new engine, the crankshaft is made of one piece of top-quality heat-treated steel and runs in two slide bearings, the rear bearing being of double collar design. The advantage in the event of repairs is that there is no need for time-consuming alignment of the bearing and crankshaft.

BMW's engineers deliberately decided to do without a third crankshaft bearing, since this would have required the two pistons opposite each other to be moved too far to the side.

The crankshaft drives the alternator and the layshaft controlling the valves and the two oil pumps, and extends directly into the five-speed gearbox.

Lubrication

The two inner-serrated oil pumps are housed in a separate unit at the front end of the layshaft - the cooling oil pump at the front, the lubrication oil pump at the rear. The circulation of lubricant is controlled by a pressure valve fitted directly behind the pump, compressed oil first flowing through the oil filter and then up to the distributor chamber with its various ducts and connection pipes. Here, in the pre-cast main

oil duct, the lubricant flows past the oil pressure switch and is siphoned off for lubricating the layshaft bearings and left-hand cylinder head.

Another duct inside the chamber leads to the front and rear main bearings for the crankshaft. One hole is sufficient in each bearing to ensure ample lubrication. From the main bearings of the crankshaft the oil flows through additional ducts to the conrod bearings also requiring lubrication. To lubricate the cylinder head on the right-hand side, oil is siphoned off through a set bolt duct from the main oil stream, flowing to the rear main crankshaft bearing and then being forced through the control sub-frame into the hollow-drilled rocker arms and camshaft. The cup tappets are lubricated by splash oil.

Circulation of cooling oil

The cooling oil pump has an open circuit, its task being to turn around as much oil as possible and circulate it into the system. Accordingly, the cooling oil pump is a volume-, and not a pressure pump.

Flowing through a distributor pipe, the cooling oil is fed into the drilled riser pipes of both cylinders and flows to the cylinder heads. In the cooling duct itself the oil flows round the outlet valve seat rings and from there runs back into the housing, where the two oil streams from the right- and left-hand cylinder meet once again. The reflow pipe enters the housing on the left-hand side below the surface of the oil.

Bleeding the engine housing and "washing" the oil in the interest of a clean environment

Efficient extraction of air from the crankcase is essential to engine performance and helps to minimise oil consumption while extending the intervals from one oil change to another. The process of bleeding air efficiently from the housing is necessary because pistons moving up and down might also be regarded as a kind of pump. Each time the pistons move down to their bottom dead centre, either on the intake or compression stroke, the air in the housing beneath the pistons is forced out. This air is enriched by blowby gases - exhaust gases forced into the crankcase between the walls of the cylinders and the pistons and past the compression rings.

This exhaust gas is contaminated by oil residues which have to be collected and removed. This, in turn, is done first by a labyrinth integrated in the crankcase and then by an external oil separator further downstream, where even the last traces of oil contained in the exhaust gas are retained. Oil particles in the blowby gas oil mist impinge on the walls of the cyclone separator and are removed from the gas by means of centrifugal forces.

The oil "washed" in this way flows back into the engine through an external pipe leading out of the oil separator. The gas is fed into the intake silencer from where - mixed with fresh air - it flows back into the combustion chambers. This sophisticated design minimises oil consumption throughout the engine's entire running life and therefore makes an important contribution to the cause of environmental protection.

Intake system

Through a snorkel beneath the tank, fresh air is drawn into the intake system air chamber, where it is cleaned by a paper filter. From the pure air chamber downstream of the filter, the air then flows on through two specially designed intake manifolds via the intake valves into the two combustion chambers. In their length and shape, the intake manifolds are designed to provide superior output and an optimum torque curve thanks to the resonance within the intake system.

Digital Motor Electronics

To further enhance engine output and torque while at the same time reducing fuel consumption and exhaust emissions, it was obviously necessary from the start to equip the engine with an electronic management system. Indeed, this proved to be quite an easy task, BMW's engineers resorting to the Digital Motor Electronics (Bosch Motronic) already featured in the K Series.

Compared with the old Boxer fitted with two Bing carburettors, the advantages of the new R 259 engine with electronic fuel injection are obvious:

- Improved performance thanks to the special design of the intake system
- Better engine response ensured by the significant reduction of flow losses within the intake manifold
- Superior economy and reduction of fuel consumption: whenever the throttle butterfly is closed and when the engine is in overrun above 2000 rpm, the supply of fuel is totally interrupted
- Grid control for extra smoothness and refinement

- Superior ease of service provided by a diagnostic chip memorising any defects subsequently read out by the BMW Diagnostic Tester
- Superior reliability and failsafe functions built into the Motronic system, allowing further - albeit restricted - operation of the engine in the event of a deficiency
- Absolutely no wear in the case of electronic systems
- Ideal conditions for using a fully controlled catalytic converter

Motronic and its systems

The fuel supply system

Housed in the fuel tank, the electric fuel pump conveys fuel to the electromagnetic injection valves within the throttle butterfly manifold, a pressure regulator keeping the pressure required for the injection process consistent. Fuel is discharged into the two intake manifolds through the two electronically controlled intake valves. It is injected intermittently, ie, once every rotation of the crankshaft simultaneously into the two intake manifolds. The compression ratio of 10.7:1 requires unleaded premium fuel (95 ROM).

The ignition

The ignition system consists of the terminal stage and coils. The ignition angle specified by the control unit is communicated by the system as a high-voltage pulse to the two spark plugs.

The control unit and sensors

The sensors determine the engine's current operating conditions, the information obtained in this way being fed into the control unit where it is compared with the data stored in the CPU's (Central Processing Unit's) EPROM. This comparison of data shows the examt amount of fuel required and the duration of the injection period.

The supply of data to the Motronic engine management system

The following sensors serve to supply the data required to the Motronic Central Processing Unit:

- **Throttle butterfly angle**

  To determine the engine's current load conditions, throttle butterfly angle alpha is measured by a potentiometer located on the throttle butterfly shaft and serving to determine dynamic driving conditions, ie, any change in the position of the throttle butterfly. Applying the throttle butterfly angle and speed signals, the Motronic then determines the basic data for the ignition angle and injection period subsequently adjusted by additional consideration of the intake air and engine oil temperature.

- **Engine speed**

  Two Hall detectors on the crankcase also serve as sensors providing data to the Motronic management system. They incorporate two magnets determining the rotational speed of the crankshaft without direct contact.

- **Intake air temperature**

  The temperature of the fresh intake air is measured in

the air filter housing, the sensor changing its electrical resistance as a function of temperature.

- **Oil temperature**
  The oil temperature sensor is fitted at the outlet from the cooling oil circuit to the oil cooler itself. It records the information required and passes on this information to the Motronic control unit and - if fitted - to the oil temperature gauge.

- **Air pressure**
  The air pressure sensor - a pressure socket incorporating a diaphragm measuring air pressure on a piezo-crystal via a vacuum - measures ambient air pressure and thus makes any adjustments required for the elevation at which the motorcycle is travelling. This system is only required, however, on models with a "simple" catalytic converter without electronic control, since the oxygen sensor takes over this function on machines fitted with a fully controlled three-way catalytic converter.

Three-way catalytic converter

BMW was the first manufacturer in the world to build motorcycles with a fully controlled three-way catalytic converter (these were the K 100 Series). Now Bayerische Motoren Werke is continuing this active policy of protecting the environment with the new Boxer, the three-way catalytic converter being the most efficient emission control system available today. The process of conversion, reduction and oxidation is however only possible as long as the lambda 1 engine data are strictly observed.

This stochiometric ratio between the amount of fuel actually supplied and the amount of fuel theoretically required is based on an air:fuel mixture of 14:1. To maintain this mixture regardless of running conditions, the oxygen sensor (simetimes also referred to as the lambda probe) measures the amount of oxygen in the exhaust gas emitted by the engine.

Oxygen sensor fitted in front of the catalytic converter

On the engine of the R 259 the oxygen sensor is fitted upstream of the catalytic converter (while on the K 100 models it is downstream of the converter) and is therefore activated quickly and efficiently. The optimum operating temperature of the ceramic probe is 600°C or 1112°F, temperatures in the region of 300°C ensuring that the sensor will be activated within seconds. To provide an even faster response, the sensor is heated by a 12 W heating system.

Immediately after the engine has been started, the oxygen sensor is switched off until the engine reaches its normal operating temperature, the fuel/air mixture being enriched in this start or warm-up phase in order to make the engine run smoothly. When the engine is in this operating condition, engine speed is increased by the choke adjusting the position of the throttle butterfly. As soon as the engine has reached its normal operating temperature, this assistance is of course no longer required.

Fuel enrichment when accelerating

The oxygen sensor control system is also deactivated whenever the engine is enriched during acceleration. This is essential in order to compensate for the leaner

fuel/air mixture during acceleration, in this way allowing the engine to run smoothly and without jolts.

Monitoring the throttle butterfly angle, the rate at which the throttle butterfly angle changes, the absolute change of angle, engine temperature and engine speed, the computer is able to determine any sudden need for power. A quick turn of the gas handle by the rider, therefore, means a complicated calculation process within the computer.

To obtain spontaneous engine power all the same without the slightest delay, the injection period required by the electronic control system is "bridged" by short, interim bursts of fuel enriching the mixture injected. This power enhancement process starts immediately after any change in engine load.

Overrun control to reduce fuel consumption

Overrun control serves to reduce both emissions and fuel consumption. It is activated at engine speeds above 2000 rpm, as long as the throttle butterfly is closed.

To avoid engine damage the injection signals are interrupted as of approximately 8000 rpm, such speed governing function reliably ensuring that the engine will not be over-revved.

The catalytic converter is recyclable

The three-way catalytic converter used on the new engine is already well known from the K 100 Series, the precious metals required for oxidation (platinum and palladium) as well as reduction (rhodium) being applied

to a metal substrate. As is generally known, oxidation converts carbon monoxides into carbon dioxide, and hydrocarbons into carbon dioxide and water. The withdrawal of oxygen then allows the breakdown of nitric oxides into nitrogen and carbon dioxide.

Compared with a ceramic-based catalytic converter, the metallic converter offers advantages in terms of both space and time: it is smaller and responds more quickly, since the metal substrate is more efficient in absorbing the heat from the exhaust gas.

The catalytic converters are recyclable and are taken back after their service life by BMW workshops.

Catalytic converter available as an option and retrofittable

The fully controlled three-way catalytic converter is available as an option. The engine also comes in an additional version prepared for subsequent installation of the catalytic converter, meaning that all technical modifications have already been made for retrofitting the fully controlled catalytic converter relatively easily.

Stainless-steel exhaust system

Made completely of stainless steel, the exhaust system is extremely resistant to corrosion. The two manifolds are designed as a resonance pipe for the exhaust gases, providing maximum torque and output. They come together upstream of the silencer.

On models fitted with a fully controlled three-way catalytic converter, the oxygen sensor is located directly at the point leading into the silencer, thus ensuring maximum efficiency.

In the standard version of the silencer with a volume of 10 litres or 0.35 cu ft, the exhaust gas flows through an intake pipe with a special absorber. On the catalytic converter model this absorber is replaced by the metallic substrate.

The rear end of the exhaust system identical on both models houses the tail muffler in reflection design. Through its configuration the silencer allows the motorcycle to outperform current noise emission limits and comply with future standards, without forfeiting any power in the process. Measured according to the ECE standard, the new engine develops a noise level of 79 dBA, the current limit being 82 dBA, the new standard from October 1993 80 dBA. (An increase by 6 dBA means that the noise pressure level is doubled - and vice versa.)

The clutch

The clutch is a single-plate dry clutch with the lowest possible inertia for a smooth and easy gearshift. Made of metal plate, the flywheel incorporates the starter gear.

The gearbox

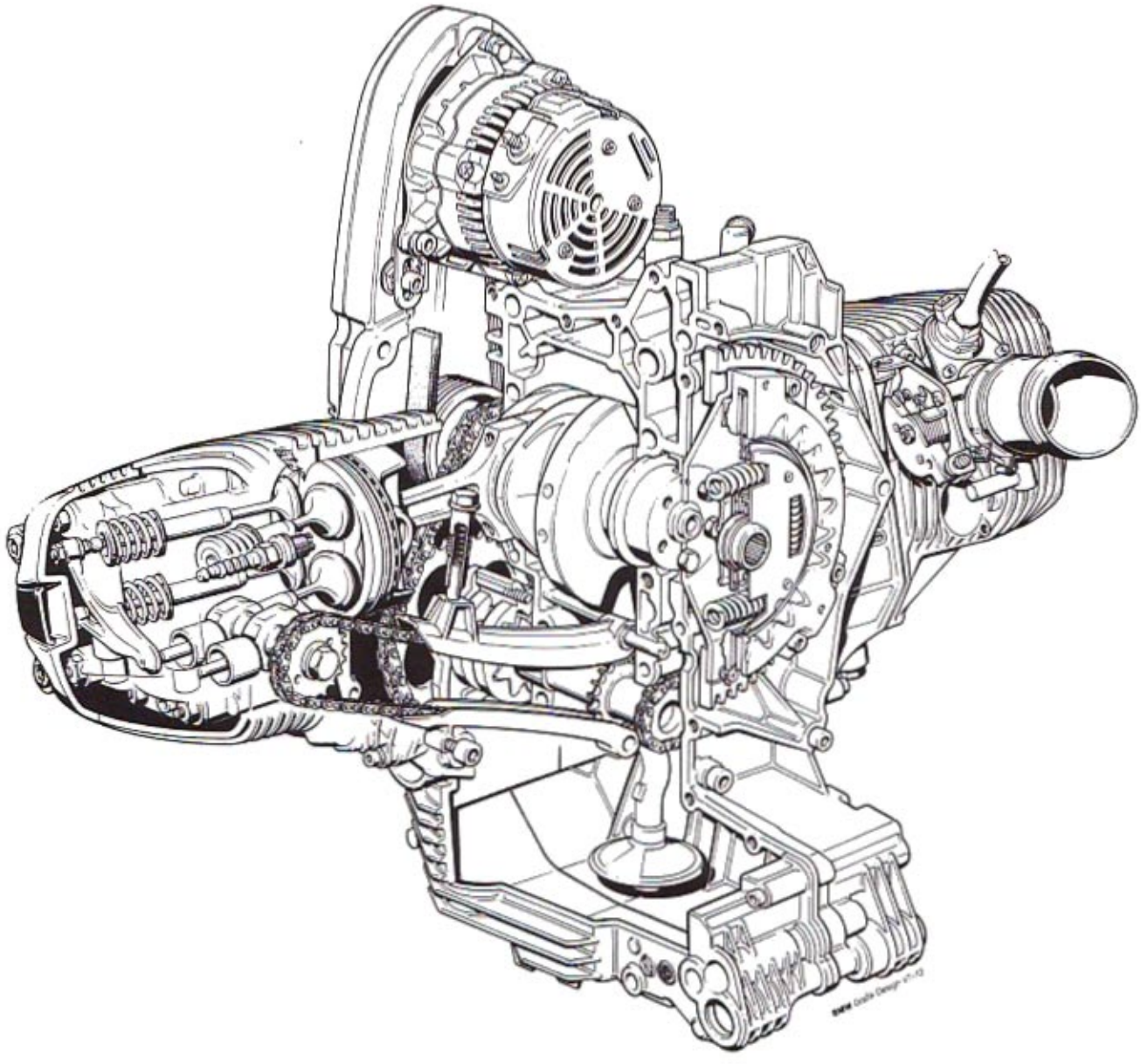
The dog-shift five-speed gearbox is derived from the gearbox already featured on the K models.

Specifications new boxer-engine R 259

Engine		
Cubic capacity	cc^3	1085
Bore/stroke	mm	99/70,5
Max output	kW/bhp	66/90
	at /min	7250
Max torque	Nm	95
	at /min	5500
Design		flat-twin
No of cylinders		2
Compression ration/fuel grade (also unleaded)		10,7/S
Valve control		HC
Valves per cylinder		4
Intake/outlet dia	mm	36/31
Fuel supply		Motronic

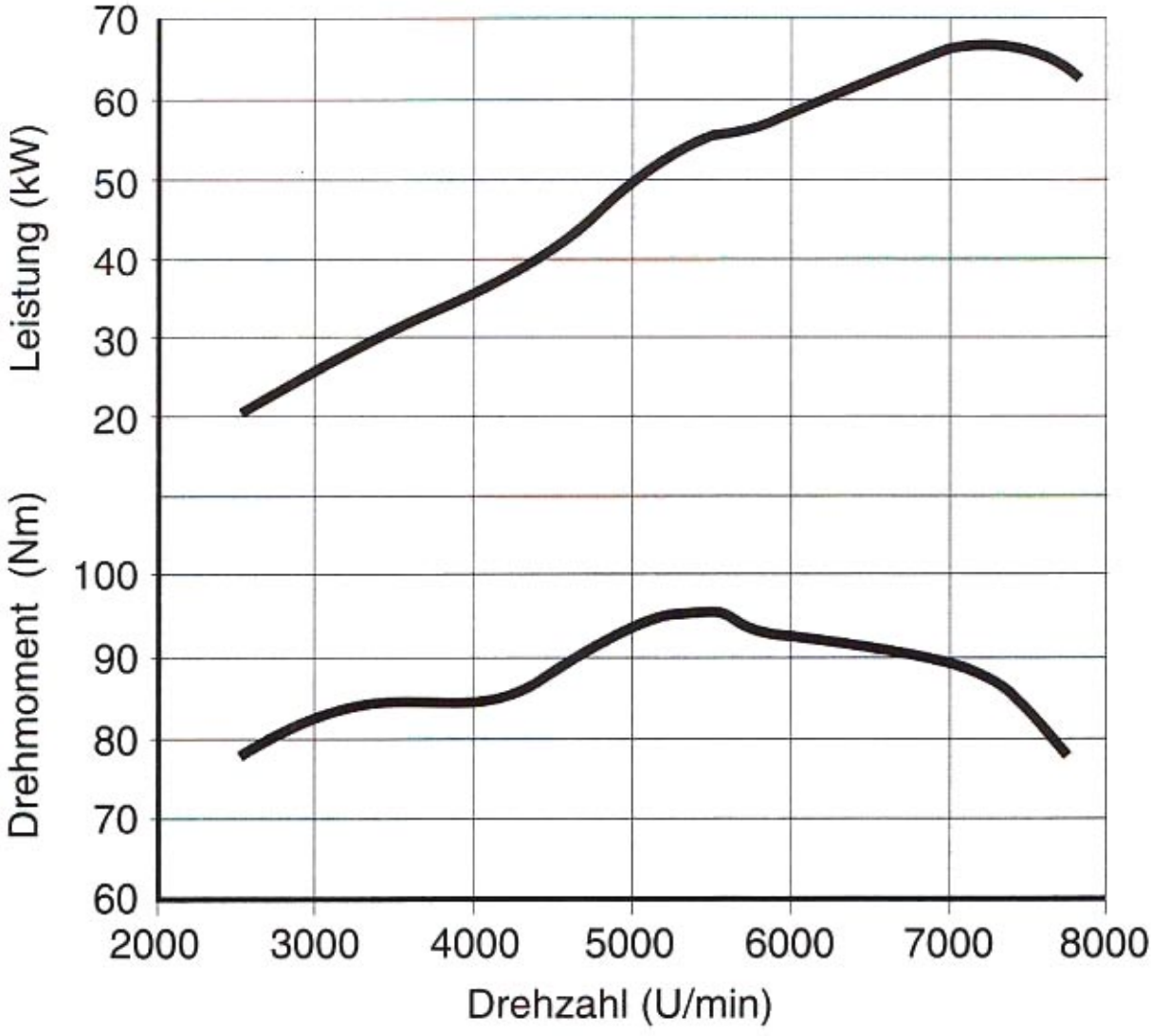
Elektrical system		
Ignition		Motronic
Alternator	W	700
Battery	V/Ah	14/50

BMW R 1100	M 93/10



BMW R 1100
Leistungs- und Drehmomentkurve

M 93/11



THE BMW C 1 DESIGN STUDY

A synthesis of car and motorcycle as a means of transport for the future

With people desiring more and more mobility in our modern age, traffic density will become even greater in future. The inevitable consequence is increasing road congestion in densely populated areas and greater environmental burdens caused by noise and pollution. At its extreme, therefore, mobility may lead to immobility, bringing traffic to an absolute standstill.

We therefore require a new, interdisciplinary perspective in order to maintain our mobility in this modern world. The various means of transport must work together - and not against each other -, providing sensible interaction of buses and trains, on the one hand, with cars, motorcycles and bicycles, on the other.

BMW's new traffic concepts

BMW has been looking at the development of new traffic concepts ever since the mid-eighties. Taking Munich and its surroundings as an example, BMW's specialists in this area are seeking to instal a better system of traffic control practicably linking individual transport with public transport.

Proceeding from this starting point, BMW initiated a project back in 1989 referred to as Cooperative Traffic Management (CTM); in the meantime no less than 50 partners from political life, administration and industry are participating herein. In 1992 this strategy was supplemented by the "Blue Zone" concept developed by BMW

for the inner city area of Munich: In a downtown region measuring 5 square kilometres in size, private car traffic is to be limited during the day, public transport and additional city buses taking over passenger transport services from a certain point.

One may rightly say that the development of such traffic concepts is a voluntary task for a vehicle manufacturer such as BMW, the subject of transport systems actually being the responsibility of others, above all politicians. But in the words of Eberhard von Kuenheim, Chairman of the Board of BMW AG, a company with genuine commitment should not just complain about the world's problems, but should rather strike out actively to solve them.

Reflections on a new means of transport

In 1990 more than 80 per cent of all passenger transport in the Western states of the Federal Republic of Germany was provided by the automobile. With public transport already being totally overcrowded during rush hours, such transport facilities will hardly be able to take a significant burden off individual transport in the foreseeable future.

Given this situation, the main task of a future-oriented manufacturer must be to carefully consider new means of transport - for example a sensible vehicle able to save space, money and energy, reducing traffic congestion and emissions while nevertheless offering individual mobility.

Being the only manufacturer of both cars and motorcycles in the Western hemisphere, BMW is naturally predestined

to develop a means of transport for the future combining the advantages of the automobile and the motorcycle and eliminating their disadvantages to the greatest possible extent.

Such a practical vehicle of the future conceived for city and short-haul traffic might have the following features:

1. Like the automobile and the motorcycle
such a future-oriented means of transport should
- offer individual mobility while nevertheless preserving the environment,
- ensure easy handling as well as
- an adequate range,
- be simple to build without requiring public money,
- be suitable for a traffic system already in existence, ie, the road traffic system we already have today.

2. Like the automobile
such a future-oriented means of transport should
- offer comfort and ample protection from wind and weather, as well as
- an adequate standard of passive safety, plus
- sufficient transport capacity (luggage space).

3. Like the motorcycle
such a future-oriented means of transport should
- take up as little traffic and parking space as possible,
- offer good value for money.

The BMW C 1:
An excellent blend of common sense and riding pleasure

In the light of the situation described and the requirements created in this way, BMW has developed the design study of such a future-oriented means of transport to be presented at the International Cologne Bicycle and Motorcycle Show in autumn 1992: the BMW C 1. To be more specific, the BMW C 1 is a joint development by BMW Technik GmbH (idea and concept) and BMW Motorrad GmbH (design and ergonomic features).

The C 1 represents an entirely new generation of road-going vehicles. While it is the attempt to combine the advantages of the automobile and motorcycle, it is more than "just" a blend of these two types of vehicles. Indeed, it is a unique and quite independent means of transport - a means of transport for the future.

In a nutshell one might define the C 1 as an agile, space-saving, environmentally oriented, low-cost individual vehicle offering reasonable protection from wind and weather as well as active and passive safety. In other words, it is a vehicle combining common sense with ample riding pleasure.

A detailed look at the BMW C 1

Safety

One of the most important objectives in developing the C 1 was to give the driver a standard of safety comparable to an automobile, without forfeiting the advantages of a single-track vehicle.

The objective to provide superior passive safety has been achieved by giving the C 1 an extruded-profile aluminium frame encompassing both the rider's seat and

the front and rear wheel. The rider is protected additionally by a rollover bar, the entire configuration providing crumple zones serving to reduce the risk of injury in an accident. It was precisely here that BMW Technik GmbH was able to apply its experience gained in building the E 1 electric car, as a result of which the C 1 complies in computer simulation tests with the head-on collision safety standards required in the USA for fully-fledged cars.

Designed to meet all ergonomic requirements, the rider's seat incorporates four-anchor safety belts, the handlebar of the C 1 being individually adjustable.

A question now to be considered is whether the rider of the C 1 still needs a helmet, considering that the vehicle offers the safety features just described and complies with all legal regulations. One possibility would be to fit the C 1 with an airbag and possibly also with longitudinal bars at the side to protect the rider in a collision.

In the interest of active riding safety the C 1 comes with ABS anti-lock brakes. Conceivably, the front and rear wheel brakes might be operated by a brake pedal, as on the automobile.

Ample protection from wind and weather

Fully enclosed in the direction of travel (with a transparent material at the front and top), the cabin offers a reasonable level of protection from wind and weather. The sides of the C 1 are open, on the other hand, for easy access to the vehicle. They may possibly be closed subsequently by the addition of side panels opening at the bottom, in this way providing full weather protection. Obviously, however, the rider must still be able

to move his legs freely when setting off or stopping the vehicle. Should it be fully enclosed, the interior of the C 1 might be ventilated by a blower possibly also incorporating a heating function.

Luggage compartment

The luggage compartment behind the rider's seats has a capacity of approximately 50 litres or 1.75 cu ft. To allow simple loading also of bulky goods, the cover can be opened to the rear or taken off completely and replaced by a luggage rack.

Drive system

Power could be provided either by a single-cylinder four-stroke engine displacing at least 250 cc or a two-stroke engine with a capacity of 125 cc. The noise level, in turn, could be reduced by encapsulating the engine beneath the rider's seat.

It almost goes without saying that the engine is equipped with a catalytic converter, the transmission of power being ensured by an infinitely variable automatic transmission. An electric motor might also be used as an alternative form of energy.

A new concept for new mobility

The BMW C 1 does not claim to be the solution to all problems in modern transport. Rather, it is - as mentioned - a design study, a new concept for further debate and consideration. It is not intended (and is not even able) to completely replace conventional means of transport, but it might supplement such conventional transport systems at least in part.

With its ideas and concepts, the C 1 is a vision in the process of developing a new, additional means of transport serving one purpose in particular: to maintain man's mobility and, accordingly, an essential feature of our freedom in life.

CONTINUING BMW's '91 ENVIRONMENTAL OFFENSIVE

Fully controlled catalytic converter also for the new Boxer generation

Studies, data, facts and figures clearly prove that widespread interest in the motorcycle remains undaunted into the '90s. But to ensure their freedom and sheer riding pleasure on two wheels also in future, conscientious motorcyclists now give increasing attention to the cause of safety and the environment.

Although motorcycles account for less than 2 per cent of the total volume of exhaust emissions generated by all road users (due to the relatively small number of motorcycles and their greater fuel economy), a representative survey conducted in Germany in 1988 showed that even then one out of five riders regarded the catalytic converter or alternative emission management systems as "a particularly important and meaningful technical innovation". As we now see from recent reports in motorcycle journals and other technical publications, this environmental awareness among motorcycle riders is continuing to increase.

Even though BMW motorcycles currently fulfill all emission control regulations worldwide even without requiring a catalytic converter, BMW moved to the forefront of the environmental protection campaign as far back as in 1988 at the Cologne Bicycle and Motorcycle Show, and was the world's first motorcycle manufacturer to announce the introduction of fully-controlled catalytic converter technology for the motorcycle at the 1990 Show. In other words, BMW has taken these steps not

under pressure from lawmakers, but rather in full recognition of the fact that action of this kind is necessary and meaningful. This was also the case when BMW introduced motorcycle ABS in spring 1988, thus taking on a pioneering role in the area of safety, too.

The announcement first made at the 1988 Motorcycle Show has now developed into a full-scale campaign: BMW's 1991 offensive to protect the environment. Three major innovations that have become reality in 1991 allow the reduction of exhaust emissions on all BMW motorcycles by applying different technological solutions: The fully-controlled three-way catalytic converter as an option on the 16-valve K 100 models, retrofittable standard catalytic converters on all other K models, and the SAS emission afterburning system as special equipment for all R models with flat-twin power plant.

The three steps in BMW's 1991 environmental offensive

1. Fully-controlled three-way catalytic converter

As of May 1991 the K 1 and K 100 RS four-cylinder models have been available as an option with fully-controlled three-way catalytic converter. And it goes without saying that this special equipment is also available on the K 1100 LT and the new K 1100 RS. This is made possible by the Digital Motor Electronics featured by these 16-valve power units as the prerequisite for the most efficient type of emission management to be found in the market today. First, exact maintenance of all engine tuning data guarantees absolute efficiency in the process of catalytic conversion;

second, engine tuning remains stable and consistent throughout a long running life, the adaptive control system largely compensating any general ageing effects such as engine wear. Not even fuel consumption changes noticeably throughout the entire service life of the catalytic converter.

Since the technical requirements to be fulfilled by a catalytic converter on a motorcycle differ substantially in some cases from the technical requirements to be fulfilled by a catalytic converter on an automobile, various problems had to be considered and solved in developing a suitable motorcycle technology. Examples are the space available and installation requirements, the question of catalyst endurance and service life considering the greater vibrations coming from the power plant and the rigidly fastened exhaust system, as well as the exposure to much higher temperatures and gas pulse effects.

Seeking to solve all these problems, BMW's specialists opted for a metal-base catalytic converter with relatively compact dimensions (length 75 mm (2.95")/diameter 85 mm (3.35")) fitting exactly into the standard exhaust without even touching its outer skin. The air layer thus formed between the catalytic converter and outer skin acts as an insulator not allowing any additional heat to escape and warm up the rider's or passenger's legs.

The "heart" of the catalytic converter is the oxygen sensor. For reasons of space, the sensor is not fitted upstream of the catalytic converter (as in automobiles), but rather immediately behind the catalyst. Measuring the amount of oxygen remaining in the exhaust emissions,

the oxygen sensor generates an exactly defined voltage signal then processed by the control unit within the Digital Motor Electronics. This ensures that the fuel/air mixture never becomes too rich or too lean, but rather remains at an optimum ratio of 14:1 (lambda = 1) at which it is ignited and burnt.

The degree of accuracy achieved by the oxygen sensor depends on its own temperature and the temperature of the exhaust emissions. If the sensor is too far away from the engine it will take relatively long to warm up to its optimum operating temperature. If it is too close to the engine, on the other hand, it may well overheat particularly when riding long distances full-throttle.

To avoid these drawbacks, the oxygen sensor in the BMW motorcycle catalyst is heated and thus achieves its optimum operating temperature even while the engine itself is still warming up.

BMW's fully-controlled three-way catalytic converter achieves roughly the following levels of efficiency with the most critical emission components:

HC down by approx 70 per cent
NOx down by approx 60 per cent
CO down by approx 80 per cent

While the K 1's engine power remains unchanged at 100 bhp (at 8000 rpm) despite the introduction of the catalytic converter, the maximum torque of 100 Nm (74 ft/lb) at 6750 rpm is down by about 2 Nm. The K 1100 LT and K 1100 RS with catalytic converter also have a maximum output of 100 bhp (74 kW), in this case however

at 7750 rpm (without catalyst at 7500 rpm). Similarly, installation of the catalytic converter reduces these machines' maximum torque only slightly from 107 to 105 Nm (79 to 77 ft/lb), in both cases at 5500 rpm. Fuel consumption also remains virtually unchanged.

A study carried out by Allgemeiner Deutscher Automobil Club (ADAC) with these two models shows that harmful emissions are reduced by up to 84 per cent. And summing up their first road test of these new machines, the experts of MOTORRAD, the German motorcycle journal, express a clear opinion: "Through its dedication to the environment, BMW has proven that the fully-controlled catalytic converter, properly tuned, can reduce exhaust emissions very efficiently without forfeiting engine power or increasing fuel consumption. And another advantage of this solution is that it is not too expensive." In Germany, for example, every second purchaser of a K 100 now opts for the fully-controlled catalytic converter.

2. Standard (non-controlled) catalytic converter for the K 75 Series

As of autumn 1991, a non-controlled catalytic converter has been available as an option for all three-cylinder K 75 models. In this case the catalyst is not equipped with an oxygen sensor.

Depending on engine tuning, the conversion rate of this non-controlled catalytic converter is approximately 50 per cent in the case of HC, roughly 30 per cent with NOx, and about 70 per cent with CO.

Mufflers with pre-assembled, non-controlled catalytic converters are available for retrofitting on the more than 100,000 two-valve car models already on the road. With the K 75 models the catalytic converter comes in the triangular silencer and on the K 100 models it is housed in the round silencer of the K 1 made from stainless steel.

3. SAS for all flat-twin boxer models

Since September 1990 all BMW R models have been available with BMW's SAS secondary air system. Applying the principle of exhaust emission afterburning, this unique technology reduces HC emissions by about 30, CO emissions by roughly 40 per cent. And it has absolutely no influence whatsoever on engine power, torque or fuel consumption. It cannot be fitted subsequently, however, since this would be too complicated in technical terms.

In some countries such as Germany nearly 100 per cent of all BMW boxers are now fitted with SAS at the factory.

Already used successfully by BMW in the USA and Switzerland in order to fulfill local emission standards, SAS uses the pressure pulses generated in the exhaust system of the flat-twin engine by the four-stroke combustion process. These pressure pulses move two diaphragm valves in the air filter housing, drawing in fresh air when open. The air surplus generated in this way together with the high temperature of the exhaust emissions ensures direct combustion of HC and CO.

Misfiring from the exhaust is avoided by interrupting the secondary air supply whenever the machine is coasting. For this purpose the left-hand SAS valve features an additional valve for controlling pressure in the intake manifold and switching off the air supply whenever necessary. Since the right-hand valve draws in fresh air through a connection hose from the left-hand valve, the supply of air to both SAS valves is interrupted as long as the motorcycle is coasting without engine power.

BMW remains the spearhead in environmental protection

While the motorcycle world has been waiting in vain ever since summer 1992 for other manufacturers to introduce the fully controlled catalytic converter, BMW is continuing its unique pledge to the environment: The new generation of Boxer machines scheduled to be launched in 1993 will also be available as an option with a fully controlled catalytic converter.

Full recycling of catalytic converters

All catalytic converters used in BMW motorcycles are fully recyclable and are taken back by BMW dealers.

THE TWO-CYLINDER R SERIES BOXERS WITH TWO-VALVE POWER UNITS

The very successful R 100 R now also available as the R 80 R

BMW most recent conventional Boxer, the R 100 R launched in the 1992 model year, is already the absolute best-seller within BMW's entire range of motorcycles. By the end of 1992 production is to exceed more than 9,000 units, giving the R 100 R a share of well over 25 per cent in BMW's total volume of motorcycles.

In Germany alone, sales of the R 100 R will amount to about 4,000 units in 1992, making the new machine BMW's best-selling model in the domestic market ever since the R 45 in 1980. And this achievement has become reality within only one year!

Now, starting with the 1993 model year, the R 100 R is being joined by a "smaller" brother, the R 80 R. In terms of its features and model fitments, the R 80 R only differs from the larger 1000-cc machine through the fact that it does not require an oil cooler. All of the R 80 R's engine specifications are the same as on BMW's other 800 cc models, which incidentally are also available in Germany with output reduced to 20 kW/27 bhp on account of driving licence and insurance regulations.

Again in the German market, the R 80 R replaces the R 80 now no longer available. (Sales of the R 80 are also being stopped in some other countries, too.)

The R 100 R: The classic road version of the R 100 GS

In the 69-year history of the Boxer, BMW has built more than 60 different models and model variants. And it is certainly no coincidence that the latest Boxer of the "old school" has one thing in particular in common with the very first Boxer, the R 32: The R 100 R is a classic "grassroots" machine, that is a motorcycle without any kind of fairing or additional equipment to impair its clean looks. The second "R", incidentally, stands for roadster.

Following the motto of "back to the roots", nearly all renowned manufacturers have recently re-discovered the "original" machine and have accordingly added suitable motorcycles to their range, in this way confirming a philosophy that BMW never even gave up in the first place.

To put it in a nutshell, you might regard the R 100 R roadster as a road version of the R 100 GS enduro in the classic look of yesteryear still so appealing today. Its "heart" is the 60 bhp one-litre power unit developing its maximum torque of 76 Nm (56 ft/lb) at just 3750 rpm. In this case, however, the oil cooler is not fitted on the cylinder protection bar, but rather right in the middle in front of the engine protection cover. And contrary to the GS models, the R 100 R comes with the round muffler of the K 100 models made from stainless steel.

The Showa telescopic fork and spring strut

Like the GS models, the R 100 R also features cross-spoke wheels measuring 17 inches at the front, but 18 inches at the rear for even better handling and behaviour on the road. The patented cross-spoke wheels are particularly stable and are fully suited for tube-

Other features taken over from the GS are the rear drum brake and the rear-wheel single swinging arm with the BMW Paralever helping to reduce drive shaft reactions to a minimum. An all-new feature is the gas-pressure spring strut adjusted to the shorter spring travel of 140 mm (5.51"). Its base spring is adjustable to six different positions, the outward stroke damping effect is infinitely variable.

Yet another innovation is the substantially improved telescopic fork with a much better reaction ensured by double-action hydraulic damping and a progressive spring curve. Like the spring strut, the telescopic fork comes from Showa in Japan. Its spring travel is 135 mm (5.31"), tube diameter 41 mm (1.61").

Front wheel brake with four-piston fixed calliper

Featuring the floating brake disc of the GS model (diameter 285 mm/11.22") and the four-piston fixed calliper of BMW's four-cylinder K models, the front wheel brake guarantees maximum efficiency.

Another new feature: the round valve cover of the R 68 plus the additional chrome kit

The classic looks of the R 100 R are enhanced significantly by the chrome-plated housing of the round headlight (from the K 75) and instruments (from the GS) as well as the round valve cover introduced no less than 40 years ago on the legendary R 68 and seen last on the /6 Series produced until 1976.

The aficionado of glossy looks also has the choice of a special chrome kit available as an option from autumn 1992 and comprising the following components: fork stabiliser, valve cover, upper carburettor section, rear grab handle, tank cap, rear-view mirrors, exhaust fastening nut, instrument console, and handlebar weights.

Other new features of the R 100 R not taken from any of BMW's previous models are the handlebar cover, the battery and side panels, the passenger grab handle and rear-wheel mudguard.

As on the GS models, the handlebar similar in design and styling to that of the R 80 ST houses the rider-friendly controls and instruments of the K models, in this case however without automatic direction indicator cancellation.

Measuring 800 mm (31.5") in height, the seat is now even more comfortable thanks to its new foam-plastic core and cover. The tank taken from the GS model has a capacity of 24 litres (5.3 Imp gals) to provide a range of 300 km (200 miles) plus.

Particularly agile and just perfect for touring

Weighing only 218 kg (481 lb) in road trim with full tank, the R 100 R is one of the lightest machines in its class. Another outstanding feature is its supreme handling and agility, making it just perfect for riding in town and on winding country roads. And with its service load of more than 200 kg (441 lb) plus BMW's well-known range of bags and cases (integral cases, tank bag), the R 100 R has everything it takes for long tours with a passenger carrying lots of luggage.

SAS emission control

It almost goes without saying that the new R 100 R - like all other BMW R model Boxers from autumn 1990 - comes with the SAS secondary air system available as an option. Featuring exhaust emission afterburning, SAS reduces HC emissions by about 30 and CO emissions by roughly 40 per cent (see also Section 5).

The other BMW Boxers also enter the 1993 model year without any changes

All the other BMW Boxers are also entering the 1993 model year without requiring any technical changes or modifications.

The R 80 - the classic sports machine

The R 80 without fairing is BMW's classic sports model for the road - indeed, you might call it another grass-roots machine. Its sturdy 800 cc power unit churns out a dependable 50 bhp (37 kW) and offers a superior torque curve with a maximum torque of 58 Nm (43 ft/lb) at just 4000 rpm.

Weighing a mere 210 kg (463 lb) with full tank, the R 80 is a lightweight in its class. With a maximum permissible weight of 440 kg (970 lb) and a maximum load of 230 kg (507 lb), this BMW flat-twin is really ideal for touring.

The R 80 is now no longer available in some countries.

R 80 RT: the comfortable tourer

Otherwise identical with the R 80, the R 80 RT features the large touring windshield for optimum protection in wind and weather. This windshield is ideal for comfortable long-distance touring in conjunction with the high-rise touring handlebar.

The multi-piece tourer fairing has a large adjustable windshield extending to the rear, direction indicators integrated in the fairing and two lockable stowage boxes. Air inlet nozzles on both sides with adjustable nozzle openings provide a good supply of fresh air in hot weather.

The R 80 RT weighs only 227 kg (500 lb) with full tank - very little for a touring machine.

R 100 RT: the large touring Boxer rides again since 1987

Launched in 1977 one year after the R 100 RS, the R 100 RT also experienced its come-back in 1987 exactly 10 years after its original premiere and a four-year interruption. Naturally, it has been modernised in the meantime to meet the latest requirements. In 1977 the R 100 RT was the first motorcycle equipped as standard with full touring fairing styled in the wind tunnel. And it is indeed a fact that this wind-and-weather-proof fairing is still one of the best in the market, together with the large touring fairing of the K 75 RT and K 1100 LT.

Particularly touring riders out on a long trip with a passenger and luggage will appreciate the extra performance and higher torque versus the R 80 RT. The R 100 RT, which offers remarkable handling for a large tourer, is

fitted as standard with an oil cooler, a dual disc brake, quartz clock, voltmeter and touring cases with one standard key for the ignition, handlebar, fuel tank, seat and touring case locks.

The GS machines remain on the road to success

Following their revision for the 1991 model year, the GS models remain on the road to success. Their most important innovation is to be seen clearly at first sight - an entirely new look. Like the R 100 GS Paris-Dakar launched in 1989, the R 80 GS and R 100 GS have come with a cockpit fairing fitted directly to the frame as of autumn 1990. The "heart" of the fairing is the tubular spaceframe serving as the support element. In conjunction with the newly designed windshield the fairing offers very good protection from wind and weather, the windshield itself being adjustable for angle as a function of rider size. Like the R 100 GS Paris-Dakar, the new models now also feature the high-intensity rectangular headlight of the K 75 S. In the cockpit itself there are two new, extra-large dials: The speedometer on the left, the rev counter on the right. The warning lights and telltales are located at the top centre beneath a glass cover.

Same handlebar controls as on the K Series

The handlebar controls taken directly from the K Series ensure an even higher standard of comfort and superior ease of operation. The only feature not adopted from the K models is the automatic direction indicator return, as the GS models do not have an electronic speedometer.

Handlebar centre bearing with fine-thread adjustment

The handlebar-centre bearing now has the same fine-thread adjustment as on the K 75 models allowing far more precise and consistent setting of bearing play.

Seat even more comfortable than before

Use of a new upholstery material ensuring the same superior comfort throughout a long running life guarantees even greater riding comfort on road and track.

New individually adjustable spring strut

The rear wheel features an all-new spring strut developed together with Bilstein. Apart from being able to pre-tension the spring to four different settings, the rider can now also adjust the expansion - ie, damping - stroke to no less than 10 different positions. This means individual adjustment to all loads, riding conditions and road surfaces.

Stainless-steel muffler

The tail-end muffler is now made of polished stainless steel.

Lowered front-wheel mudguard

The front-wheel mudguard has been lowered closer to the tyre, but is also available as an option at its former, elevated position.

Floating front-wheel brake disc

Like all other Boxers with a single-disc brake, the GS models now also feature a brake disc in floating arrangement as of the 1991 model year.

The R 100 GS differs from the R 80 GS only through its larger engine and increased output, as well as the oil cooler and cylinder protection bars with integral side-stand fitted as standard on this model.

The following innovations introduced for the R 80 GS and R 100 GS are also featured by the R 100 GS Paris-Dakar: adjustable windshield, instruments, handlebar controls, handlebar centre bearing, spring strut and tail-end muffler.

Sports suspension for the GS models as a conversion kit

Special accessories for really tough off-road riding have been available as a brand-new feature from spring 1990. With these accessories the genuine enthusiast can convert all new GS models to a sophisticated sports suspension developed jointly by BMW and the Dutch company, White Power. This conversion kit consists of a complete set of long, progressive-action telescopic springs with improved load-bearing capacity plus a sports-tuned rear-wheel spring strut adjustable to several different settings.

	SPECIFICATIONS BMW MOTORCYCLES		R 80	R 80 RT	R 80 GS	R 80 R
Engine	Cubic capacity	cc	798	798	798	798
	Bore/stroke	mm	84/70.6	84/70.6	84.8/70.6	84.8/70.6
	Max output	kW/bhp	37/50	37/50	37/50	37/50
	at	/rpm	6500	6500	6500	6500
	Max torque	Nm	58	58	61	61
	at	/rpm	4000	4000	3750	3750
	Design		flat-twin	flat-twin	flat-twin	flat-twin
	No of cylinders		2	2	2	2
	Compression ratio/fuel grade (also unleaded)		8.2/N	8.2/N	8.2/N	8.2/N
	Valve control		OHV	OHV	OHV	OHV
	Valves per cylinder		2	2	2	2
	Intake/outlet dia	mm	42/38	42/38	42/40	42/40
	Fuel supply		Bing carburettors	Bing carburettors	Bing carburettors	Bing carburettors
	No of carburettors/dia		2/32	2/32	2/32	2/32
Electrical system	Ignition		contactless transistorized coil ignition			
	Alternator	W	240	240	240	240
	Battery	V/Ah	12/25	12/25	12/25	12/25
	Headlight	W	H 4 55/60 dia 180 mm	H 4 55/60 dia 180 mm	H 4 55/60	H 4 55/60 dia 180 mm
	Starter	kW	0.7	0.7	0.7	0.7
Power transmission, Gearbox	Gearbox		5-speed gearbox with dog-type shift			
	Gear ratios	I	4.40/3.20	4.40/3.36	4.40/3.20	4.40/3.20
		II	2.86/3.20	2.86/3.36	2.86/3.20	2.86/3.20
		III	2.07/3.20	2.07/3.36	2.07/3.20	2.07/3.20
		IV	1.67/3.20	1.67/3.36	1.67/3.20	1.67/3.20
		V	1.50/3.20	1.50/3.36	1.50/3.20	1.50/3.20
Suspension	Rear-wheel drive		Encapsulated drive shaft with universal joint and helical-gear follower plate, torsion damper in drive shaft		BMW Paralever	
	Clutch		Single-plate dry clutch with diaphragm springs			
	Type of frame		Double-loop tubular steel frame with bolted-on tail section			
	Spring travel front/rear	mm	175/121	175/121	225/180	135/140
	Wheel castor	mm	120	120	101	101
	Wheelbase	mm	1447	1447	1513	1513
	Brakes	Front	single-disc brake, dia 285 mm	dual-disc brake, dia 285 mm	single-disc brake, dia 285 mm	single-disc brake, dia 285 mm
		Rear	drum brake, dia 200 mm	drum brake, dia 200 mm	drum brake, dia 200 mm	drum brake, dia 200 mm
	Wheels		Cast light-alloy	Cast light-alloy	Cross-spoke	Cross-spoke
	front		MTH 2 2.50 x 18 E	MTH 2 2.50 x 18 E	1.85 – 21 MT	2.50 x 18 MTH 2
	rear		MTH 2 2.50 x 18 E	MTH 2 2.50 x 18 E	2.50 – 17 MT	2.50 – 17 HTH 2
	Tyres front		90/90 – 18 H	90/90 – 18 H	90/90 – 21 F	110/80 V 18
	rear		120/90 – 18 H	120/90 – 18 H	130/80 – 17 T	140/80 V 17
			low-profile	low-profile	low-profile	low-profile
Dimensions and weights	Length, overall	mm	2175	2175	2290	2210
	Width with mirrors	mm	800	960	1000	1000
	Handlebar width without mirrors	mm	635	714	830	720
	Seat height	mm	807	807	850	800
	Weight, unladen with full tank	kg	210	227	215	217
	Max permissible weight	kg	440	440	420	420
	Fuel tank/reserve	ltr	22/2	22/2	24/4.7	24/4.7
Performance	Fuel consumption					
	90 km/h (56 mph)	ltr	4.6	4.8	4.7	4.5
	120 km/h (75 mph)	ltr	6.3	7.2	6.6	5.5
	Acceleration					
	0–100 km/h (62 mph)	sec	6.0	6.4	6.0	6.0
	standing-start km	sec	27.6	29.0	28.3	28.3
	Top speed	km/h	178	170	168	168
Model features	Fairing			Full fairing fixed positively to frame, adjustable windshield and integral stowage boxes (glass-fibre-reinforced plastic)	Glass-fibre-reinforced fairing	
	Standard features		Toolkit, repair kit	Toolkit, repair kit	Toolkit, repair kit, luggage rack	Toolkit, repair kit, luggage rack

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	SPECIFICATIONS BMW MOTORCYCLES		R 100 GS	R 100 GS Paris-Dakar	R 100 R	R 100 RT
Engine	Cubic capacity	cc	980	980	980	980
	Bore/stroke	mm	94/70.6	94/70.6	94/70.6	94/70.6
	Max output	kW/bhp	44/60	44/60	44/60	44/60
	at	rpm	6500	6500	6500	6500
	Max torque	Nm	76	76	76	74
	at	rpm	3750	3750	3750	3500
	Design		Flat-twin	Flat-twin	Flat-twin	Flat-twin
	No of cylinders		2	2	2	2
	Compression ratio/fuel grade		8.5/N	8.5/N	8.5/N	8.45/N
	Valve control		OHV	OHV	OHV	OHV
	Valves per cylinder		2	2	2	2
	Intake/outlet dia	mm	42/40	42/40	42/40	42/40
	Fuel supply		Bing carburettors	Bing carburettors	Bing carburettors	Bing carburettors
	No of carburettors/dia		2/40	2/40	2/40	2/32
Electrical system	Ignition		contactless transistorized coil ignition			
	Alternator	W	240	240	240	240
	Battery	V/Ah	12/25	12/25	12/30	12/30
	Headlight	W	H 4 55/60	H 4 55/60	H 4 55/60 dia 180 mm	H 4 55/60 dia 180 mm
	Starter	kW	0.7	0.7	0.7	0.7
Power transmission, Gearbox	Gearbox		5-speed gearbox with dog-type shift			
	Gear ratios	I	4.40/3.09	4.40/3.09	4.40/3.09	4.40/3.0
		II	2.86/3.09	2.86/3.09	2.86/3.09	2.86/3.0
		III	2.07/3.09	2.07/3.09	2.07/3.09	2.07/3.0
		IV	1.67/3.09	1.67/3.09	1.67/3.09	1.67/3.0
		V	1.50/3.09	1.50/3.09	1.50/3.09	1.50/3.0
Suspension	Rear-wheel drive		BMW Paralever	BMW Paralever	BMW Paralever	BMW Paralever
	Clutch		Single-plate dry clutch with diaphragm springs			
	Type of frame		Double-loop tubular steel frame with bolted-on tail section			
	Spring travel front/rear	mm	225/180	225/180	135/140	175/121
	Wheel castor	mm	101	101	101	120
	Wheelbase	mm	1513	1513	1513	1447
	Brakes	Front	single-disc brake; dia 285 mm	single-disc brake; dia 285 mm	single-disc brake; dia 285 mm	dual-disc brake; dia 285 mm
		Rear	drum brake, dia 200 mm	drum brake, dia 200 mm	drum brake, dia 200 mm	drum brake, dia 200 mm
	Wheels		Cross-spokes	Cross-spokes	Cross-spokes	Cast light-alloy
	front		1.85 – 21 MT	1.85 – 21 MT	2.50 x 18 MTH 2	MTH 2.50 x 18 E
	rear		2.50 – 17 MT	2.50 – 17 MT	2.50 x 17 HTH 2	MTH 2.50 x 18 E
	Tyres front		90/90 – 21 T	90/90 – 21 T	110/80 V 18	90/90 – 18 H
	rear		130/80 – 17 T	130/80 – 17 T	140/80 V 17	120/90 – 18 H
			low-profile	low-profile	low-profile	low-profile
Dimensions and weights	Length, overall	mm	2290	2290	2210	2175
	Width with mirrors	mm	1000	1000	1000	960
	Handlebar width without mirrors	mm	830	830	720	714
	Seat height	mm	850	850	800	807
	Weight, unladen with full tank	kg	220	236	218	234
	Max permissible weight	kg	420	420	420	440
	Fuel tank/reserve	ltr	24/4.7	35/5	24/4.7	22/2
Performance	Fuel consumption					
	90 km/h (56 mph)	ltr	4.9	4.9	4.9	4.4
	120 km/h (75 mph)	ltr	6.9	6.9	6.1	6.6
	Acceleration					
	0–100 km/h (62 mph)	sec	4.8	4.8	4.8	5.0
	standing-start km	sec	26.5	26.5	26.5	26.0
	Top speed	km/h	180	180	180	185
Model features	Fairing		Glass-fibre-reinforced fairing	Glass-fibre-reinforced fairing		Glass-fibre-reinforced tourer fairing
	Standard features		Toolkit, repair kit, luggage rack, oil cooler, windshield	Flared mudguard, solo seat, large luggage rack, engine protection, revolution indicator, quartz clock	Toolkit, repair kit, oil cooler, luggage rack	Toolkit, repair kit, oil cooler, voltmeter, quartz clock, cases with standard lock

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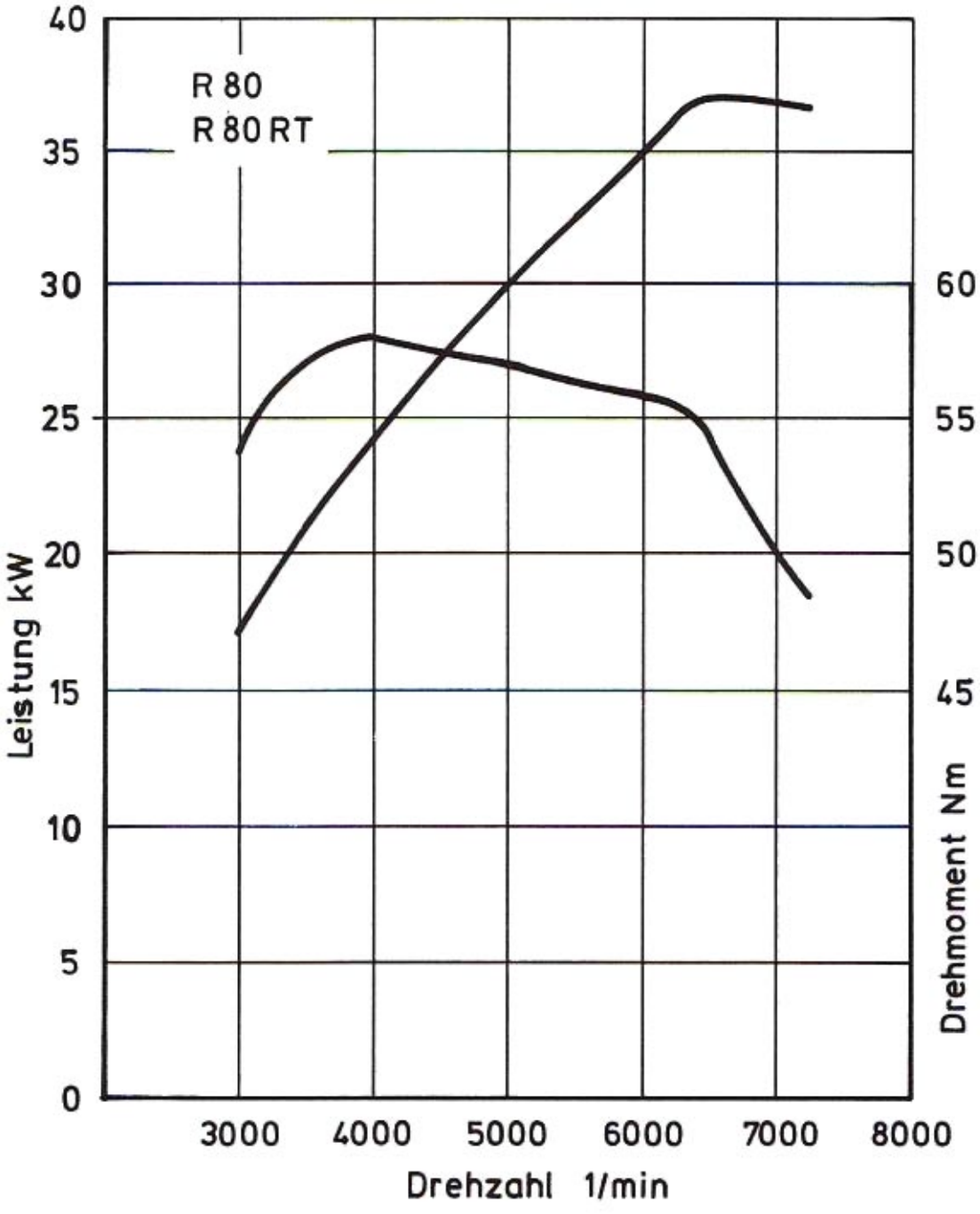
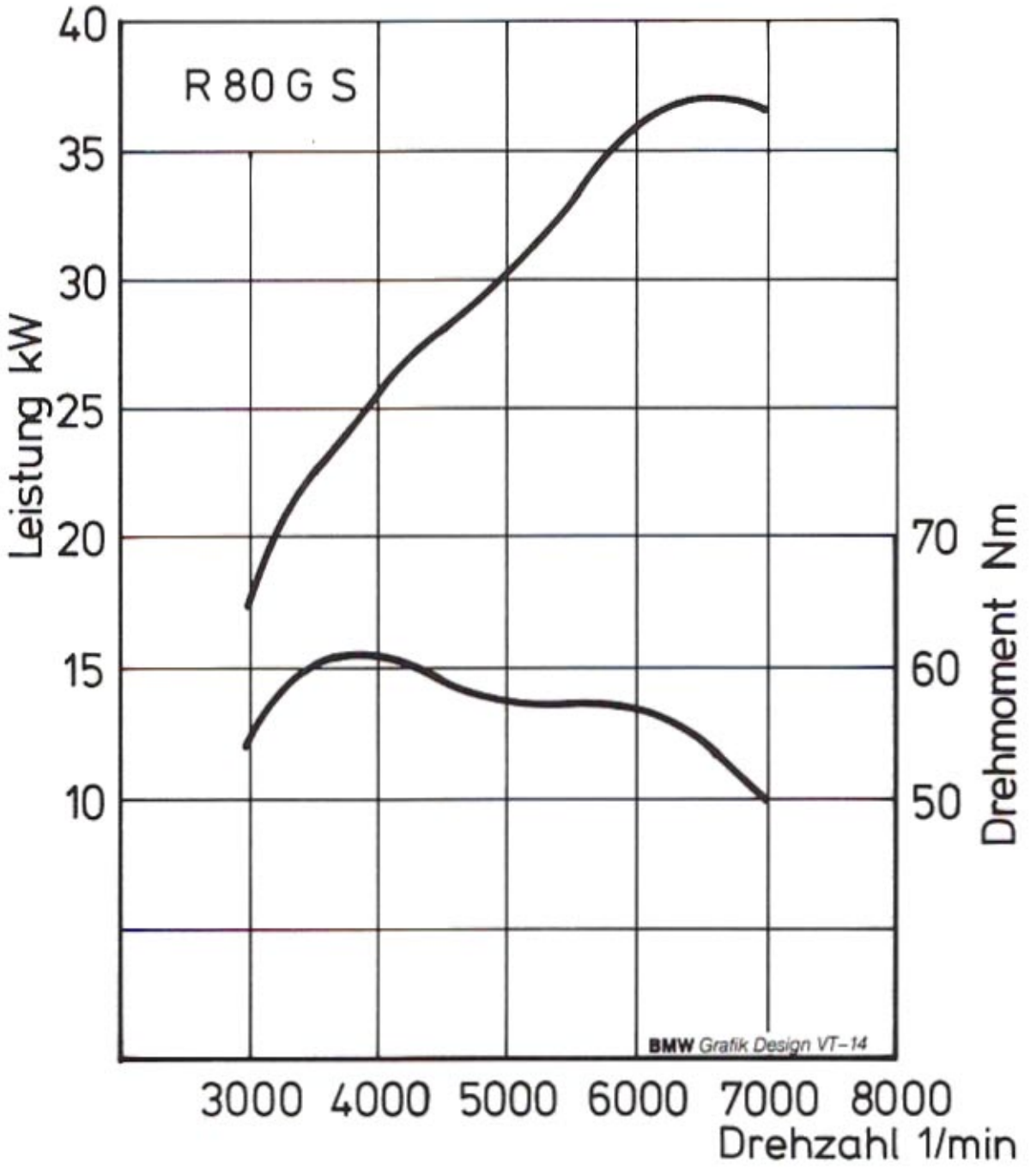
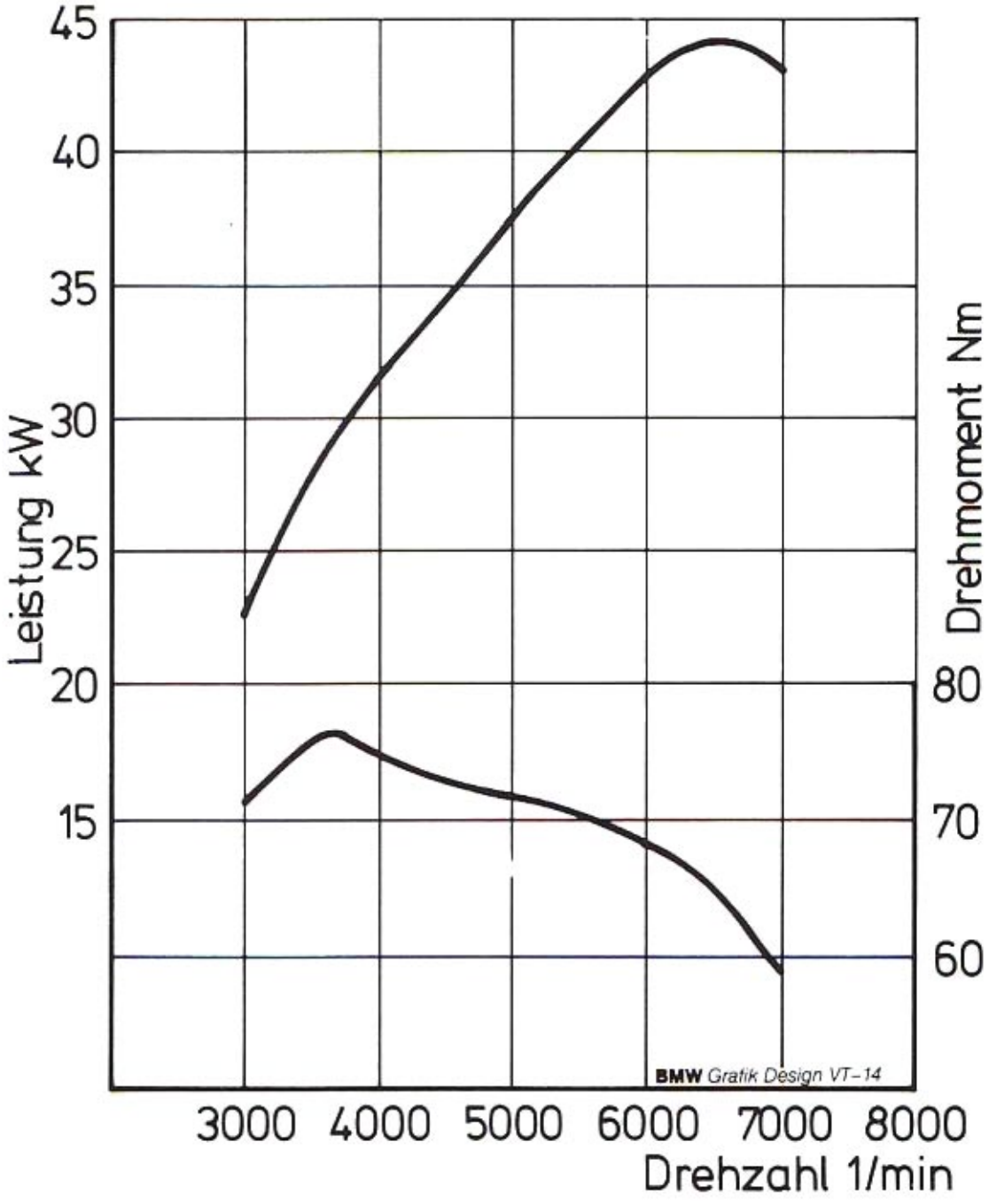
BMW R 80 und R 80 RT	M 93/1



BMW R 80 GS und R 80 R | M 93/2



BMW R 100 R, R 100 GS und R 100 RT	M 93/3



THE THREE-CYLINDER K 75 SERIES

The K 75 RT now also available with electrically adjustable windshield

Launched in autumn 1985, BMW's three-cylinder K 75 Series has already been sold far more than 50,000 times worldwide. Both models, that is the K 75 and the K 75 S, have been available since 1990 with BMW's unique electronic/hydraulic anti-lock brakes (ABS) as an optional extra, which naturally also comes as a special fitment on the K 75 RT launched in the 1991 model year. As of the 1992 model year, all K 75 models will be available furthermore with catalytic converter also coming as an option for retrofitting (see Section 5). Other new features are the Showa telescopic fork providing even better response and handling on the road, hazard warning flashers and an automatic side stand moved back to its stationary position by the clutch lever (all standard).

K 75: An attractive model for achievers with an extra-low seat

In terms of both price and styling, the "basic" K 75 without fairing is a very attractive model for achievers moving into the BMW K Series. With its seat height of 760 mm (29.9") it is just right for the somewhat smaller rider. Since the 1990 model year, the K 75 has been available with a number of features previously only seen on the K 75 S: First, the front-wheel fork with 135 mm or 5.31" spring travel (previously 185 mm/7.28"), sports tuning and fork stabiliser. Second, the rear-wheel disc brake replacing the old drum brake - and providing the technology required for the use of ABS. This also means that the K 75 has a smaller 17" wheel at the rear (previously 18"), just like the K 75 S, K 100 and K 100 LT.

K 75 S: Sports suspension and dynamic looks

The sports version of the K 75 features a sports fairing with integral direction indicators styled in BMW's wind tunnel. The relatively slender but nevertheless efficient fairing offers not only good protection from wind and weather but also increases the dynamic riding characteristics and safety of this machine by considerably reducing lift forces on the front wheel and air resistance.

The engine spoiler fitted as standard blends very harmoniously with the overall styling of the K 75 S awarded a special prize in 1986 by the Stuttgart Design Center. From the 1988 model year the short, sporty handlebar has been 3 cm wider, further improving the handling of the K 75 S.

As of the 1991 model year the K 75 S has had silver-painted wheels in three-spoke styling like the K 100 models. These wheels are also available for the K 75 and K 75 RT as an option.

K 75 RT: With all the comfort of a superior touring machine

Starting with the 1991 model year the K 75 Series has also had a superior touring model with the same large tourer fairing as the K 100 LT replaced in the meantime by the K 1100 LT. The silky-smooth refinement of the three-cylinder power unit combined with the superior handling of the K 75 make the new K 75 RT already sold successfully in the USA and Spain since the beginning of the 1990 model year an interesting alternative for the touring enthusiast.

As of the 1993 model year, the K 75 RT is also available as an option with the electrically adjustable windshield featured on the K 1100 LT.

THE FOUR-CYLINDER K 100 SERIES

The new K 1100 RS: Facelift and extra power for BMW's succesful sports tourer

Ever since they were launched in autumn 1983 BMW's four-cylinder K 100 models have been one of the absolute best-sellers in the motorcycle market. Production at BMW's motorcycle factory in Berlin amounts to more than 110,000 units in 9 years. Since 1988 all K 100 models have been available as an option with ABS, nearly 90 per cent of all purchasers deciding in favour of this special feature in 1991. In 1989 the two-valve K 100, K 100 RS and K 100 LT models were joined by the K 1 supersports machine with its 100 bhp four-valve power unit. In early 1990 the new K 100 RS then also received the same technical innovations as the K 1, that is the four-valve power unit, Paralever, brakes, etc.

The K 100 LT launched in 1984 and designated the K 100 RT up to 1986, was also thoroughly updated for the 1992 model year. The K 1100 LT has received an excellent response from the motorcycle press and is in great demand in the market, production of this outstanding model being increased to approximately 7,000 units in 1992.

Things therefore look very good for the further revision of the K 100 RS now re-designated the K 1100 RS for the 1993 model year, following a facelift and further improvement of engine torque and performance.

BMW's successful sports tourer

The K 100 RS sports tourer may be regarded as one of the most successful motorcycles of the '80s. The readers of MOTORRAD, Europe's largest motorcycle journal, have voted the K 100 RS Motorcycle of the Year no less than five times running, a truly unique achievement in the history of this popularity vote.

In other European countries, in America, Australia and even in Japan, the K 100 RS has also received many coveted awards. Selling almost 50,000 units worldwide, it is the best-selling K model.

Following the model update in early 1990, the K 100 RS is now being thoroughly revised once again for the 1993 model year, this time with modifications to the fairing, engine and running gear.

Now the K 1100 RS also features the high-torque power unit of the K 1100 LT

Almost exactly one year after the launch of the K 1100 LT, the successor to the K 100 RS is now also receiving a new power unit: the 1000-cc four-valve engine of the K 1 is being replaced by the ultra-powerful 1100-cc engine of BMW's luxury tourer, the new model designation being K 1100 RS.

While the engine of the K 1100 RS (see the K 1100 LT for all specifications) has the same output as so far of 100 bhp (74 kW), the speed at which this output is generated is now 7500 rpm and no longer 8000 rpm. The increase in engine size helps to boost torque from 100 Nm or 74 ft/lb at 6750 rpm to 107 Nm or 79 ft/lb at 5500 rpm. Unlike the K 1 (2.75) and K 1100 LT (2.91), the final drive ratio of the otherwise identical five-speed gear-

box is 2.81 on the K 1100 RS, thus giving this new model much better acceleration and traction than the former K 100 RS.

Even at first sight, the K 1100 RS clearly bears testimony to its thorough modification: The almost classic upper part of the fairing has been combined with new side panels and an engine spoiler, providing a very attractive and stylish combination of individual features. Together with the new battery panels, this creates an - almost - brand-new, appealing look. A further important point is the better protection from wind and weather around the rider's legs.

The suspension has also been modified to suit the new fairing and engine features, the Marzocchi telescopic fork and Showa spring strut on the rear wheel being retuned accordingly. In the interest of even greater riding stability, the frame has been reinforced by adding v-shaped tiebars connected to the handlebar centre-point and the rear support bar.

The new alternator combines extra power with even more compact dimensions and will also be featured in BMW's new generation of Boxers as of 1993. The specifications of this new three-phase alternator are indeed very impressive: 14 V, 50 Amps, 700 W (previously 12 V, 25 Amps, 460 W). There is also a new 12 V, 19 Amp battery, while some other new features are the redesigned gearshift lever and an innovative brake lever adjustable to four different positions depending on the size of the rider's hand. A further feature is the footrest support plate separated from the motorcycle itself to reduce vibrations (also on the K 1100 LT).

In the light of all these changes, it is quite appropriate to call the new K 1100 RS a new machine with new looks, even more power and better riding stability. The bottom line, of course, is that the excellent all-round qualities of this outstanding sports tourer have been improved even further.

The world's only sports tourer
available with ABS and catalytic converter as an option

The K 1100 RS is currently the world's only sports tourer available as an option with ABS and fully controlled catalytic converter.

The K 1100 LT:
A larger engine for extra torque

Even the model designation - K 1100 LT - shows that in updating this luxury tourer for the 1992 model year BMW has gone a step beyond the K 1 and K 100 RS: Engine capacity of the four-cylinder power unit has been increased by more than 10 per cent from 987 cc (60.2 cu in) to 1092 cc (66.6 cu in) by increasing engine bore from 67 mm (2.64") to 70.5 mm (2.78"), the largest increase in engine size so far in the history of BMW motorcycles.

Otherwise identical with the 16-valve power units of the K 1 and K 100 RS, the new engine also develops 100 bhp (74 kW), this time however at a relatively low 7500 rpm. More importantly, the increase in engine size helps to boost torque significantly - a particularly important factor with a luxury tourer of this calibre: Compared with the 100 Nm (74 ft/lb) developed by the K 1 at 6750 rpm, the engine of the K 1100 LT offers a maximum torque

of 107 Nm (79 ft/lb) at just 5500 rpm. To offer another comparison, the former model with two-valve technology developed 90 bhp (66 kW) at 8000 rpm and a maximum torque of 86 Nm (63 ft/lb) at 6000 rpm.

The K 1100 LT again features Digital Motor Electronics for optimum fuel efficiency and as the ideal technology for the fully controlled three-way catalytic converter available as an option (as with the K 1 and K 100 RS since spring 1991).

Another outstanding feature of the K 1100 LT is BMW's proven five-speed gearbox. The 5th gear transmission ratio, as on the K 1 and K 100 RS, is now 1.61 (K 100 LT: 1.67), while the final drive ratio remains the same as on the K 100 LT at 2.91.

In creating the K 1100 LT, BMW's engineers have followed the same policy as two years ago when updating the K 100 RS, thus taking over important innovations and features from the K 1. Examples are the BMW Paralever, the highly efficient double disc brake with four-piston fixed calipers on the front wheel, the three-spoke light-alloy wheels (in this case, however, measuring 18" at the front and 17" at the rear, as on the K 100 LT), the slightly modified telescopic fork with 135 mm (5.31") spring travel already featured on the K 100 RS, the stainless-steel silencer, and the central ignition and handlebar lock.

Yet another special feature of the K 1100 LT is the spring strut from Showa in Japan with progressive spring action, infinitely variable outward stroke damping and base spring pretension adjustable to five different positions. Spring travel is 120 mm or 4.72".

Apart from the foot lever, front-wheel mudguard, side covers and battery panels, the handlebar (now measuring 765 mm/30.11" in width versus 755 mm/29.72" on the K 100 LT) and handlebar cover are also new.

Fairing with electrically adjustable windshield

The fairing, seat and storage compartments of the K 1100 LT present the most conspicuous innovations. Indeed, BMW's large tourer fairings developed in the wind tunnel have always set standards in the luxury touring range, for example on the R 100 RT in 1978 and the K 100 RT in 1984.

In the meantime the fairing has been optimised to provide the best conceivable protection from wind and weather. First, it comes with new panels at the side supplemented as the second new feature by electric adjustment of the windshield itself: By means of two adjustment rails arranged at an angle to one another, the transparent windshield can be moved up and down by 75 mm (2.95") and swivelled for angle by 24°, in this way providing a total height adjustment range of 112 mm (4.41"). The electric adjustment system is comparable to an electric sunroof in a car and is controlled by a push button automatically cutting off the power supply when the windshield has reached its final position.

As a result, windshield height can be chosen individually as a function of rider size and road speed, weather and temperature. And on the road this means not only better protection from wind and weather, but also a significant reduction of wind noise.

The instruments of the K 1100 LT are no longer fitted on the handlebar unit, but now directly on the frame of the motorcycle, in this way being protected even more efficiently from vibrations of any kind. A feature the rider will appreciate in particular is that the fairing has been moved 30 mm (1.2") to the front in order to provide extra kneeroom. And all riders will benefit from the extra seating comfort provided by new seat upholstery and the extension of the rider's seat by 20 mm (0.79") in length.

Topcase and touring cases even larger and more functional

The new topcase offers extra capacity, being increased in size from 22 ltr (0.77 cu ft) to 35 ltr (1.23 cu ft). A special feature is that the carrier handle for the topcase now also serves for fastening the case to the motorcycle itself.

Increased in size to 33 ltr (1.16 cu ft) from 31 ltr (1.09 cu ft) and significantly improved in terms of watertightness, stability and convenience, the touring cases fitted as standard just like the topcase now offer even greater practical value. As an example, a newly developed labyrinth system efficiently seals the lower part of the case and the lid.

The lower part of the touring cases now features an integral, folding handle, but otherwise remains unchanged and is fastened to the motorcycle - as in the past - by a profile carrier. The lid, on the other hand, has been completely redesigned and is now made of ABS (acrylnitrile butadiene styrene) plastic suitable for painting. The lid also comprises locks turned 180° to the outside and with improved function.

The new design of the single-piece double-wall lid can also be seen from the two foam plastic sections at the outside, serving to protect the case from damage in the event of an impact.

Applying a standard BMW principle, all the locks on the K 1100 LT (ignition, handlebar, tank cap, seat, touring cases and topcase) can be opened and closed with one single key.

Weighing in at 290 kg (639 lb) with full tank, touring cases and topcase, the K 1100 LT is certainly not a lightweight, but is still the lightest machine in the luxury tourer market. It also offers a standard of superior handling one might not expect at first sight. And it does not present any weight problems, either, when it comes to service load: With the maximum permissible weight being increased from 480 to 500 kg (1058 - 1103 lb), the K 1100 LT's service load is now a very adequate 210 kg (463 lb).

The world's only luxury tourer available with ABS and three-way catalytic converter as an option

There can be no doubt about it: When it comes to the engine, running gear, brakes, fairing, riding comfort or luggage space, the new K 1100 LT is a significant improvement over the already outstanding K 100 LT in nearly every respect. And not least, it is the world's only luxury tourer available as an option with ABS (like all of BMW's K models) and fully controlled three-way catalytic converter. So that like the K 100 LT in the '80s, the K 1100 LT once again sets standards in the luxury tourer market. Or, to put it in other words, it is truly the original in its class now improved to an even higher standard.

THE K 1 SUPERSPORTS MACHINE

BMW's top model: a spearhead in technology

The appearance of the K 1 supersports machine in 1989 caused a tremendous stir in the motorcycle world. Apart from boosting BMW's image, this top-of-the-range model also served as a technology spearhead for the subsequent updating of the K 100 RS and K 100 LT.

Although the technical features of the K 1's engine (with the exception of engine size and performance data) and suspension are virtually the same as with the K 1100 LT and K 1100 RS, these features are described here once again in detail.

Technical features of the BMW K 1

The engine: four-valve technology for even better performance and riding culture

The development of an even more dynamic high-performance version of the four-cylinder power unit started back in 1983, the first year of the K 100 on the market. BMW's strategy of progress was clear from the outset: To consistently and logically apply the four-valve concept, a technology acknowledged the world over, for even greater power and performance. Martin Probst, at the time Head of Engine Development at BMW Motorrad GmbH, was definitely the right man to steer the destiny of the Company in this direction, since he was able to look back on years of experience with four-valve engines in his former job with BMW Motorsport GmbH, where BMW's standard-production four-cylinder power unit was ultimately converted into a Formula 1 World Championship winner.

While supreme power was the overriding objective in the development of the Formula 1 engine, the motorcycle power unit, though based on the same concept, was developed from the outset for BMW's traditional assets of superior motoring refinement, practical everyday value, all-round economy and a long running life. The designers' brief was to revise the engine in such a way so as to provide superior torque and output even better than the two-valve power plant throughout the entire speed range. Given this objective, BMW's engineers naturally increased engine power to the 100 bhp (74 kW) limit voluntarily agreed by all motorcycle manufacturers in the Federal Republic of Germany. A comparison of the output and torque curves of the two-valve K 100 versus the K 1 four-cylinder clearly shows that the new four-cylinder reaches its objective in every respect: Output is up from 90 to 100 bhp (in both cases at 8000 rpm) and torque has been increased from 86 Nm/64 ft-lb (at 6000 rpm) to 100 Nm/74 ft-lb (at 6750 rpm).

The engine of the K 1 refutes the common prejudice that four-valve power units simply have to be unflexible and one-sided. For in this case the more sophisticated technology with twice the usual number of valves serves to provide a more rapid, thorough and efficient charge cycle with a better cylinder charge at low and medium engine speeds. The mean operating pressure often applied as a yardstick for determining the quality of an engine's design amounts to a magnificent 12.7 bar in the power unit of the K 1.

With this new concept and design, BMW's four-cylinder provides even greater refinement and smoothness despite its extra power. Even without constantly using the engine speed available and thus maintaining a cool, calm

and collected style of riding, the K 1 ensures high performance at its best.

The modifications made are very impressive even though the cylinder head looks quite similar from the outside. After all, any change in the number of valves also means that they must change in size. Inlet valve diameter is therefore 26.5 mm (1.04") in both cases instead of 34 mm (1.33") on the former single inlet valve, outlet valve diameter is 23 mm (0.91") in either case instead of 30 mm (1.18") with the conventional engine.

The combustion chamber geometry and valve angles have also been modified for the new engine. Thanks to this modification and the central position of the spark plug, it is now possible to increase the compression ratio from 10.2:1 to 11:1 (running on 95 ROM Euro super). This means not only extra power and torque, but also greater efficiency and fuel economy.

BMW's engineers deliberately decided not to change the valve opening times despite the extra power this would have provided at high engine speeds. Accordingly, the four-valve power unit intentionally has the rather conservative valve opening angle of 284° serving to provide extra torque throughout the entire speed range.

Positive experience gained with the valve clearance remaining unchanged even in endurance tests for tens of thousands of kilometres induced BMW's engineers to modify the tappets of the four-valve engine in order to further reduce the volume of moving parts and ensure even greater reliability. Hence, the new engine does not

require the valve adjustment spacers still needed for the two-valve unit. Instead, adjustment of valve clearance now called for only in exceptional cases can be carried out by choosing the tappets from a wide range of individual components of pre-defined size.

The K 1 has inherited the light-alloy water-cooled cylinder block of the K 100 without any fundamental modifications. The cylinder bore of 67 mm (2.64") and the stroke of 70 mm (2.76") chosen right from the beginning ensures superior torque thanks to the particular configuration of the engine. It also ensures very compact combustion chambers contributing to the specific qualities of the K 1's engine, thus providing superior fuel economy, a high standard of engine flexibility and exceptional refinement when running under part load, an asset not that common with high-performance engines.

A number of detailed modifications in the engine of the K 1 again spell out genuine progress and an even higher power potential. Benefitting from a new process of calculation based on the Finite Element Method, the weight of the forged crankshaft has been reduced by 1.3 kg (2.87 lb). The same process has also served to optimise the weight of the conrods.

Digital Motor Electronics like in all BMW cars

The electronic engine management of the K 1 features a fundamental innovation. While the ignition and fuel injection of the K 100 are operated by separate engine management systems, the K 1 has fundamentally the same Digital Motor Electronics to be found in all of BMW's car engines (petrol models) ranging from the four-cylinder all the way to the V 12.

Another new feature of the K 1 is that it no longer has the conventional butterfly-type air volume meter, which inevitably represents a kind of obstacle in the intake manifold. Instead, Digital Motor Electronics determines engine load via a potentiometer in the throttle butterfly shaft and informs the computer in the control unit of the exact throttle butterfly opening angle. To determine the injection volume required, the engine management system also picks up and processes data on engine speed, intake air temperature, coolant temperature and atmospheric pressure (altitude factor). This new, low-resistance intake system contributes 4 - 5 horsepower to the higher output of the K 1. Comparative measurements have also shown that it helps to reduce fuel consumption.

A further asset of Digital Motor Electronics is the substantial ease of service provided by the built-in defect memory for retrieving defect information in the workshop with the help of the BMW Diagnostic Tester. Superior dependability at all times is ensured by fail-safe functions enabling the engine to keep on running even if certain components should fail to operate.

One look at the exhaust system of the K 1 reveals that there have been conspicuous changes here, too: The exhaust pipe made of high-grade stainless steel features a round muffler not extending that far to the rear. The extra silencer volume thus required is provided by an expansion chamber beneath the gearbox.

The running gear and suspension of the K 1
The same BMW Paralever as on the GS models

While the suspension and running gear have remained largely unchanged, they have obviously been adapted wherever necessary to the superior performance of the K 1. This progress is most evident on the rear wheel: Although the rear wheel features a single swinging arm as before, it is now BMW's worldwide patented Paralever fitted on the R 80 GS and R 100 GS enduro models since autumn 1987. The smooth balance of forces ensured by this unique component provides significant advantages not only with long spring travel and on rough off-road terrain, but also with a road machine. Even if the spring travel of such a machine is not that long, the Paralever reliably prevents the acceleration reactions otherwise inevitable, particularly with a high-performance engine.

Strong front-wheel fork and even more efficient brakes

The new wheel fork of the K 1 also shows a resemblance to the enduro models, since both units come from the same manufacturer: Italian specialist Marzocchi. Extra-sturdy with a diameter of 41.7 mm (1.64") and featuring reinforced fork bridges, this telescopic fork ensures optimum torsional rigidity. In cooperation with this specialist supplier, BMW has selected shock absorbers with a highly progressive damper curve under compression for optimum roadholding. On 50 per cent of the spring travel totalling 135 mm (5.31"), that is up to the position of the fully laden motorcycle at rest, these shock absorbers have minimum damper action but then become much harder upon further compression of the springs up to the hydraulic stop point. The very sensitive response of the wheel fork ensured in this way is further enhanced by the teflon-coated bushes for minimum friction and wear.

The fork comes with a Brembo brake system fully capable of handling the K 1's superior performance. The two brake discs are spirally perforated to save weight and measure 305 mm (12.00") in diameter and 5 mm (0.20") in thickness. Applying a technology developed in motor racing, the brake discs are mounted in floating arrangement on roller-shaped supports. Four-piston brake callipers round off this High-Tech brake system. To ensure consistent wear of brake linings, the brake pistons vary in diameter (32 and 34 mm, 1.26" and 1.34", respectively).

Precise application of the front wheel brakes has been improved substantially by optimising the transmission ratio of the hydraulic system (piston diameter in the master cylinder versus piston diameter in the brake calliper) and designing the brake lever with highly ergonomic contours.

The rear wheel of the K 1 features the proven brake of the K 100. To ensure even better thermal stability, however, the brake disc has been increased in thickness from 4 to 5 mm (0.16 to 0.20").

It almost goes without saying that the highly efficient brakes of the K 1 are available as an option with ABS, like all the K 100 models. Given the different suspension geometry, the new front wheel fork and brakes as well as the wider tyres, the anti-lock brake system nevertheless had to be thoroughly adapted to the K 1. To achieve optimum weight distribution and keep the brake lines as short as possible, the ABS pressure modulator for the front-wheel brake has been moved to the front beneath the fairing of the K 1.

New spring strut and sports wheels

To ensure optimum roadholding of the rear wheel, the Paralever swinging arm is supported on the frame by a new, specially-rated gas-pressure spring strut (140 mm/ 5.51" spring travel). Two special features of the spring strut are its progressive-action spring and travel-related damping effect. To adjust to the load the motorcycle is carrying, the spring can be set to four different positions by means of the tools in the toolkit, and is easily accessible.

Featuring light-alloy wheels in sporting three-spoke design, extra-wide rims and radial-ply tyres (120/70 VR-17 at the front, 160/60 VR-18 at the rear), the K 1 provides a clear visual testimony to its superbike qualities.

Reinforced frame and modified suspension geometry

Since research conducted by BMW's Test Department shows that suspension and running gear loads increase at the squared root of road speed, the frame of the K 100 was modified accordingly to match the greater power and performance of the K 1. All the tubes in the load-bearing centre section are even stronger and wider in diameter. Additional stability is also provided by the extension of the wheelbase by 54 mm (2.13"), which is mainly attributable to the longer Paralever swinging arm and, to a lesser extent, to the modified wheel fork geometry. Since road tests of the K 1 showed right from the beginning that directional stability was very good, handling has been optimised by keeping front wheel castor very short at a mere 90 mm (3.54").

To maintain this superior handling also on winding roads, the K 1 deliberately breaks with the tradition of slender handlebars on high-performance machines. The handlebar grab points are therefore 670 mm (26.38") apart.

K 1 fairing, features and model fitments

Unconventional through and through

Launching the R 100 RS in 1976 and the K 100 RS in 1983, BMW already set new standards in aerodynamic motorcycle styling. Now the Company is continuing this tradition with the K 1. Although the K 1 is designed to a greater extent for dynamism and performance, the objective was not only to reduce air drag but also to enhance rider comfort. In designing the body of the K 1, BMW's stylists were therefore required to ensure relaxed and fatigue-free riding even at high speeds as well as sensible protection from wind and weather.

To fulfill even more demanding objectives, the designers and stylists then had to introduce some unconventional solutions. One particularly striking example is the shape of the front wheel fender designed as an integral part of the new aerodynamic concept and thus standing out clearly from the traditional mudguard design. Air vents for cooling the new brake system obviously became a necessity in the light of this brand-new concept.

Record-breaking streamlining for even greater safety and road comfort

The voluminous and, as seen from above, wedge-shaped contours of the front-wheel fender provide a complete, symmetrical fairing profile and, as a result, a turbu-

lence-free flow of air along the fairing, past the rider's legs and back to the rear end of the tapered tail section. The product of frontal area (A) and drag coefficient (cd) essential to road performance is far below 0.4 cd x A in the case of the K 1 - or, in more precise terms, 0.38 with the rider sitting upright and 0.34 with the rider leaning forward. This outstanding sleekness reduces fuel consumption and increases road performance. The top speed of more than 230 km/h (143 mph) is nevertheless largely a theoretical entity on public roads.

Not built for touring under all circumstances

Through its striking looks and the rider's seating position alone, the K 1 clearly shows that it does not seek to provide the same touring qualities as all of BMW's motorcycles so far. Indeed, the concept of the K 1 to be more of a sports machine than a tourer is also expressed by the fact that the K 1 is deliberately designed not to carry touring cases.

	SPECIFICATIONS BMW MOTORCYCLES		K 75	K 75 S	K 75 RT	
Engine	Cubic capacity	cc	740	740	740	
	Bore/stroke	mm	67/70	67/70	67/70	
	Max output	kW/bhp	55/75	55/75	55/75	
	at	/rpm	8500	8500	8500	
	Max torque	Nm	68	68	68	
	at	min	6750	6750	6750	
	Design		inline	inline	inline	
	No of cylinders		3	3	3	
	Compression ratio/fuel grade (also unleaded)		11.0/S	11.0/S	11.0/S	
	Valve control		DOHC	DOHC	DOHC	
	Valves per cylinder		2	2	2	
	Intake/outlet dia	mm	34/30	34/30	34/30	
	Fuel supply		LE-Jetronic with coasting cut-off			
Electrical system	Ignition		VZ-51 L digital ignition			
	Alternator	W	460	460	460	
	Battery	V/Ah	12/25	12/25	12/25	
	Headlight	W	H 4 55/60 dia 180 mm	H 4 55/60	H 4 55/60	
	Starter	kW	0.7	0.7	0.7	
Power transmission, Gearbox	Gearbox		5-speed gearbox with dog-type shift			
	Gear ratios	I	4.50/3.20	4.50/3.20	4.50/3.20	
		II	2.96/3.20	2.96/3.20	2.96/3.20	
		III	2.30/3.20	2.30/3.20	2.30/3.20	
		IV	1.88/3.20	1.88/3.20	1.88/3.20	
		V	1.67/3.20	1.67/3.20	1.67/3.20	
Suspension	Rear-wheel drive		Encapsulated drive shaft with universal joint and integrated torsion damper			
	Clutch		Single-plate dry clutch rotating in opposite direction			
	Type of frame		Tubular space, engine serving as loadbearing component			
	Spring travel front/rear	mm	135/110	135/110	135/110	
	Wheel castor	mm	101	101	101	
	Wheelbase	mm	1516	1516	1516	
	Brakes (asbestos-free)	Front	dual-disc brake, dia 285 mm			
		Rear	single-disc brake, dia 285 mm			
	Wheels		Light-alloy wheels	Light-alloy wheels	Light-alloy wheels	
	front		2.50 – 18 MTH 2	2.50 – 18 MTH 2	2.50 – 18 MTH 2	
	rear		2.75 – 17 MTH 2	2.75 – 17 MTH 2	2.75 – 17 MTH 2	
	Tyres front		100/90/H 18	100/90/V 18	100/90/V 18	
	rear		130/90/H 18	130/90/V 17	130/90/V 17	
			tubeless	tubeless	tubeless	
Dimensions and weights	Length, overall	mm	2220	2220	2220	
	Width with mirrors	mm	900	810	916	
	Handlebar width without mirror	mm	710	650	770	
	Seat height	mm	760*	810	810	
	Weight, unladen with full tank	kg	228	235	258	
	Max permissible weight	kg	450	450	480	
	Fuel tank	ltr	21	21	22	
Performance	Fuel consumption					
	90 km/h (56 mph)	ltr	4.5	4.3	4.5	
	120 km/h (75 mph)	ltr	5.2	5.0	5.2	
	Acceleration					
	0–100 km/h (62 mph)	sec	4.6	4.6	4.6	
	standing-start km	sec	25.6	25.2	25.2	
	Top speed	km/h	200	210	210	
Model features	Fairing			Glass-fibre-reinforced plastic sports fairing fitted to frame, glass-fibre-reinforced engine spoiler	Multi-piece aero-dynamically opti-mized sports-touring fairing	
	Standard features		Repair kit, toolkit, digital clock	Repair kit, toolkit, digital clock	Repair kit, toolkit, digital clock	

* *alternatively 800 mm*

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	SPECIFICATIONS BMW MOTORCYCLES		K 1	K 1100 RS	K 1100 LT
Engine	Cubic capacity	cc	987	1092	1092
	Bore/stroke	mm	67/70	70.5/70	70.5/70
	Max output	kW/bhp	74/100	74/100	74/100
	at	rpm	8000	7500	7500
	Max torque	Nm	100	107	107
	at	rpm	6750	5500	5500
	Design		inline	inline	inline
	No of cylinders		4	4	4
	Compression ratio/fuel grade (also unleaded)		11.0/S	11.0/S	11.0/S
	Valve control		DOHC	DOHC	DOHC
	Valves per cylinder		4	4	4
	Intake/outlet dia	mm	26.5/23	26.5/23	26.5/23
	Fuel supply		Motronic	Motronic	Motronic
Electrical system	Ignition		Motronic	Motronic	Motronic
	Alternator	W	460	700	460
	Battery	V/Ah	12/25	14/50	12/25
	Headlight	W	H 4 55/60	H 4 55/60	H 4 55/60
	Starter	kW	0.7	0.7	0.7
Power transmission, Gearbox	Gearbox		5-speed gearbox with dog-type shift		
	Gear ratios	I	4.50/2.75	4.50/2.81	4.50/2.91
		II	2.96/2.75	2.96/2.81	2.96/2.91
		III	2.30/2.75	2.30/2.81	2.30/2.91
		IV	1.88/2.75	1.88/2.81	1.88/2.91
		V	1.61/2.75	1.61/2.81	1.61/2.91
Suspension	Rear-wheel drive		BMW Paralever	BMW Paralever	BMW Paralever
	Clutch		Single-plate dry clutch rotating in opposite direction, dia 180 mm		
	Type of frame		Tubular space frame, engine serving as load-bearing component		
	Spring travel front/rear	mm	135/140	135/120	135/120
	Wheel castor	mm	90	90	101
	Wheelbase	mm	1565	1565	1565
	Brakes	Front	dual-disc brake, Ø 305 mm		
		Rear	disk brake, Ø 285 mm		
	Wheels		Light-alloy wheels	Light-alloy wheels	Light-alloy wheels
	front		3.50 – 17 MTH 2	3.50 – 17 MTH 2	2.50 x 18 MT-H 2
	rear		4.50 – 18 MTH 2	4.50 – 18 MTH 2	3.00 x 17 MT-H 2
	Tyres front		120/70 VR 17	120/70 VR 17	110/80-VR 18
	rear		160/60 VR 18	160/60 VR 18	140/80-VR 17
			tubeless	tubeless	tubeless
Dimensions and weights	Length, overall	mm	2230	2230	2250
	Width with mirrors	mm	760	800	915
	Handlebar width	mm	670	610	765
	Seat height	mm	780	800	810
	Weight, unladen with full tank	kg	259	268	290
	Max permissible weight	kg	480	485	500
	Fuel tank	ltr	22	22	22
Performance	Fuel consumption				
	90 km/h (56 mph)	ltr	4.2	4.9	4.9
	120 km/h (75 mph)	ltr	5.0	5.8	5.8
	Acceleration				
	0–100 km/h (62 mph)	sec	3.9	3.8	4.3
	standing-start km	sec	22.3	22.7	24.3
	Top speed	km/h	more than 230	more than 220	more than 210
Model features	Fairing		Multi-piece-aero-dynamically opti-mized sports fairing	Multi-piece-aero-dynamically opti-mized sports-touring fairing	Multi-piece-aero-dynamically opti-mized touring fairing
	Standard features		Repair kit, toolkit, digital clock, central locking	Repair kit, toolkit, digital clock, central locking	Repair kit, toolkit, digital clock, central locking, luggage rack, topcase

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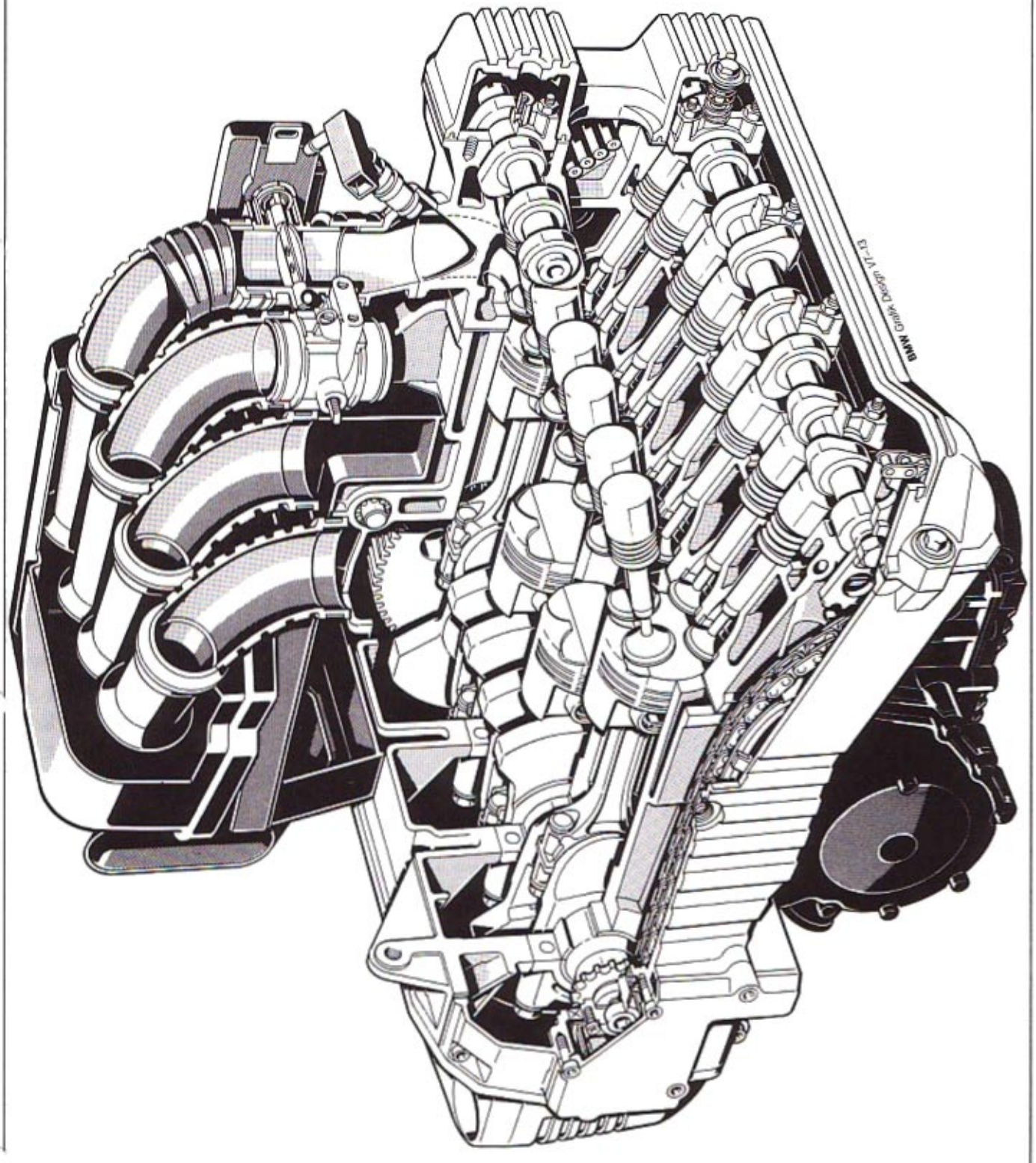
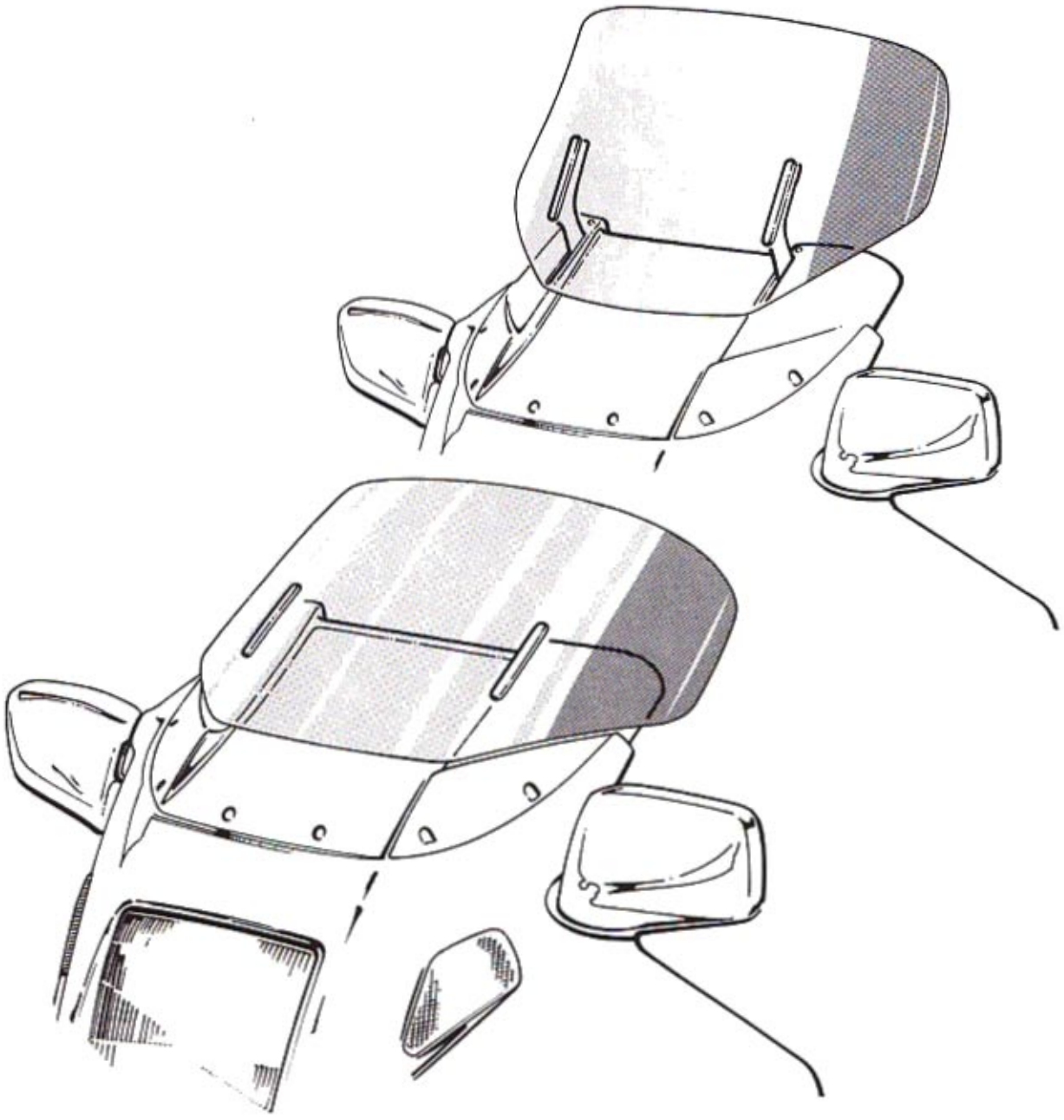
BMW K 1, K 1100 RS und K 1100 LT	M 93/4



BMW K 1100 LT

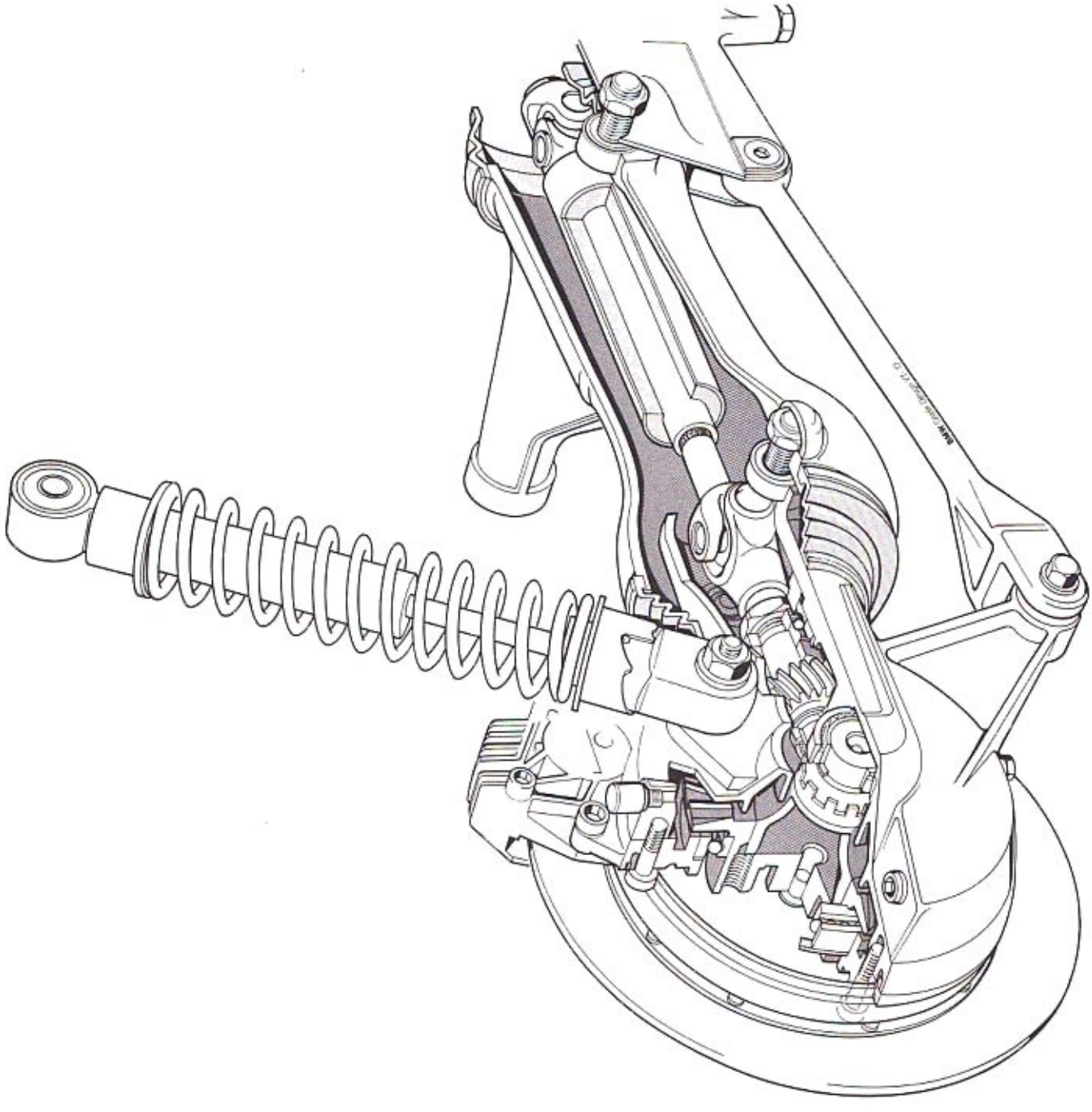
Elektrisch verstellbare Windschutzscheibe
Electrically adjustable windshield

M 93/5

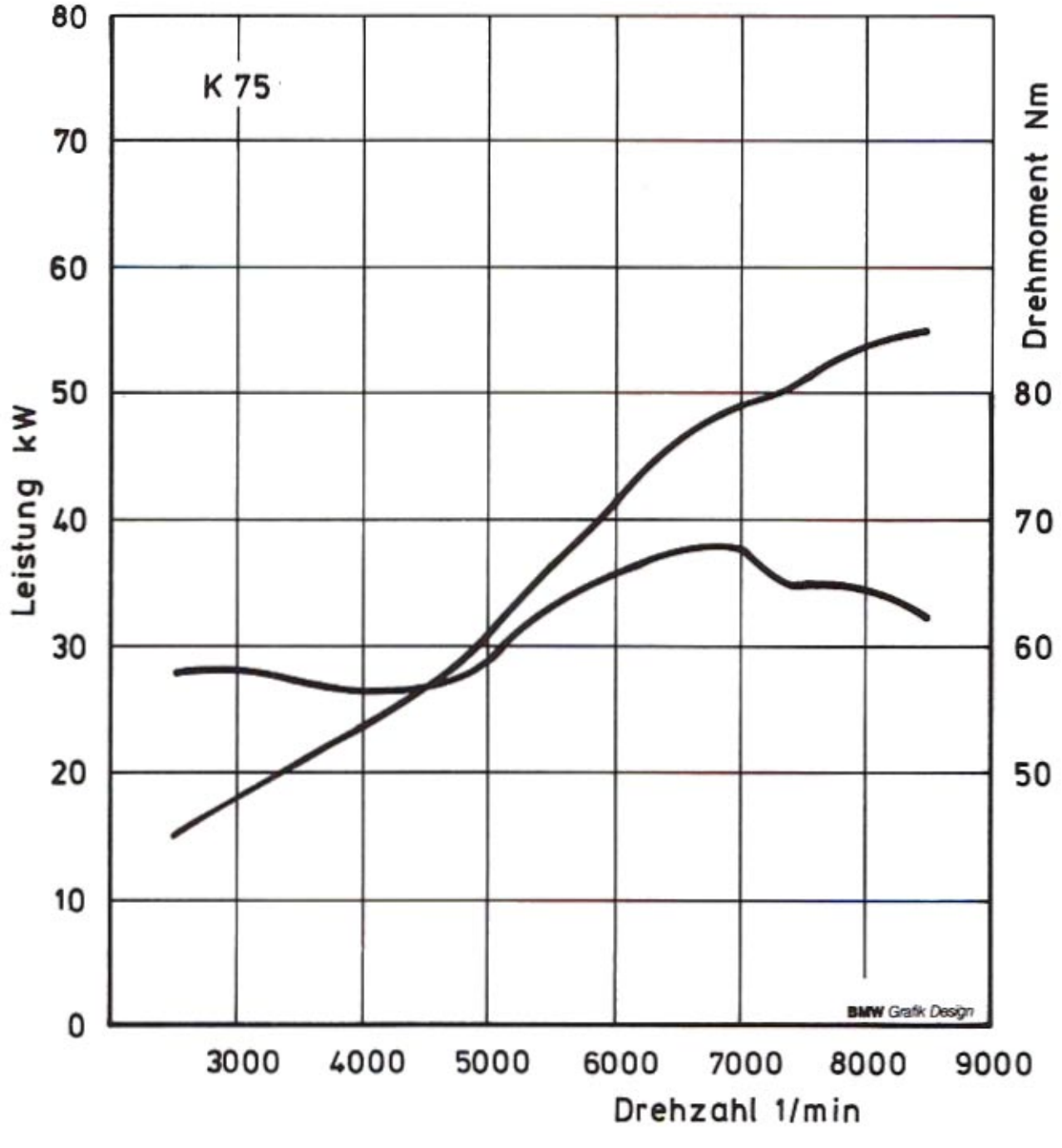


BMW K 1, K 1100 RS und K 1100 LT

M 93/6



BMW K 75	M 93/7


K 75
Leistung kW
Drehmoment Nm
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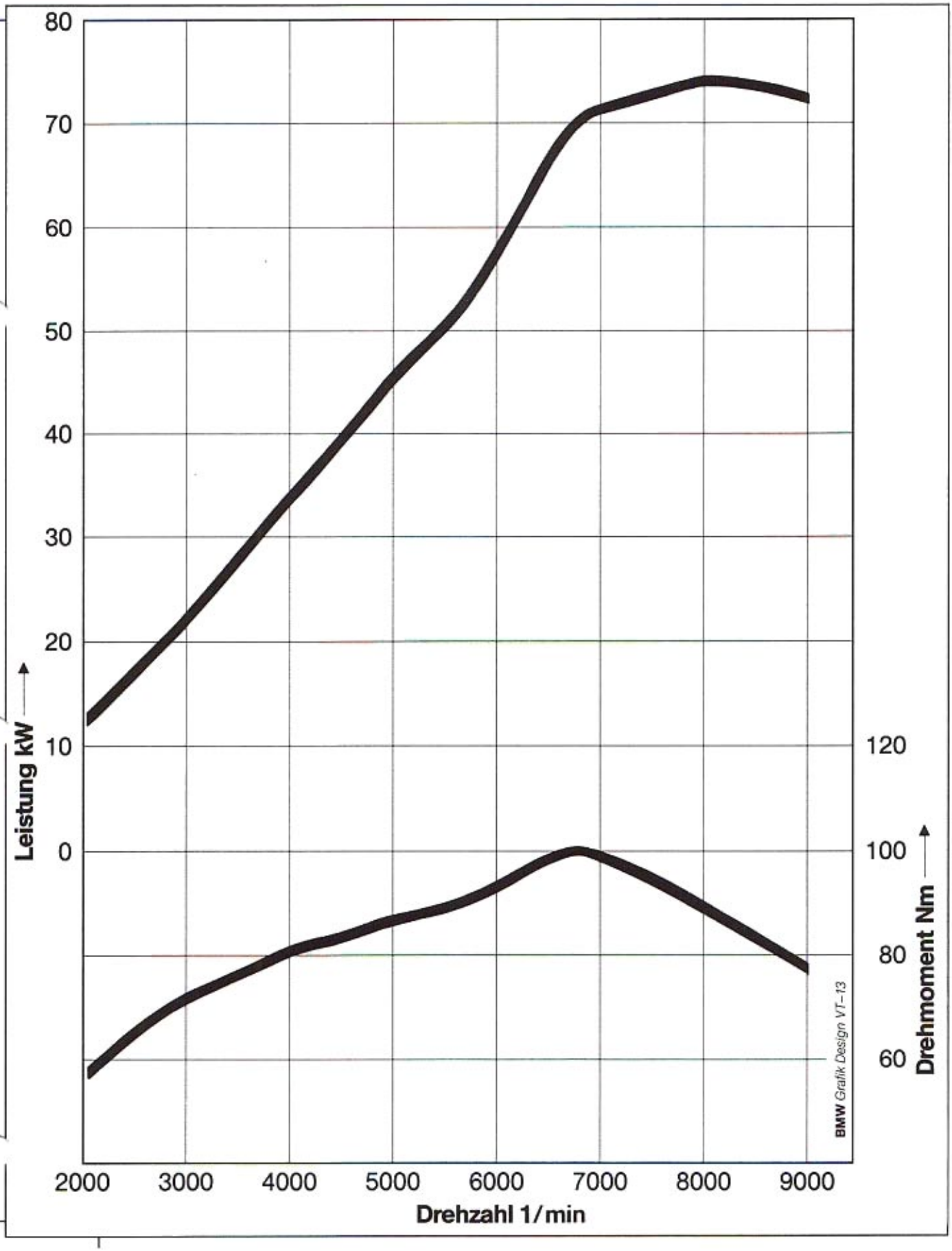
BMW Grafik Design

BMW K 1

M 93/8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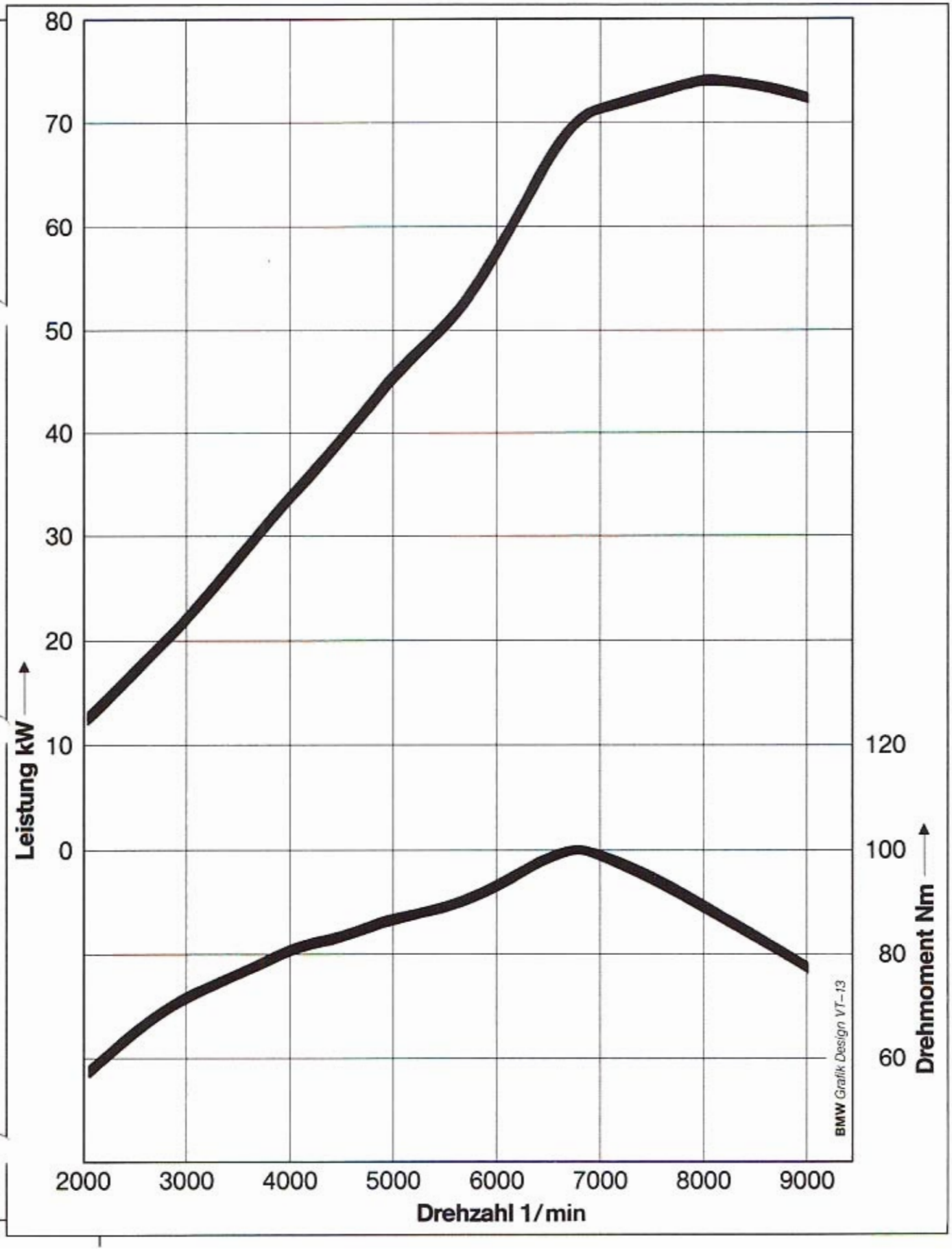
BMW Grafik Design VT-13

BMW K 1

M 93/8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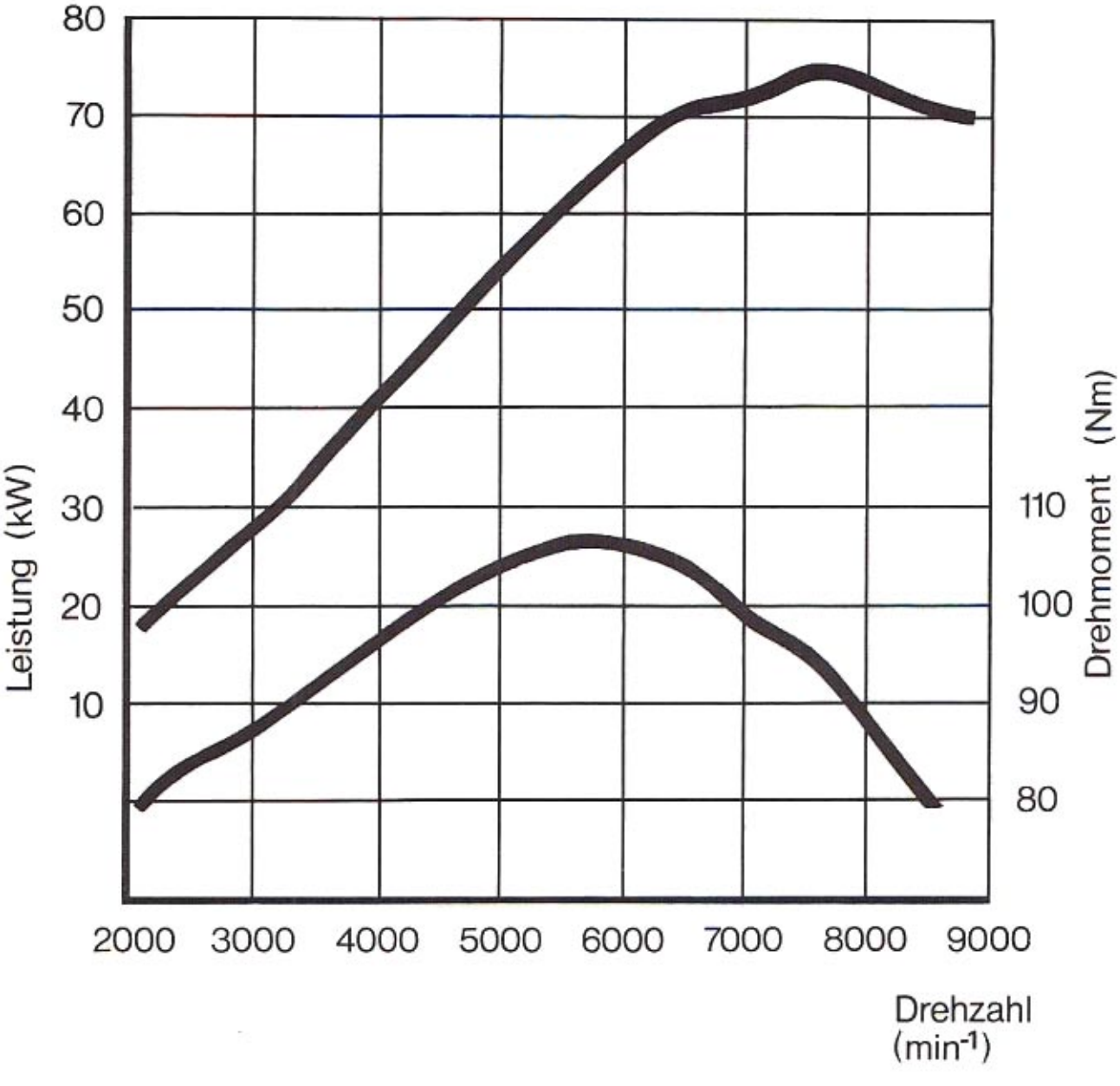
BMW Grafik Design VT-13

BMW K 1100 LT und K 1100 RS | M 93/9



PAINTWORK COLOURS OF THE 1993 MODEL YEAR

R models

R 65*, R 80 and **R 80 RT:**
classic black metallic, mystic red metallic

R 80 R and **R 100 R:** classic black metallic,
amethyst metallic, turkish green metallic

R 100 RT: classic black metallic, mystic red metallic,
turkish green metallic

R 80 GS and **R 100 GS:** avus black/yellow,
mystic red metallic, velvet violet

R 100 GS Paris-Dakar: alpine white/marrakech red,
alpine white/flash green, alpine white/velvet violet

K models

K 75, K 75 S and **K 75 RT:**
classic black metallic, mystic red metallic,
silk blue metallic, astral blue metallic

K 1100 RS: classic black metallic, mystic red metallic,
silk blue metallic, astral blue metallic

K 1100 LT: classic black metallic,
mystic red metallic, silk blue metallic,
astral blue metallic, pine green metallic

K 1: classic black metallic, silk blue metallic

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* Available only in Germany