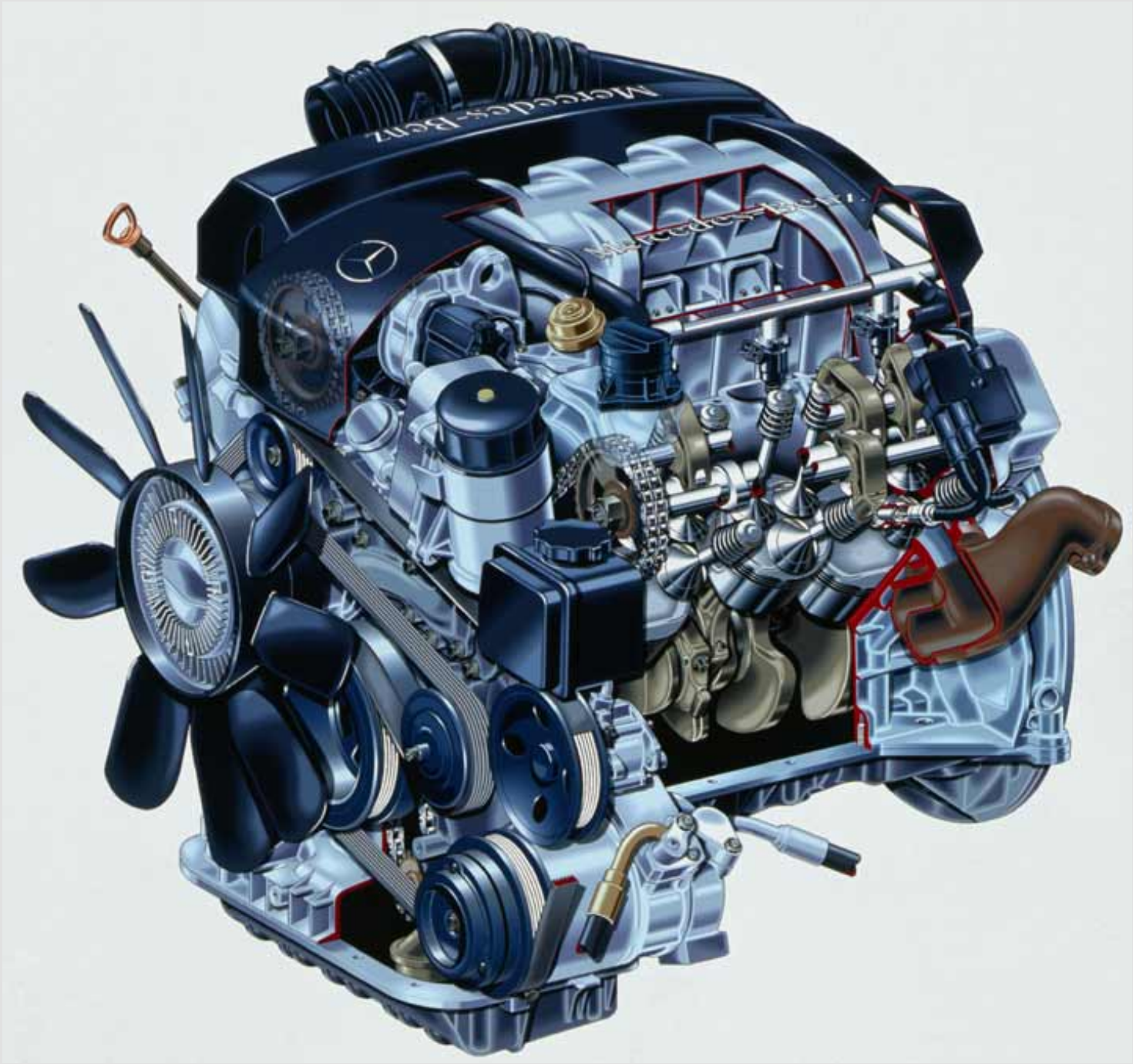

MERCEDES-BENZ TAKES WRAPS OFF NEW V6 ENGINE

New Engine Is 40 Percent Cleaner, 25 Percent Lighter and 13 Percent More Fuel-Efficient

based on MBUSA material from the M112 intro in 1998 with my updates and changes. The M113 V8 followed a year later and is based on the same technology.

MONTVALE, N.J. Mercedes-Benz is launching many of its 1998 models including the new M-Class all-activity vehicle and the CLK coupe with a new-generation V6 engine which is more fuel-efficient and lighter in weight, with lower exhaust emissions and a broader torque range than the previous in-line six-cylinder engine. The new Mercedes-Benz powerplant will be among the very few engines capable of meeting future Ultra-Low-Emission-Vehicle (or ULEV) standards.

The First Production V6 From Mercedes-Benz

Mercedes-Benz is replacing its proven in-line sixes in most models with the company's first production V6 powerplants. The 90-degree "V" cylinder layout provides very compact packaging, low engine weight and high safety in frontal collisions. The new engine uses an aluminum cylinder block and cylinder heads as well as magnesium valve covers and intake manifold, and features the first use of cylinder sleeves made of an innovative low-friction silicon-aluminum alloy. The new Mercedes V6 weighs just under 330 pounds, about 100 pounds less than the previous in-line powerplant.

Another Mercedes-Benz First Low-Friction Silicon-Aluminum Cylinder Sleeves

Mercedes-Benz is the world's first automaker to use innovative silicon-aluminum cylinder sleeves with a low-friction surface that allows piston-ring spring tension to be reduced by 50 percent. Thanks to a number of such friction-reducing measures, the internal "drag" of the new engine is 45 percent lower than other V6 engines. The efficiency pay-off for low internal friction means both fuel savings and increased power.

The new sleeve technology is also designed to provide exceptional block stiffness while minimizing weight. The new sleeves are more than a pound lighter than conventional iron sleeves, and overall, the new aluminum cylinder block weighs only 57 pounds over 50 percent lighter than its predecessor's cast-iron block.

Three-Valve Technology Reduces Emissions by 40 Percent

The new Mercedes-Benz V6 engine features innovative three-valve-per-cylinder technology which can reduce exhaust emissions dramatically over 40 percent particularly during the critical warmup stage, before the catalytic converter usually begins to operate. Catalysts must heat up to work effectively, and this takes nearly two minutes with most modern engines. Increasingly strict emissions limits mean this converter light-off time must be reduced to about one minute, and the new Mercedes-Benz V6 meets this tough criteria. There's about 30 percent less surface area at the exhaust port, relative to a comparable four-valve engine, which dramatically reduces exhaust heat losses between the engine and the catalytic converter. This translates to higher exhaust temperature (about 70 degrees Centigrade or 125 degrees Fahrenheit) and converter "light-off" about 12 seconds earlier.

In the new V6, combustion heat in each of the large, single exhaust valves is dissipated through a sodium-filled valve stem, while exhaust heat is retained and insulated by double-wall piping in the exhaust manifold. The seamless double-wall manifold is made by using high-pressure liquid-forming technology, for greater durability and lighter weight.

There is no tradeoff in horsepower and torque with the new three-valve technology compared to a four-valve design. In any efficient, well-designed engine, exhaust valve size needs to be somewhat smaller than the intake valve area, simply because the "leftovers" of combustion (especially in a modern, clean-burning engine) take up less space than the incoming fuel-air mixture.

A One-Two Punch For Spark Plugs

Using one less exhaust valve also makes room for two spark plugs per cylinder, and an innovative offset-phase twin-plug ignition system matched to the new three-valve technology actually improves performance in the new engine.

Among other things, the new dual ignition system allows an extremely lean fuel-air mixture and late ignition timing during warm-up (retarded by 5-10 crank degrees), which further increases exhaust gas volume and temperature. In this way, the tri-metal catalytic converter is heated up more quickly and begins converting pollutants even sooner. In addition, the dual ignition system activates the two spark plugs in each cylinder one after the other in quick succession (rather than simultaneously), depending on engine load and speed. This "phase-shifted" twin-plug sequence (as well as the basic ignition timing) can change after each combustion cycle for extremely precise control of the combustion process. This also enables combustion chamber pressures to be closely controlled to minimize combustion noise without sacrificing efficiency.

Modern Modular Assembly

Not only did Mercedes-Benz engineers decide that genuine progress would mean a new-from-the-ground-up

engine, but their analysis also showed that an entirely new engine factory with the most advanced equipment would make the best sense in terms of both quality and cost efficiency.

Key to this approach is the ability to manufacture six- and eight-cylinder engines under the same roof, with as many standardized components as possible. This strategy provides for increased output, which further reduces costs. As a result, a full range of V6 and V8 engines all with a standard distance between cylinders of 106 millimeters or 4.2 inches is being produced at the new engine plant in the Stuttgart suburb of Bad Canstatt. Details of a new V8 engine will be revealed at a later date. The Mercedes-Benz S600 sedan and coupe and SL 600 coupe/roadster will continue to use the current 389-horsepower 6.0-liter V12 engine.

Balance Shaft Ensures Smoothness

These plans also spelled the end of the in-line six engine family produced since 1984. With the proposed side-by-side manufacture of modular V6 and V8 engines, Mercedes engineers faced a basic conflict: while a 90-degree cylinder angle is ideal for V8 power, a 90-degree V6 design was chosen, and without compromising vibration and noise.

This coin vibration test is especially difficult due to the convex cover surface. Notice the low idle with just under 600 rpms. Sweet.

The new V6 incorporates a balance shaft in the block, nestled between the cylinder banks about where the camshaft in a pushrod-type "vee" engine might be located. Fitted with two small off-center weights, the balance shaft counter-rotates at crankshaft speed, compensating first order and second order moments inherent in 90-degree V6 engines.

The wide, 90-degree block layout also provides good rigidity for exceptionally low vibration. Mercedes engineers placed special emphasis on minimizing vibration frequencies in the 500 to 1500 Hertz range, where the human ear is particularly sensitive.

The Longest Intake Runners In The Industry

The Mercedes-Benz V6 engine features the longest intake pipes in the industry, a plus which provides outstanding low- and mid-range power. Cast into the super-lightweight magnesium intake manifold are long intake passages which spiral around to each cylinder. Incorporated into the manifold are two flaps that are closed below about 3,700

rpm, forcing intake air to take the "long route" through the manifold and build up pressure waves which boost the intake process and improve low- and mid-range torque.

At higher speeds, the two flaps open, allowing intake air to take a shortcut a more direct route to the cylinders for maximum high-speed power and efficiency. The electronic engine control unit determines precisely when the flaps are open and closed. The new 3.2-liter V6 produces 221 horsepower at 5,500 rpm, while peak torque is rated at 233 lbs.-ft. @ 3,000-4,600 rpm, depending on the specific model, and e.g. catalytic converter volume. The 2.8-liter version of the new V6 in the C280 sport sedan produces 194 horsepower and 195 lbs.-ft. of torque.

Summarizing The Building Blocks

Putting all the pieces together underscores the efficient design of the new Mercedes-Benz V6 engine. An exceptionally stiff forged-steel crankshaft (with four main bearings and six offset rod bearing journals) is at the heart of the new engine, and it's bolted into a pressure-cast aluminum block or crankcase housing. An aluminum oil pan also contributes to block rigidity. Aluminum pistons are mounted on the connecting rods, then slid into the silicon-aluminum sleeves which are an integral part of the block.

Connecting rods must be made in two pieces for assembly on the crank, and the new V6 uses hollow, forged steel rods which are made in one piece, then "cracked" hydraulically, instead of being machine-cut and reground. The irregular fracture provides a very strong, durable fit, even at high engine speeds, and shortens the production process since re-grinding isn't necessary. The two cylinder heads come next, each with a single, hollow camshaft driven by double roller chains and silent, rubber-coated sprockets. Twin rocker shafts in each head hold low-friction, roller-tip aluminum rocker arms to actuate the valves, and housed in the end of each rocker arm is a small hydraulic lifter which ensures quiet, maintenance-free valve operation.

Super-lightweight magnesium valve covers, the intake manifold and the double-wall sheet-steel exhaust manifolds complete the assembly of the basic engine. The double walled exhaust manifolds also reduces heat radiation to surrounding components.

Motronic Magic

The new Mercedes V6 engine is managed by a high-performance Motronic ME 2.0 electronic management unit. Not only does it handle both fuel injection and the new phase-shifted dual ignition, but the engine control unit is also networked via a CAN data bus with other micro-computers for the automatic transmission and the traction control and Electronic Stability Program (ESP). In this way, data is constantly exchanged at lightning speed to ensure good fuel economy and performance, low emissions, and outstanding handling safety.

Wide Acclaim

Starting in 1995 engine experts at Ward's Automotive select The Ten Best Engines every year. The Mercedes-Benz V6 has won this distinguished award four consecutive times since its introduction, in 1998, 1999, 2000 and in 2001, more often than any other Mercedes engine. In 2002 the MB V8 (M113) in the ML 500 was thus honored. Overall V6 engines received this prestigious award more often than any other engine configuration, closely followed by the popular V8s.

Veni, vidi,
M.

Wolfgang's ML Page

Wolfgang's ML Page

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radios + navigation

accidents + crashes

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winter tires

off-road tires

W163.154, M112.942, 722.662, ZF.970.402

33" BFG All-Terrain T/A KO 285/75 R16
black Kamax wheel screws
262 lbs welded Krupp steel box section frame with two longitudinals and tripple cross members manufactured by Budd Canada
central fuse and controller E-box cooled by ebm-papst brushless fan
Borg Warner transfer case with 48/52 torque split front rear and 2.64:1 low range
ZF front and rear open diffs
Spicer articulated halfshafts
Dana front and rear axle subframes
Kautex window washer tank
Kostal lower control panel
301 x 26 mm vented Brembo front disc brakes with Bosch-MB-ZF single piston sliding calipers
Wagner Thermoquiet brake pads with wear sensors on front and rear axle
Continental Teves brake controller
Siemens VDO instrument cluster
Alpine MCS DVD navigation with Weatherband
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Siemens CAN-bus adapter
Kathrein GPS/cell active rear roof antenna
GPS amplifier and splitter
150 Watt Bose Acoustimass® sound system and OEM Matsushita CD changer with AUX audio
BEI Systron Donner inertial yaw rate gyro
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iron coated Nüral® cast aluminum pistons with hard anodized ring lands
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Mercedes Debuts New V6 Engines for the 21st Century

26 June, 1997

Image Gallery

- **40 percent cleaner**
- **20 percent lighter than competitors**
- **13 percent more fuel-efficient**
- **Optimised torque from 2500rpm**

Mercedes-Benz has debuted a striking, new range of all-alloy V6 engines designed to power its passenger cars into a cleaner, greener 21st Century.

The new V6 engines are cleaner, lighter and more economical than their predecessors, which had been in production since 1984.

The V6's (the first ever built by Mercedes-Benz) are marginally more powerful than the former in-line powerplants but produce their maximum torque at lower engine speeds. This adds up to smoother, quieter driving characteristics.

The first new V6 (of 3.2 litres capacity) features in Mercedes' latest E-class saloons and the same powerplant will shortly appear in the dynamic, new CLK coupe'.

The new V6 is also smaller than former iron-block, in-line engine - giving designers greater scope when creating new body shapes and styling cues.
The shorter dimensions of the V6 also contribute to greater safety by further reducing the risk of mechanical intrusion into the passenger compartment during frontal impacts.

Already dubbed 'The World's Safest Car' the latest E-class, equipped with the new V6, has the potential to raise automotive safety to new heights.

With the in-line engine configuration now developed to its fullest environmental capacity, the most efficient answer to future emissions legislation is through the use of the lighter V-engine design.

The new V6's rank among the world's most environmentally compatible six-cylinder units. Emissions from the latest Mercedes powerplant are about 50 percent below the current EU values and the strict American limits for 'low-emission-vehicles'.

Three Valves per Cylinder

To a large extent, this has been possible through the use of three-valve dual ignition technology by Mercedes for the first time.

Better emissions have been achieved by dispensing with one exhaust valve per cylinder which reduces exhaust gas heat loss enabling the catalytic converter to reach its optimum temperature much quicker.

Additionally, dual ignition almost completely burns the fuel-air mixture in the first instance ensuring that the untreated V6 emissions are already very low, in all operating modes, before they reach the catalyst.

The combination of dual ignition, lightweight design and low-friction construction help the new V6 achieve fuel economy figures up to 13 percent lower than the previous straight-sixes making it one of the world's most efficient six-

cylinder petrol engines.

The all-alloy V6 produces the same 3 1 5 Nm torque as the previous in-line six. But importantly, the V6 achieves its maximum torque performance lower in the engine revolution band at 3OOOrpm (against 3850rpm for the in-line six).

And because of the new engine's brawnier torque pattern, around 95 percent of the engine's available torque is on tap from just 25OOrpm.
The new V6 produces 165Kw power (up from 162kW). *90 Degrees*

The new V6 is designed to a 90 degree configuration and uses a balancer shaft in the crankcase to minimise noise and vibration. The shaft rotates in the opposite direction to the crankshaft at the same speed compensating for the free vibrations normally found with V6 engines. The result means the new V6 can match the former straight-six for its smooth power delivery refinement.
The 90-degree configuration is also more rigid in design and installation producing lower vibration than similar in-line sixes.

Engineers concentrated on noise reduction in the critical 500-1500 Hertz band - the frequency which is the most sensitive to the human ear.

Technical data - Mercedes-Benz V6 3.2 litre engine
Capacity 3199cc
Max.Power 165kW (5600rpm
Max. Torque 315Nm (~3000-4800rpm
Cylinder diameter 89.9mm
Cylinder 5 acing I O6mm
Bore 89.9iTun
Stroke 84.0~
Connecting rod length 148.Smm
Crankcase height 221 .9mm
Main bearing diameter 64,Omm

Cold Start

The catalytic converter remains the key automotive emission control component but its limitations mean it is unlikely to help engines comply with future regulations.
Current engine technology enables the catalyst to reach its optimum operating temperature inside 90 seconds.
Future European and American
regulations will demand a maximum one minute warm-up.

Mercedes' innovative engineers have again pioneered the answer, this time with three-valve technology.

The new, V6 engines feature two inlet valves and one, large sodium- cooled exhaust valve. By dispensing with one of the exhaust valves the exhaust port surface is about 30 percent lower than the four-valve engine and this greatly reduces heat-loss from the exhaust gas flow by a significant 70 degrees Celsius compared with the four-valve engine.

As a result the catalyst can reach its optimum efficiency, from a cold start, around 12 seconds earlier.

E*missions 40 percent lower*

The use of three-valve, dual-spark technology and quicker responding catalysts reduce emissions from Mercedes new V6 engines by an impressive 40 percent.

Two spark plugs per cylinder mean the V6 is able to bum fuel at practically 100 percent efficiency. With only one spark plug, this cannot be guaranteed. Unburnt fuel equals higher emissions - especially during engine warm-up.

More pioneering technology from Mercedes-Benz adds to greater emissions control: a new process, which makes do without conventional welding seams, was used for construction of the inner tubes of the exhaust manifold. Instead, the internal components are simply interlocked and attached to the outer shell with laser welds.

This new technology (called internal high-pressure forming - IHU) has been jointly developed and patented by Mercedes and Germany's Paderbord University.

Doing away with the welding seams increases the life of the manifold and reduces its weight.

The catalytic converters for the V6 engines also feature a tri-metal coating made from rhodium, palladium and platinum which heats up more quickly.
In the Long-Term

The proposed European emission regulations demand that manufacturers document the performance of their componentry over the long-term:
160,OOOkms. And dual ignition helps here, too.

In case one ignition circuit should fail, a second system ensures an adequate mixture combustion. Mercedes-Benz is investigating the durability of its exhaust systems in comprehensive programs which have already clocked more than three million test kilometres in Germany and the USA.

Fuel Efficient

Dual ignition, exhaust gas recirculation and a host of other intelligent fuel saving measures result in a hefty 13

percent fuel saving for the new 3.2 litre V6 over its in-line predecessor. The new, E320 E-class 5-speed automatic uses only 6.8 litres/I O0kms on the highway.

The Mercedes V6 powerplants are among the most economical engines in their displacement category worldwide.

E320 Saloon 5-speed **automatic**
fuel consumption:
I City 110.0 litres/IOOkms I
Highway 6.8 litres/lOOkms
AS 2877 figures

Lightweight

Intelligent use of high-tech materials like magnesium, as well as a greater use of aluminium, have helped the V6 engines to a trimmer profile over the former in-line sixes.

The 3.2 V6 is around S0kgs lighter than the Mercedes in-line engine it replaces. This also makes the new powerplant one of the lightest V6 engines in the world weighing 50kg (25 percent) less than its predecessor and up to 20 percent less than similar engines produced by competitors.
Weight saving have been made through the introduction of more **lightweight metals.**

Now made from aluminium are: crankcase (reduced from 55kg to 26 kg), oil sump, cylinder head, pistons, roller-type rocker arms, engine control unit housing. Made from magnesium are: intake pipe, cylinder head cover and closing covers. A hollow, single camshaft per cylinder bank also saves weight.

Torque Spread

But, in addition to ecology and saving weight, driving enjoyment was high on the priority list for the new V6 range. Before settling on the performance dynamics for the new engines, a test program analysed the everyday, practical needs of motorists and logged the engine-speed ranges most commonly used in everyday driving.

The two-year test involved 12 cars covering 400,000 kms and produced data during typical road trips showing engine speed figures (normally in the 2000 to 5OOOrpm band).

The engineers set up the new, V6 engines for high elasticity and maximum torque available over wide engine-speed band (3000 - 4800 rpm). This design means drivers can make more use of fourth or fifth gear and save fuel by operating at lower engine speeds.

New Manufacturing Plant

The new range of V6 engines is manufactured at Mercedes-Benz' newly- built plant at Bad Canstatt in the suburbs of Stuttgart. Fittingly, the plant now occupies the site of Gottlieb Daimler's first workshop erected there in 1887.

Built at a cost of \$A615 million, the Bad Canstatt facility is now the world's most modern engine plant employing 1200 people and producing more than 1600 engines per day.

In building the new plant, Mercedes-Benz placed environmental compatibility high on the agenda. More than 5,000 sq. m of roof-mounted solar panels produce more than 500kW power for the factory (equal to the amount of power needed for 120 average homes). And, through effective treatment of waste, the factory produces no harmful effluent's. Because of the similarities in production techniques of V6 and V8 engines it is possible to achieve a number of production advantages at Canstatt, which compensate for the higher cost of V-engine production.

Although the former in-line engine still has some minor technical and economic potential Mercedes engineers found that genuine, forward looking innovation could only be achieved by building a new engine from scratch.

And by constructing a new factory it will be possible to eventually build, under the same root, six-cylinder and eight-cylinder engines which Mercedes currently manufactures in different locations.