

IMMEDIATE

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## **THE NEW BMW M3: A LEGEND IS REBORN**

**Woodcliff Lake, New Jersey, December 1, 2000...** For enthusiasts of ultimate automotive performance, it's a magic name: **BMW M3**. Combining the all-around excellence of the BMW 3 Series with the spectacular performance and handling prowess of BMW M, the M3 is the formidable BMW sports car that has won – again and again – the accolades and comparison-test victories of the world's motoring critics while providing its buyers with real practicality. Now, there is a new M3 – an all-new generation of this legendary sports car that surpasses even its acclaimed predecessor.

Entering production in February 2001, the new 3rd-generation M3 has been derived from the successful E46 3 Series coupe. It is powered by a new, dramatically more powerful BMW M 6-cylinder engine; equipped with new and unique stability enhancements; designed and equipped to radiate BMW M sportiness and quality as no car at its price level has ever done. At a base price of \$46,045, the new M3 brings together BMW M virtues in a brand-new way that is bound to set off another round of applause from those who appreciate the very best in road capabilities.

### **A BRIEF HISTORY OF THE M3**

The **1st-generation M3** was essentially a racing car tamed for road use. Offered in the U.S. from 1988 through 1991, it was based on the then-3 Series generation (internal platform designation E30) and was a winged, spoilered 2-door sedan powered by a rip-snortin' BMW M 4-cylinder engine

–more–

of 2.3 liters and 192 hp. This was a full-on BMW M engine, with 4 valves per cylinder at a time when no regular-production BMW had more than 2; an individual throttle for each cylinder; honed cylinders; and other racing-style engineering finery. Over time, there were hotter versions, both road- and race-going; just a single model was sold in the U.S. That M3 certainly wasn't for everyone; but it was a hearty and competent sporting machine, and even today it has a devoted following.

The **2nd-generation M3** is better known. Based on the then-current E36 3 Series and making its debut as a 1995 model, this M3 had a mission beyond the usual BMW M dedication to great performance and handling: to bring BMW M and its wonderful driving machines to a wider spectrum of buyers in the U.S.

This was accomplished by powering the M3 not with a traditional, highly elaborate BMW M engine, but rather with a specially developed version of what was now standard BMW practice: an inline 6-cylinder engine with dual overhead camshafts, 4 valves per cylinder and a single throttle. Taking this approach, BMW M created an engine of 3.0 liters (vs. the standard 325i models' 2.5) and a solid 240 horsepower. The strategy was perfect: Within the range of speeds American drivers experienced, this engine provided thrilling performance, yet cost thousands less to produce. The rest of the car was very much the same M3 that Europeans could buy.

In 1996 the engine grew to 3.2 liters and delivered more torque. In either form, it was loved by America's enthusiasts and critics alike. "Anyone who has audited a class in German Engineering Appreciation is familiar with the simple equation: 3.2 liters to the M power equals heart-pounding thrills," opined *Motor Trend* in September '97. "The BMW M3 has it all," reported *Car and Driver* in December '94. "Scintillating speed, brilliant handling, a utilitarian package."

This 2nd-generation M3 was offered through 1999; a convertible and a 4-door sedan joined the original coupe model along the way, extending M3 virtues to buyers with differing priorities.

## **THE NEW M3: E46 PERFECTION, M MUSCLE**

As universally acclaimed as the 1995-99 E36 M3 was, progress never stops at BMW – nor at BMW M. With the debut of the new E46 3 Series generation for the '99 model year, it was inevitable that an E46 M3 would someday appear. Now it is here.

At any point in time, the diligent people who conceive, design and engineer BMW vehicles are always striving toward the future, toward something even better than that already achieved. So it is with the 3 Series, a core BMW product. *Car and Driver*, naming the new 3 Series to its 10Best list in February '99, put it this way: "...the car is now in its fourth generation, each iteration better than the one before it. Every time BMW polishes the design, it brings the 3 Series a bit closer to perfection."

Thus the M3, too, could be brought closer to perfection. As before, the first model of the new M3 generation is a coupe. It is based on the E46 3 Series coupe, introduced only a year ago in 323Ci and 328Ci form and already evolved into the further improved 2001 325Ci and 330Ci. Yet the new M3 is more than just a "3 Series plus": Like all M Cars, it is very much its own machine, a true and dazzlingly gifted sports car.

## **A NEW APPROACH TO POWER CREATES NEW CAPABILITIES**

As multi-talented as any M Car is, its heart is always the engine. The new M3's heart is utterly new, and a dramatic departure from the already wonderful engine of its predecessor.

After the resounding success of that special, simpler, less costly engine, BMW M has decided to endow all new M3s with the same engine: a "world engine," and one that does indeed embody the more exotic, costlier, even higher-performance concept formerly reserved for other markets.

Why? Because M owners and enthusiasts demand and expect more; the bar must be raised. The previous engine's dual overhead camshafts, 4 valves per cylinder, single throttle, "rev range" to a then-impressive 6800 rpm – such features and characteristics have become normal for high-

performing regular-production automobiles. To further the M3's leading-edge position, it was time to move on to an even higher-caliber machine.

Under the new M3's domed aluminum hood, then, is an engine like none other – even more spectacular than the one that powered 2nd-generation European M3s.

### **AN ALL-NEW BMW M ENGINE: THE S54, WITH NEARLY 100 HP MORE**

In its broad concept, the new M3 engine, designated the S54 <sup>1</sup>, shares the familiar layout of other BMW inline 6-cylinder engines. Virtually all of its engineering details, however, are unique and oriented to the very highest level of performance.

Given that other current BMW "sixes" have an aluminum block with cast-iron cylinder liners, it may be surprising that the new M3 engine (like its predecessor) has a cast-iron block. Why?

**Compactness** is the primary reason. An inline six is longer than a V-6, and BMW nurtures the inline layout because of its superior smoothness and sound. An aluminum block's cylinder liners take up space; with liners it would not have been possible to achieve the engine's 3.2-liter displacement without lengthening the block.

The second reason is **strength**. Given that this engine develops fully 333 hp from 3.2 liters – significantly over 100 hp per liter – its internal stresses are immense. According to M3 Project Director Siegfried Friedmann, BMW engineers researched a silicon-impregnated aluminum block (as used in BMW V-8 and V-12 engines), which would not require liners. But they became convinced that a cast-iron block could best sustain the engine's high cylinder pressures and very high piston speed at maximum rpm. (Current Formula 1 engines attain piston speeds around 25 meters per second; with 24 m/sec. at its rpm limit of 8000 rpm, the S54 is very close.)

The block accommodates the engine's new bore and stroke of 87 x 91 mm; these have increased from the previous U.S. engine's 86.4 x 89.6 mm to give a displacement of 3246 cc, up from 3152. Increased displacement, however, is not the major contributor to the huge power increase over the

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<sup>1</sup> – All BMW M engines are designated "S" for Sport. Current regular-production BMW 6-cylinders are of the M54 family; the previous M3 engine was designated S52 US.

previous M3 engine. Playing much larger roles in the nearly 100-hp increase are the new engine's induction, combustion and exhaust engineering, together with its execution as a **high-rpm engine**. And the starring role here is played by a brand-new cylinder head that could be termed "exotic."

### **TOUR DE FORCE: THE CYLINDER HEAD**

To achieve more than 100 hp/liter, an engine needs exceptional breathing ability. The new engine's head is not merely new relative to the previous U.S. M3; it is also new relative to the previous European engine, which delivered 317 hp (SAE net).

Feature-by-feature, the new head (of aluminum as before) differs sweepingly from the previous U.S. head, becoming more like other BMW M cylinder heads. Features shared with the BMW M5's V-8 engine, for example, are noted with an asterisk (\*):

**Double VANOS steplessly variable valve timing\***. The previous U.S. engine had VANOS <sup>2</sup> variable valve timing on its intake valves only: a 2-stage system, with one timing setting for low, one for high engine speeds. The new engine has stepless Double VANOS, which varies valve timing on the intake and exhaust camshafts without the "step" of the 2-stage system. Though this VANOS is employed in current 3 and 5 Series 6-cylinder engines, as used in the M3 engine it varies timing over a wider range and contributes in a major way to the engine's stratospheric power output. Intake timing is varied by 60°, exhaust by 46 °, vs. 40 ° /25 ° <sup>3</sup>. As in all BMW engines where it is employed, VANOS is hydraulically actuated in response to electronic controls.

**VANOS pressure pump\***. The VANOS system has its own radial-piston hydraulic pump; in regular-production BMW engines the main oil pump supplies the pressure to operate VANOS. This pump is included in the exhaust camshaft's VANOS mechanism, and produces up to 120 bar (1740 lb./sq in.) of pressure. Herbert Vögele, who directs engine development at BMW M, explains that this high oil pressure enables the M3's VANOS to vary valve timing more quickly at very high rpm than would the regular-

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<sup>2</sup> - **VA**riable **NO**ckenwellen **St**euering = variable camshaft control, or variable valve timing.

<sup>3</sup> - In terms of crankshaft rotation.

production hydraulic system. Thus BMW M refers to the M3's VANOS system as **High-Pressure Double VANOS**.

**Unique valve mechanism.** All current BMW double-overhead-camshaft (DOHC) engines employ "bucket-type" hydraulic lifters, actuating the valves directly with minimum noise and no periodic adjustment. For the S54's rpm potential, BMW M needed a valvetrain with less reciprocating mass.

To achieve this, they created a different actuating mechanism, using finger-type rocker arms. Pivoting on their own shafts (one on the intake side, one on the exhaust), these small – one could almost say dainty – arms reach out to provide the actuating surface between camshaft and valve. As the entire arm does not move the distance of valve lift, its effective reciprocating mass is less than its actual mass – and it weighs less than the "bucket tappets" in the first place. When all is said and done, the effective mass is 30% less; in turn, this allows lighter valve springs, which also reduce inertia. The lower valvetrain inertia helps the engine attain its 8000-rpm capability.

As the system involves no hydraulic maintenance of valve clearance, it does have to be inspected periodically. Lead engine engineer Helmut Himmel asserts that it is unlikely that clearance will actually require adjustment, but if so it is done with shims (tiny metal discs of various thickness) without removal of the camshafts.

The rocker-arm arrangement also results in less friction. Unlike the rocker arms of BMW's V-12 engine, however, these do not incorporate rollers, which would add too much mass for such a high-revving engine.

Where the regular-production 6-cylinder engines have a simplex (single) primary chain driving the exhaust camshaft and a smaller secondary chain driving the intake camshaft from there, the S54 has a full duplex (double) chain driving both camshafts directly. As usual with BMW engines, the chain is hydraulically tensioned and needs no periodic adjustment or replacement.

**Extra-high compression ratio.** At 11.5:1, the M3 engine has the highest ratio in current BMW production. (M5: 11.0:1, also quite high.)

**Machined surfaces\*.** "Engineering finery": The combustion chambers and intake ports are completely machined, for smoothness that facilitates airflow. The exhaust ports are partially machined. For durability, the valve seats are of especially hard steel. A 3-layer stainless-steel head gasket ensures effective sealing of the head to the block.

**Head casting and sealing.** Extreme strength in the cylinder head has been achieved by making it a single aluminum casting. This construction, though more difficult to realize than the previous European engine's 2-piece head casting, also saves weight – a very significant 29 lb. As this weight savings is at the top of the engine, it helps lower the car's center of gravity.

### **INDUCTION SYSTEM: BMW M TRADITION, STATE-OF-THE-ART TECHNOLOGY**

The new M3 returns to a BMW M tradition: **an individual throttle for each cylinder.** Positioned much nearer the cylinders than a single throttle can be, these bring atmospheric pressure practically right to the cylinder. The "lag time" inherent in airflow into the cylinders is thus greatly reduced and the engine can react more quickly to throttle movements.

In principle, the M3 system – electronically controlled individual throttles – is like that of the M5 even though no actual components are shared. All six throttles operate from a single shaft, each in its own throttle body right at the intake ports. Via the accelerator pedal and its two potentiometers, the driver gives the commands, which in turn are processed by the engine control module and received by a DC servo motor. The motor drives the throttle shaft through a tiny gearbox.

Upstream of (and acoustically decoupled from) the throttle bodies are the six intake trumpets, made of weight-efficient fiberglass-reinforced PA6 thermoplastic; their diameter-to-length ratio was calibrated with a computer program of BMW's Formula 1 racing department. In turn, the trumpets are laser-welded into the induction plenum of the same composite material to form a single assembly.

As on the M5, **M Driving Dynamics Control** provides Normal and Sport settings for throttle response. In the Sport setting, selected via a console switch, the ratio of throttle opening to pedal movement is increased so that apparent engine response is even quicker. Remarkably, even the transitional response of the electronic engine controls (primarily ignition timing) is altered to suit. Drivers will find one or the other setting more to their liking, or choose them according to driving conditions; the system always reverts to Normal when the engine is started.

Together with the stepless VANOS, this elaborate induction system contributes to the engine's immense breathing and fuel/air processing capabilities.

### **EXHAUST SYSTEM: ENGINEERED FOR FREE FLOW**

The M engine team led by Messrs. Vögele and Himmel developed one of the freest-flowing exhaust systems ever installed in a production vehicle. After the partially machined exhaust ports, it begins with two elaborately snaking stainless-steel headers serving three cylinders each.

These headers are formed under high pressure **with water inside them**, which ensures even distribution of the forming pressure and thus consistent wall thickness. In turn, this process allows stainless-steel walls only 1 mm thick (about 1/25th of an inch), not only helping save weight but also hastening engine warmup as there is less metal to heat up after a cold start.

Each header is a single piece, thus not welded-up as are most headers.

In one of the few differences between the U.S. and European versions of this engine, whereas the Euro model's catalytic converters are under the floorpan, in the U.S. version engine each header also includes the catalytic converter. This puts the catalysts closer to the engine, improving emission control when the engine is started from cold and meeting more stringent U.S. regulations in this regard. Four Lambda (oxygen) sensors are employed; the engine meets U.S. LEV (Low Emissions Vehicle) limits.

From the catalytic converters rearward, the exhaust system continues as a true dual system through a large, L-shaped muffler/resonator at the rear, which occupies half the under-trunk space that in E46 coupes is devoted to the spare-tire well. From the resonator emerge four polished outlets that speak the authoritative tones of M Power.

This elaborate and efficient exhaust system imposes fully 40% less back pressure on the engine than that of its European-version predecessor, and of course this too contributes to the engine's enormous breathing and power-producing capacity.

## **HIGH-PERFORMANCE LUBRICATION AND COOLING**

Though their lubrication systems are not identical, there is similarity to the M5 engine in that a “semi-dry-sump” system helps ensure adequate lubrication under the high cornering, acceleration and braking loads the M3 attains. Particularly in hard cornering to the left, there might not be natural return of the oil to a conventional pan; therefore, integrated into the gear-type pressure pump is a **scavenging pump** (the M5 has two of these) that collects oil from the right side of the small forward oil sump and pumps it back into the main, larger rear sump. This rear sump is almost completely closed off from the rest of the system, and thus able to hold the oil necessary for the required lubrication throughout the engine. Specific return passages are also incorporated into the intake (left) side of the engine to help ensure ideal oil flow under all operating conditions.

The graphite-coated aluminum pistons are cooled by oil spray, and each valve rocker arm is sprayed with oil just as it is about to be loaded by its camshaft lobe.

As on the M5 engine, a thermal sender is employed to monitor both oil level and temperature. If the level drops low, a warning appears in the instrument cluster; the tachometer face includes the oil-temperature gauge.

As on the M5 engine, the M3 cylinder head incorporates crossflow cooling; this promotes consistent temperatures from the front to the rear of the head, helping minimize distortion and wear under the extreme heat such a high-performance engine develops when its full power is being exploited.

## **THE HIGH-RPM CONCEPT**

BMW M engineers chose the S54's high-rpm concept to achieve high power from moderate displacement. High engine speeds pose challenges; engineers must ensure that durability standards are met and that the engine performs properly at the high rpm levels. As mentioned earlier, the engine's rev limit is 8000 rpm; its maximum power occurs just below this limit at 7900 rpm. Drivers who mean to enjoy this engine “to the limit” may operate it frequently in these upper reaches of rotational speed.

To achieve the impressive revving capability, the engineers employed a number of detail measures. A forged, nitro-carbonized steel crankshaft

provides great strength in this critical component. Forged-steel “crack” connecting rods eliminate the need for bolt sleeves and thus reduce reciprocating weight.

Demonstrating just how many details can go into realizing the high-rpm concept, a unique new water pump plays a role too. The crossflow cooling, essential to the high-speed operation, requires high coolant flow. To achieve this, the engineers developed a pump with 3-dimensionally contoured vanes. Such contours would have been inordinately costly to produce in metal, so BMW M developed a brand-new, novel pump design. Each vane is a small plastic casting, pressed into an also-plastic rotor and then welded into place. Thanks to this innovative impeller, water-pump efficiency has been boosted significantly. Adding future efficiency is a ring-type thermostat, which imposes less resistance to coolant flow than conventional plate thermostats.

**Electronics** also play a key role in the high-rpm concept. BMW fully developed the S54’s control module: Manufactured by Siemens and called MSS 54, this unit “can do everything, and do it fast,” as Helmut Himmel says. Every 6 degrees of crankshaft rotation, it calculates and adjusts the ignition and fuel-injection at each cylinder individually. Ignition takes place through a very small-diameter “pencil” coil at each cylinder, adopted from BMW’s V-12 racing engine and making its first appearance in a production car.

### **SPECTACULAR RESULTS: POWER, TORQUE, REVS, PERFORMANCE, SOUND**

All this major and detail engineering work results in a remarkable, high-performing, great-sounding sports engine. Powered by its 333 hp through the standard 6-speed manual transmission, the new M3 sprints from rest to 60 mph in a thrilling 4.8 seconds – same as the M5 – and continues on to an electronically limited maximum of 155 mph.

Yet for all this through-the-gears showmanship and the theatrics of upshifting at 8000 rpm, the M3 engine is by no means short on everyday driveability, willingness and auditory pleasure. “Every bit as impressive is the fact that it needs only 5.4 sec. to storm from 50 to 75 mph in fourth gear, which is nearly as quick as the Z8,” commented *Automobile Magazine* in its

November 2000 issue. *Autoweek* (October 23, 2000) concurs: "It redlines at a racy 8000 rpm, but pulls like a Percheron <sup>4</sup> from 800 or less."

### **GREAT LOOKS TOO: THE VIEW UNDER THE HOOD**

The S54 engine is engineered beautifully, and also designed to look beautiful. Open the hood and you'll see: Tubing – for the idle air supply, fuel to the injectors, fuel from the fuel pump – is stainless steel. Housed in cast aluminum, the VANOS mechanism projects prominently forward of the cylinder head. Stainless-steel screws secure the camshaft cover. Chrome rings hold the induction trumpets to the ports. The "M" logo adorns the front of the camshaft cover, which also carries a special M oil filler cap. Upper shock/spring-mount covers are special to the M3 too. A long tradition of visually attractive machinery from BMW M (and BMW in general) is advanced another step here.

### **M3 DRIVETRAIN: GETTING S54 POWER TO THE ROAD**

Like every M Car to date, the M3 transmits its power to the road via classic rear-wheel drive <sup>5</sup>; BMW M is not inclined to accept the extra weight and friction of all-wheel drive in an ultimate performance vehicle.

That said, the M3 packs some premium and fascinating engineering into its drivetrain.

**6-speed manual transmission.** In another departure from the previous M3, the new one comes standard with the familiar, robust and precise Getrag

Type D, 6-speed manual transmission. As in the M5, it is crisply controlled by a shift knob with illuminated shift pattern and M logo.

A dual-mass, hydraulically damped flywheel between the engine and clutch is specially tuned to the S54 engine's power pulses and drivetrain configuration. Its primary plate is made of forged steel for high strength. For the first time in a 6-cylinder M Car, the clutch is self-adjusting; this maintains

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<sup>4</sup> – A French breed of workhorse.

<sup>5</sup> – The original M Car, the M1, had a midship engine and rear-wheel drive.

consistent clutch-pedal forces over the life of the clutch, which helped the engineers achieve high torque capacity with moderate pedal effort. The hydraulic actuation circuit includes a limiter orifice that smoothes momentary loading peaks (shocks) without in any way cutting into the clutch's performance; this helped avoid excess weight in the drivetrain.

The transmission housing incorporates NACA air intakes which, together with careful aerodynamic design of the underbody, help keep internal transmission temperatures down; the engineers speak of 30°C (about 55°F) cooler oil. After an initial oil change at 2000 miles, the transmission oil needs no further replacement for the life of the vehicle.

**M5-sized differential unit.** Significant modification in the rear-suspension area, including an all-new subframe, has allowed equipping the M3 with the same heavy-duty differential dimensions as the even more powerful (394-hp) M5. For the first time in a BMW, a new high-strength steel alloy, called 18CrNiMo7, is used for the differential gears to achieve superior quietness and durability. A relatively "short" final drive ratio, 3.62:1, fully utilizes the engine's generous torque and rpm range; the 6th gear keeps it humming moderately at cruising speeds. Here too, targeted airflow under the vehicle helps keep the oil cool, along with a ribbed differential case.

**Variable M Differential Lock.** Together with the German division of GKN Viscodrive, BMW M engineers developed a new mechanical limited-slip differential for the new M3.

The principal (and principle) difference between a traditional limited-slip "diff" and the new Variable M Differential Lock is that where the former senses torque, the new senses wheel speed (rpm). Under dry to not-quite-dry road conditions, the traditional limited-slip has always enhanced the handling of sporty rear-wheel-drive BMWs; however, under slippery conditions, this differential type is limited (in the literal sense) in its ability to improve traction. On all current BMW models, electronic traction control addresses this issue, although not in an optimum manner for sporty, M Car-style driving.

The Variable M Differential Lock specifically addresses low- and split-traction situations in a way that reinforces sporty handling, imparting to the M3 a slippery-road ability no high-performance, rear-wheel-drive sports car

has ever had. Where the traditional limited-slip is a torque-sensing mechanism, this is an **rpm-sensing** device.

Any time a speed difference develops between the two rear (driven) wheels, a **shear pump**, driven solely by this difference, develops pressure in the silicon viscous fluid in which the lock operates. In turn, this pressure is directed to a multi-disc clutch that transfers driving torque to the wheel with the better road grip ("select high"). The greater the speed difference between the two wheels, the more positively the clutch engages. As soon as the difference between the two wheels' speeds begins to diminish, the clutch begins to ease off.

This mechanism is what engineers call "elegant," in that it achieves sophisticated action by entirely natural means. There is no external pump, no external source of lubrication or operating fluid. The very motion to be controlled – differences in speed between left and right wheels – generates its locking action. Viscous fluid is so-called because it develops internal force (via an increase in viscosity) whenever it is sheared; this is why the relatively small difference between one wheel speed and the other can generate the necessary action here.

**Dynamic Stability Control.** This electronic traction and stability system, now standard on all BMW models except the M roadster and coupe (they will get it when their 2001 models appear), is complementary to the Variable M Differential Lock.

DSC optimizes traction by electronic means, with the system sensing wheel-speed differences and reducing engine torque and/or applying individual rear-wheel brakes. The crucial difference to the M3 driver between the Variable M Differential Lock and the DSC traction function is that the former in no way impedes power delivery, and is hence suitable for performance driving.

Yet in fact, DSC's traction function also operates in the M3 in such a way as to "dampen" driving enjoyment less than in more mainstream BMW models. In cooperation with Continental Teves, BMW M engineers developed specific logic that, in combination with the fast-reacting engine, performance-oriented gearing and Variable M Differential Lock, achieves the desired traction optimization in a more M-compatible way...in other words, without undue interference with M3 performance and the differential lock's ability to get power to the road.

The stability-enhancing function of DSC is essentially unrelated to traction. Sensing differences in wheel speed in a critical cornering or avoidance maneuver, DSC detects any deviation from the normal cornering path (abnormal understeer or oversteer) and gently applies individual wheel brakes to help the driver keep the vehicle on the intended path.

As usual with DSC, it can be de-activated via a console button.

### **M3 CHASSIS: THE BEST OF E46 3 SERIES AND BMW M**

Conceptually, two elements characterize the direction BMW M engineers took with the new M3:

**M3** – The previous M3 was known for its fantastic handling. In September 1997, it was acclaimed by *Car and Driver* as the “Best-Handling Car Over \$30,000” – against models, some of them out-and-out exotics, costing up to twice its price. A key target was that the new M3 had to be even better.

**E46 3 Series** – Compared to the E36 3 Series on which the previous M3 was based, the E46 generation had made significant strides in refinement. It handles at least as well as the “old” E36, while affording its occupants greater comfort and refinement.

As we shall see, the new M3 benefits from this two-faceted heritage.

**Front suspension.** While retaining the basic concept of both E36 and E46

3 Series, BMW M stayed close to the E36 M3 in terms of the system’s kinematics (its arrangement and movements of components as the suspension works over bumps and in curves). At the same time, the new M3 system takes advantage of E46 developments, including the wider front track and aluminum lower arms. Specifically:

- At 59.4 in., the new M3’s front track is a hefty **3.4 in. greater** than that of its forebear.
- As on the E46 3 Series, weight-saving, strong forged-aluminum lower arms are employed. But their design is unique to the M3.

A major thrust in development of the M3 front suspension was the rigidity of its connections to the chassis/body structure; here the engineers went all-out.

To form an ultra-rigid basis for the suspension system, the BMW M engineers created a new **thrust plate**, a reinforcement that handles the immense lateral thrust generated by the M3's tires in cornering. It is made of aluminum 3 mm thick, and attaches in the area between the left and right lower suspension arms. The thrust plate even incorporates a NACA air intake that takes in air to cool the transmission.

The bearings, bushings and cushions on which these arms pivot are also all-new:

- The E36 (regular and M3) had a steel balljoint at the front and a rubber cushion at the rear of the lower arm.
- The E46 has a steel balljoint at the front, and a hydraulic cushion at the rear that is a principal element in the E46 3 Series' greater riding comfort.
- The new M3 has a steel balljoint at the front and a rubber cushion at the rear.

Thus the M3's mounting of the lower arms is similar to that of the E36 M3, and stiffer than that of the E46 3 Series.

In contrast to the arc-shaped lower arms of the E46, the M3's **new lower arms** have a "bat wing" shape that achieves even greater strength. As on the regular E46 models, they are made of forged aluminum for lightness; the M3 arms add three open sections for further weight savings.

Other new or modified front-suspension components include:

- New steering knuckles
- Modified wheel bearings
- Subframe – from 3 Series convertible, rather than coupe.

An additional distinction is that the M3 struts – like the E36, unlike the E46 – separate the top mountings of spring and shock absorber. The strut's top anchor point moves rearward, increasing caster, while the coil spring's mounting stays where it was; the separate mounting improves isolation from road harshness, compensating to some degree for the firmer bushing arrangement.

**Steering.** The M3 employs essentially the same steering mechanism as the E46 3 Series: rack-and-pinion, with engine-speed-sensitive variable power assist. Its overall ratio is 15.4:1, just slightly "quicker" than the 15.5:1 of regular 3 Series models. The power assist is calibrated for extra-firm road feel, and steering return action is enhanced by the increased caster.

**Rear suspension.** The advanced multi-link system used in the previous and current 3 Series is also employed in the M3, with upper lateral links of cast aluminum as on current models. Here the track is also increased relative to the previous M3 (up 1.8 in. to 60.0 in.), and both pairs of lateral links (lower and upper) have steel balljoints instead of rubber bushings at their outer ends. There are many other points of distinction from the standard rear suspension as well.

For the larger, stronger M3 differential, M engineers developed an entirely new mounting system that uses one bushing at the front and two at the rear, just the opposite of the standard 3 Series setup. In BMW's usual "acoustically decoupled" mounting, the differential mounts through these bushings to a subframe, which then attaches to the main structure through four rubber mounts. This subframe is specific to the M3, having been developed to accommodate the larger differential assembly.

Not only is the subframe itself new; BMW M has added a V-brace to stiffen its attachment to the main structure. This is analogous to the thrust plate at the front, and has the same purpose: to add rigidity where the suspension joins the vehicle structure.

As the most prominent element of the multi-link rear suspension system, the massive Central Link is retained. The link pivots on a large rubber bushing at its forward end; this element is firmer in the M3 than in any other current 3 Series model. The axle halfshafts are upsized for extra strength, and the wheel carriers are special to the M3: adopted from the 7 Series, and therefore endowed with strength intended for 4500-lb. vehicles.

**Springs and shock absorbers: "black magic."** When we arrive at this topic, we enter an area where BMW's – very especially BMW M's – capabilities are legend. "Black magic and witchcraft. Those must be BMW's secrets," raved *Car and Driver* in a recent road test. "How else does one explain the way it manages to bring inanimate metal, rubber, and plastic to life?"

After the basic design and geometry are set, M's chassis engineers hit the road and race track in prototypes, testing, changing, fine-tuning for absolutely optimum performance. The M3's coil springs have been carefully calibrated for the ideal blend of firmness and compliance. Its twin-tube gas-pressure shock absorbers – with hollow piston rods to minimize inertia and

mass – are likewise perfectly calibrated for sports-car response. Anti-roll (stabilizer) bars – 26 mm front, 21.5 mm rear <sup>6</sup> – have been carefully sized front-to-rear for ideally responsive, yet not nervous, handling. All this has been confirmed and re-confirmed on the BMW Proving Ground's handling course and at the famous Nürburgring racing circuit in Germany.

**Brakes: even more powerful.** Powerful brakes are always a BMW strength, and the recently introduced 330 models already upgraded 3 Series braking ability with front discs of 325-mm / 12.8-in. diameter and rear discs of 320-mm / 12.6-in. diameter. The M3 goes a step further with 328-mm / 12.9-in. rear discs, and the rotors are thicker all around: 28 mm at the front, vs. 22; and 20 mm at the rear, vs. 19. A tandem booster, sized 10 in. / 9 in., provides extra vacuum assist over the 330s' single 10-in. booster. As always on M Cars (and presently the 3 Series too), all four discs are ventilated for high fade resistance; electronically proportioned for optimum distribution of braking power; and backed up by Dynamic Brake Control, which reinforces the driver's pedal effort in emergency braking. Though published stopping-distance data are not yet available, BMW M points out that the M3 can be brought to a halt from 100 km/h (62 mph) in half the time it takes for it to accelerate to that speed.

**Wheels and tires: ultimate grip and style.** M3 wheel and tire equipment comes tantalizingly close to that of the top-of-line M5. In a new interpretation of the M Double Spoke design concept, the wheels are sized 18 x 8.0 front and 18 x 9.0 rear and have the same Satin Chrome finish as the M5's wheels

Connecting these massive, deep-dish alloy wheels to the road are suitably wide, low-profile, high-speed-rated tires, developed specifically for the M3. They are sized 225/45ZR-18 front / 255/40ZR-18 rear.

As in all other current M models, the M3's exhaust system precludes space for a spare tire. If a tire is punctured – a rare event these days in any case – the **M Mobility System** provides a way to get home.

M Mobility consists of a container of rapid sealant, a compressor and a hose to connect the compressor to the damaged tire. All this is carried in a container in a recess under the trunk floor. (The compressor, plugged into the console power socket, can also be used for leisure purposes, such as

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<sup>6</sup> –330Ci with Sport Package: 24 mm front / 19 mm rear.

pumping up an inflatable boat or tent.) The system can seal punctures up to approximately 1/4 inch across.

Omitting the spare tire saves fully 15 kg, or about 33 lb.

**BMW M Tire Pressure Monitoring system.** Like the M5, the new M3 is equipped with this system to warn the driver of loss of tire pressure. Using the wheel-speed sensors that serve ABS, DSC and other functions, the system detects abnormal variations in the tires' rotational speed, which indicate a falloff in tire pressure at one wheel or another. This is signaled to the driver by a warning in the instrument cluster's Check Control display.

**Optimum weight distribution:** 51% front / 49% rear. A traditional BMW strength that contributes significantly to formidable handling.

### **EXTERIOR DESIGN: MORE DISTINCTION FROM 3 SERIES, STILL A TASTEFUL PERFORMANCE STATEMENT**

The M3's exterior design continues the established themes of BMW M:

- Distinguish the M Car from its regular-production counterpart
- Visually emphasize its performance and road capabilities
- Maintain the good taste and timeless esthetics that characterize all BMWs.

The differences between the M3 and its regular-production 325Ci and 330Ci counterparts are extensive, purposeful and more dramatic than those setting the previous M3 apart from its regular-production counterparts.

**Front view.** The distinctive bumper/spoiler ensemble features three openings: center, with screen, for the engine oil cooler; sides, for the foglights. These outer openings are in fact air intakes for brake cooling.

The M3 hood, of aluminum to reduce weight, differs sharply from the 3 Series' steel hood (and contributes to excellent weight distribution). It features a "power dome" and contours that sweep up from the grilles' flanks to the A-pillars, the latter lines echoing the 5 Series. As on the regular models, Xenon low-beam headlights are optional. "White" or clear turn-signal lenses are used here and at the rear, another distinction from the 3 Series coupe.

**Sides.** Dramatic changes. The wheel openings are flared out fully 20 mm (0.8 in.) more on each side, accenting the 18-in. wheels and tires and keeping them inboard of the sheet metal. Overall, the body is 0.9 in. wider than the 330Ci – a distinction the previous M3 did not include.

Other specific side elements include “gills,” which recall the E9 (2.5 CS – 3.0 CSi) coupes of the 1960-70s. Typical M aerodynamic outside mirrors add to the distinctive look. And by pointing toward the rear wheels, unique side sills visually emphasize BMW’s rear-wheel drive.

**At the rear.** The rear bumper/apron is all-new. Rear reflectors have migrated from there to the taillight clusters, a lateral ridge stretches all the way across, and openings for the four exhaust outlets line up with the trunklid sides. A discreet spoiler tops the lid’s top edge, but can be deleted at no extra cost if customers desire.

**Colors.** The U.S. M3 is available in a choice of eight exterior colors, four of them metallic.

### **INTERIOR DESIGN AND EQUIPMENT: THE IDEAL DRIVING ENVIRONMENT**

With the exemplary 3 Series driving environment as its starting point, the M3 cabin adds features and design details that express the M3’s formidable capabilities and provides the ideal command center for them.

**The driver’s view.** The instrument cluster closely resembles that of the M5, with bright rings around each of the four dials, M logo in the speedometer, and red pointers on gray backgrounds throughout.

Appropriately, the tachometer is of great interest. Its scale reaches to 9000 rpm. From 4000 to 8000 rpm, the **variable warning segment** first seen in the M5 also appears here. When the engine is cold, illuminated orange LEDs begin at 4000 rpm, reminding the driver not to use maximum performance yet. As the engine warms up – operation is based on oil temperature – these LEDs phase out in increments of 500 rpm until the segment reaches its normal 7500-8000 rpm range (which always remains illuminated). The tachometer’s advanced servo-motor operation is revised to keep pace with the M3 engine’s rapid climb up the rpm curve. Also in the tachometer face is an analog oil-temperature gauge.

Another prominent facet of the driver's command center is the new M sport steering wheel. Incorporating updated design and arrangement of its multi-function controls, the wheel has a wide bottom spoke with the M logo. Its leather-covered rim with M-color stitching is extra-thick, with thumb contours at 10 and 2 o'clock.

An oval rearview mirror is yet another distinctive M element in the driver's view; electrochromic auto-dimming is standard.

**Seats: two choices, all designed for support and comfort.**

Standard in the M3 are 10-way manual sport seats, with adjustments for –

- Fore-aft
- Cushion height
- Front-of-cushion height (cushion angle)
- Backrest angle
- Thigh support.

These seats include BMW's "differentiated contours": the backrests have prominent side bolsters toward the bottom, then a delineated upper backrest section without side bolsters. The idea is to provide the desired lateral support, but without possible constriction around the shoulders. The cushions are also prominently bolstered at the sides for lateral support – something the M3, with its high cornering capability, puts to good use.

The next step up is **power seats**, with 8-way power adjustment and manual thigh support. These are available as part of the Luxury Package, and include the memory system for driver's seat and outside mirrors <sup>7</sup>.

As a further option BMW M has added yet another dimension to "lateral support without constriction" by equipping the backrest bolsters with inflatable air chambers. A control on the seat's outer edge allows the occupant to vary backrest width. Included in this option is **4-way power lumbar support**; altogether, these ultimate sport seats offer 14-way power adjustment.

In all M3 seats, one sits relatively low and sporty; as there is a height adjustment, occupants can adjust this to suit their own personal tastes and requirements. The front head restraints are manually adjustable for height

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<sup>7</sup> – All power-seat options also include BMW's thoughtful automatic tilt-down feature: When reverse is selected, the right outside mirror tilts down to give the driver a view of the curb.

and angle, and the cleverly configured 3 Series fold-up center armrest (with contoured storage compartment inside) is standard.

**Upholstery and trim.** Standard upholstery is a new, attractive ribbed fabric called M cloth, with Nappa leather trim and available in black only.

Many U.S. M3 buyers are expected to order the Nappa Leather interior, available in the Luxury Package or as a stand-alone option in a choice of four colors. Familiar from the previous M3 and currently seen also in the 750iL, this premium leather is applied with unique stitching to –

- Seats
- Door panels (complete except upper ledges and outer surfaces of storage pockets at bottom; leather extends into inner walls of pockets)
- Rear-compartment side panels.

With all upholstery combinations, the headliner is in Anthracite color. High-gloss black trim appears across the instrument panel and on the door and rear side armrests.

**Split folding rear seats standard.** As in the 3 Series coupes, split folding rear seats add a measure of versatility that might be surprising given the M3's performance and sportiness. They include a fold-up center armrest, and for security can be released only from the trunk. Rear-seat entry and exit are facilitated by BMW's easy-entry feature, which allows the front seats to be moved forward when their backrests are folded over.

## **COMPREHENSIVE SAFETY AND SECURITY FEATURES**

Paralleling the 3 Series, the M3 is standard-equipped with an exemplary range of safety equipment, including –

- 2-stage front-impact Smart Airbags
- Height-adjustable front safety belts with automatic tensioners and force limiters
- Interlocking door anchoring system for side impacts
- Front-seat Head Protection System
- Front-seat side-impact airbags, door-mounted
- Battery Safety Terminal
- Central locking system with double-lock anti-theft feature, selective unlocking

- Coded Driveaway Protection.

Rear-compartment side-impact airbags are offered as a moderately priced option so that customers may choose to have them or not; vehicles with them are delivered from the factory with the rear airbags de-activated, and customers may have them activated or de-activated at any time, free of charge and regardless of the vehicle's age or mileage.

Thus the M3 addresses not only the emotional desire of customers to possess a machine of great performance and beauty, but also the rational demand for safety and security. It is of the same basic construction and equipment as the 2000 3 Series sedan that was recently tested and ranked along with four other midsize luxury sedans by the Insurance Institute for Highway Safety.

In actual 40-mph offset frontal crash tests of five models, the 3 Series sedan earned the Institute's Best Pick rating. BMW's occupant compartment held its shape, with low likelihood of injury.

### **OPTIONS AND ACCESSORIES: APPEALING CHOICES**

Beginning with the M3's base price of \$45,970, BMW M offers an appealing range of Packages and stand-alone options to outfit the M3 to individual customers' tastes and priorities.

**Luxury Package.** Rain-sensing windshield wipers, leather upholstery, power seats with memory, tilt-and-slide power moonroof.

**Cold Weather Package.** High-pressure headlight cleaning system, heated front seats and ski bag.

**Power Seat Package.** Includes 4-way power lumbar support and power-adjustable backrest bolsters. Available for vehicles not equipped with the Luxury Package.

**Width-adjustable power front seat backrests with 4-way lumbar support.** These features are available as a separate option for power seats which are included in the Luxury Package.

**Xenon low-beam headlights.** For even brighter, more daylight-like illumination. These include automatic leveling of the lamps.

**Park Distance Control.** Four ultrasonic sensors in the rear bumper help the driver avoid backing into unseen obstacles.

**Spoiler delete.** The rear spoiler can be deleted at no extra cost.

**Leather upholstery.** As in the Luxury Package, but as a stand-alone option.

**Power moonroof.** As in the Luxury Package, but as a stand-alone option.

**Harman Kardon audio system.** Increased audio power, more speakers and upgraded componentry.

**In-dash single-disc CD player.** Replaces the standard cassette deck.

**BMW Onboard Navigation System.** Multi-faceted system including GPS Navigation, 8-function Onboard Computer, and controls for the audio system and (if the vehicle is so equipped) BMW Cellular Phone System.

**Rear-seat side-impact airbags,** special-order option.

**BMW Cellular Phone System** – full-featured, fully integrated in-car/portable system installed by the BMW Center.

**Alarm system.** Keyless entry and a multi-function, keyhead-integrated remote control are standard; the alarm system is Center-installed.

**6-disc CD changer.** Choice of trunk or glove-compartment versions; Center-installed.

**BMW Universal Transceiver.** 3-function remote control for garage doors and other amenities.

### **AN M3 LIKE NEVER BEFORE**

As a logical, yet highly emotional evolution of the previous, beloved M3, the new E46 M3 not only represents a significant step forward in the art of high-performance automobiles, but maintains and advances BMW M's reputation as a creator of unique sports machinery. After the exotic M1, two generations of M3, the current 3rd-generation M5 and the spirited M roadster and coupe, the new M3 is yet another BMW M milestone.

### **FULL MAINTENANCE PROGRAM INCLUDED WITH EVERY M3**

Like almost all other 2001 BMW models, every new M3 includes BMW's 4-year/50,000-mile Limited Warranty, Roadside Assistance for the same period, and BMW's Full Maintenance Program for 3 years or 36,000

miles <sup>8</sup>. This reassuring package of product backing and customer service makes every BMW model even more appealing from a cost standpoint than its value-oriented base price would indicate.

### **PERFORMANCE WITH A CONSCIENCE**

BMW strives to produce its motor vehicles and other products with the utmost attention to environmental compatibility and protection. Integrated into the design and development of BMW automobiles are such criteria as resource efficiency and emission control in production; environmentally responsible selection of materials; recyclability during production and within the vehicle; elimination of CFCs and hazardous materials in production; and continuing research into environmentally friendly automotive power sources. Tangible results of these efforts include the recycling of bumper cladding into other vehicle components; water-based paint color coats and powder clear coats; and various design and engineering elements that help make BMWs easier to dismantle at the end of their service life.

### **BMW IN AMERICA**

BMW of North America, Inc. was established in 1975. Since then, the company has grown to include marketing, sales and financial-services organizations in the United States; a South Carolina manufacturing operation; DESIGNWORKS/USA, an industrial design firm in California; a technology office in Palo Alto, California; and various other operations throughout the country. BMW is represented in the U.S. through a network of more than 340 car, 315 Sports Activity Vehicle and 160 motorcycle retailers. BMW US Holding Corp., the group's headquarters for North, Central and South America, is located in Woodcliff Lake, New Jersey.

Information about BMW products is available to consumers via the World Wide Web on the BMW homepage. The address is <http://www.bmwusa.com>.

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<sup>8</sup> - The 750iL luxury flagship includes Full Maintenance for 4 years or 50,000 miles  
-more-

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**Journalist note:** Information about the BMW Group and its products is available to journalists on-line at the BMW Group PressClub at the following address: [www.press.bmwgroup.com](http://www.press.bmwgroup.com).