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Technical Knowledge for Independent BMW Service Professionals

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Welcome.

the bimmer pub is sponsored by your local BMW wholesaling dealer parts department, and is dedicated specifically to independent technicians who service BMW vehicles.

Our position is simple. If you are able to repair and maintain BMW vehicles properly and efficiently, your reputation will be enhanced, as well as the reputation of BMW. To this end, feature articles are intended to provide hands-on diagnostic and repair procedures, service and maintenance techniques, with content sourced from both BMW and successful independent BMW repair specialists.

With a driving combination of the proper repair procedures and the correct Original BMW Replacement Parts, you can expect to fix that BMW right the first time, on time, every time.

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We want to make *the bimmer pub* the most useful and interesting technical magazine you receive, and you can help us do that. Please email our publisher at: cayers@thebimmerpub.com and let us know what topics you would like to see covered in upcoming issues. Your suggestions and comments are welcome, and with your involvement, this publication can become one of your most important tools.

Thanks for your continued interest.

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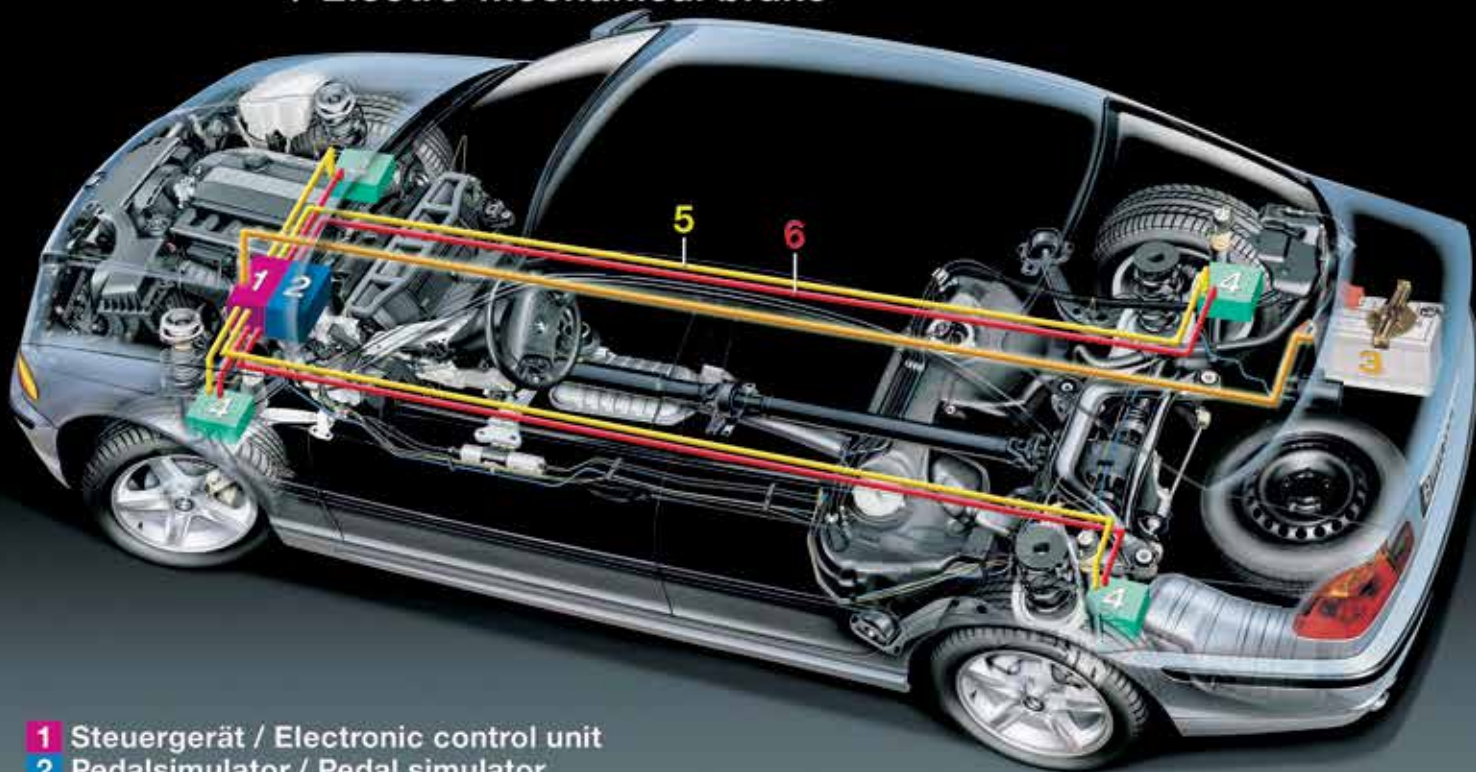
BMW's quest to make vehicles stronger, lighter and more fuel efficient is never ending. In order to achieve these goals, new ways of thinking and new materials are necessary. That translates into new repair procedures.

Caution: Vehicle servicing performed by untrained persons could result in serious injury to those persons or others. Information contained in this newsletter is intended for use by trained, professional auto repair technicians ONLY. This information is provided to inform these technicians of conditions which may occur in some vehicles or to provide information which could assist them in proper servicing of these vehicles. Properly trained technicians have the equipment, tools, safety instructions, and know-how to perform repairs correctly and safely. If a condition is described, DO NOT assume that a topic covered in these pages automatically applies to your vehicle or that your vehicle has that condition. BMW of North America, LLC, the BMW name and BMW logo are registered trademarks of BMWAG.

Perfect Brake Service

If you're just "hanging pads" without doing a careful inspection and evaluation of the whole braking system, you're doing both your customer and your shop a disservice.

EMB Elektro-Mechanische Bremse / Electro-mechanical brake



- 1** Steuergerät / Electronic control unit
- 2** Pedalsimulator / Pedal simulator
- 3** 42 V (36 V)
- 4** Aktuator/Radelektronik / Actuator/Wheel control unit
- 5** EMB-Signale / EMB-signals
- 6** Energieversorgung / Power supply

Safety concerns have led to brakes being among the most highly-engineered and rigorously-tested systems in today's family of BMW vehicles. And properly so. Fortunately, BMW engineers have been able to design advanced systems that perform extraordinarily well, while still being relatively easy to diagnose and repair. This is especially helpful since the volume of brake work needed, unlike that of many other repairs, has remained steady, or has even increased in recent years, and is a mainstay of your business. It represents an attractive profit opportunity for independent repair shops servicing BMWs. The key, of course, is to make sure it's done right the first time in order to prevent comebacks that can suck the profit out of an otherwise profitable job.

How do you know?

There are obvious and less-obvious indications that brake work is called for. Certainly a "Brake Service" light on the dash is the most "in-your-face" clue to the presence of a shortcoming in the system. This may be due to a pad wear indicator that has grounded to a rotor, or low pressure in one hydraulic circuit. And a signal from the BMW CBS (Condition Based Service) indicator suggests that a combination of miles driven and driving habits as analyzed by onboard electronic logic have resulted in critical brake lining wear. A parking brake light that stays illuminated can alert the driver to a brake issue even if no CBS alert is activated. Or, an illuminated ABS warning light can point to a damaged wheel speed sensor, or even to a caliper, lining, or rotor problem.

But these are far from the only indicators of brake trouble. Customer complaints often raise the need for brake work. Typical customer reports can include brake noise (especially squeal), pedal pulsation, low pedal, or pulling to one side while braking, all of which point to the need for a careful inspection of all system components.

If your shop is in an area that mandates Periodic Motor Vehicle Inspection (PMVI), you know that it requires, at minimum, a thorough visual inspection of the brake components of at least one front and one rear wheel on the opposite side of the car, and some

locales require physical inspection of the brakes at all four wheels. Even if not mandated, it's certainly wise to inspect the brakes all around since there may be a fault at just one corner.

Many independent repair shops are taking a cue from dealership strategies, performing a "safety check" of critical systems whenever a car is in for any repair whatsoever. This is a valuable service for the motorist since today's less-frequent shop visits can allow problems to go unnoticed for extended periods of time. Such delays can lead to substantial damage and expense, so it is in the best interests of both the motorist and the repair shop for you to provide an inspection of safety-related systems, either free or for a modest fee.

Finally, a road test, even for issues not related to braking, affords technicians the opportunity to evaluate braking performance. This is especially important since stopping capability can degrade gradually over time, unnoticed by a vehicle owner who's become accustomed to the gradual loss of control. Part of being "The Ultimate Driving Machine" is providing extraordinary braking ability, a hallmark of all BMW vehicles. A discriminating technician will likely notice any malfunction or shortcoming right away. Remember that when a car leaves your shop, your reputation rides with it. So don't assume anything. Bear in mind that a less-skilled technician may have replaced brake components previously, possibly with sub-standard non-BMW parts. So satisfy yourself as to the integrity of all parts of the braking system.

Start with the pads

Visual inspection usually tells the tale with brake pads. Any technician worth his salt will be able to see if pads are worn to the point of needing replacement. The depth of lining left above the wear sensor is the give-away here.

But a key factor in brake pad inspection is comparison of wear levels. If the pads are worn at one front wheel but not the other, then it's likely that the caliper at the wheel with the good pads is not

working properly. This may seem counter-intuitive since at first blush you might think that there's a problem at the wheel where the pads are worn. But in most cases it's just the opposite.

Similarly, if one pad at a wheel is worn more than its mate at the same location, it's likely that rust, corrosion, or a significant burr on pins or sliding surfaces is preventing a single-piston caliper from exerting equal force on both sides of the disc. With rigidly-mounted dual-piston calipers, uneven wear suggests a hydraulic problem such as a stuck piston. Also, check the friction surface of each pad for tapered wear, which can suggest binding caliper components, and look for a glazed surface which would indicate improper previous break-in, overheating of the friction material, or contamination.

If new pads are called for, choose carefully. The quality of replacement disc brake pads can range from that of "pressed cardboard" off-brands of dubious composition to more expensive specimens that may contain impressive-sounding materials like ceramics and even titanium. If your focus is on a high-quality, trouble-free brake job, as it certainly should be, your safest choice is to install the same type of pads the car was born with. After all, the brakes didn't squeal when the car was new, and they shouldn't squeal after your brake service. So, it's best to use genuine OE pads from your local BMW dealer's parts department. And, whenever replacing disc brake pads, always install new wear sensors. The old ones almost certainly have grown brittle with age and heat, and your chances of successfully removing them and installing them on new pads are almost nil.

Refer to the rotors

Evaluating the condition of the discs requires more accuracy and judgment than any other part of brake service. Some clues are visual, some are measurable, and some are even invisible.

For visible flaws, look for scoring, grooves, discoloration, or cracks. That's the easy part.

The measurable part, however, requires the use of a suitable micrometer and dial indicator, both in good calibration, and skill on your part if you are to achieve safe and satisfying braking. Your first check should be for minimum thickness, since this is the characteristic most likely to call for replacement. A dedicated disc brake rotor micrometer, whether mechanical or digital, will tell if a rotor is at, or near, its minimum safe thickness, a figure that, by law, is cast into the hub of every disc. Remember, the rotor thickness will still have to exceed its minimum even if you choose to machine it on a lathe to cut to a



If brake pad lining remaining above the wear sensor is minimal, it's time for new pads. Never try to re-use wear sensors. They'll be brittle from thousands of heat cycles and will almost certainly break if you try to remove them.

smooth surface past grooves from scoring. In most cases, BMW only allows 0.064 in. (1.6 mm) of material loss before the discard thickness is reached, which amounts to additional justification for advocating the sale of new rotors to your customers.

This brings up the subject of “rotor forecasting.” That is, extrapolating from the amount of metal lost during the wearing out of the last set of linings to what the thickness will likely end up being by the time the new pads you are installing reach the end of their life. Typically, this reduction will be on the order of 0.032 to 0.040 in. (or 0.8 to 1.0 mm) per cycle. If the rotor has more than that left, and no machining is necessary, you can reuse the discs and just install fresh pads. On the other hand, if that subtraction puts you below the discard spec, you’re leaving yourself open to both complaints and liability. It’s easy math to explain to your customers, and if you handle it right you should sell a lot more new rotors.



This is typical wear and scoring on a well-used BMW disc brake rotor. While it may not appear severe, it might just put the rotor beyond allowable specs.

You should use your micrometer for measuring disc thickness variation (DTV), too -- where some areas of the rotor are thicker than others. Any appreciable DTV will cause the pads to move in and out as they try to stay in contact with both rotor surfaces, causing pulsation in the brake pedal. They can also, at higher vehicle speeds, cause the disc brake pads to skip over low spots. This not only reduces brake effectiveness; it also causes the pads to contact only certain areas of the rotor, making them much hotter than surrounding areas, and therefore more subject to warping or becoming “hard spots,” which can produce different friction characteristics in various spots on the surfaces. BMW recommends a maximum of 0.0002 in. variation in rotor thickness.

Finally, you’ll need a dial indicator to measure disc runout. While this “wobble” itself may not be the actual cause of pedal pulsation, it leads to that by promoting the uneven wear that results in DTV. Simply put, runout may be present even if the rotor is thick enough, and even if thickness variation is within specs. Runout can be a result of heat-induced warpage, but it can also come from rotor mounting errors (get those hub mounting surfaces clean!) and tolerance build-up in the spindle, hub and bearing assembly. BMW recommends a maximum of 0.001 in. of runout.

To turn or not to turn?

In years past, machining rotors has been a common practice, as long as the finished piece still had a thickness that exceeded the minimum figure stamped into it. And recently we’ve seen on-car lathes being promoted as providing more precise machining than bench lathes. Each type has benefits and drawbacks. Bench lathes can produce an adequate friction surface, but may not run true on the vehicle due to tolerance build-up. On-car lathes yield surfaces that run true on the car, but these lathes are costly and setup can be slow, involving time-consuming set-up and calibration for runout.

Rare is the BMW dealership that machines rotors today. Instead, nearly all will recommend and install new rotors in order to assure the most consistent and effective braking.

In the final analysis, turning rotors is time-consuming, and necessarily leaves the disc that much closer to its discard thickness, which can compromise its ability to withstand warping. Since new rotors are affordable, most technicians today opt to simply install new discs rather than machine the old ones. It's certainly best to replace rotors in pairs to assure even, balanced braking.

Since technicians report frequent problems with cheap aftermarket rotors produced off-shore, it's safest to source new rotors from your local BMW parts department. Note, too, that BMW specifies that disc brake rotors on M-series cars, or any others that are cross-drilled, should never be machined.

Think of it this way: When you subtract the labor of turning rotors in a workmanlike manner on a well-maintained lathe, then cleaning them thoroughly (the avoidance of which is a common cause of squeak and squeal), the cost difference between that alternative and installing new isn't so great after all, and with the latter choice you can be more confident in the results.

Caliper concerns

Brake calipers are generally not replaced as part of a routine brake job, but that doesn't mean they shouldn't be carefully inspected to find out if that step is necessary. But what, exactly, does "necessary" really mean? In truth, there are really just two reasons to condemn a brake caliper -- leaking seals, or sticking/stuck pistons. Happily, both conditions are easy for a technician to determine -- but only if he looks.

Liquid brake fluid in the vicinity of the caliper's dust boot, or a dust boot swollen because it's filled with fluid are the give-aways of leakage. On multi-piston units, uneven pad wear is a sure sign of a stuck piston, while on the

single-piston type, such pad wear is evidence that something is interfering with the necessary side-to-side transfer of force, such as a burr or corrosion on the pins or sliding surfaces of the caliper halves -- the piston may be causing one pad to wear without pulling the other pad against the rotor.

This uneven wear can manifest itself in one of several ways. You might notice that pads on one side of the car are worn much more than those on the other side of the vehicle. That's a sure sign of a stuck piston or a restricted hydraulic line or hose on the side with little or no wear. One or both pads at the same wheel that are worn at an angle signifies a problem with caliper bushings or mountings. So you have to be discriminating in your diagnosis.

Few service technicians rebuild calipers anymore; it's just too time-consuming to be profitable or practical. While some may choose to install remanufactured aftermarket calipers, their quality and durability are reported to be spotty, and a comeback on a brake job will be a profit-killer for sure. So it's best to purchase



It's best to use a dedicated rotor micrometer for measuring disc thickness, since this tool will have pointed tips to extend down into wear grooves. Conventional micrometers with flat tips will not provide an accurate representation of the condition of the rotor.

new genuine BMW calipers and replace them in pairs, since the failure of one caliper suggests that its mate is not far behind. Replacing calipers in pairs will also assure even braking on both sides of the vehicle.

Note, too, that new-generation BMWs are fitted with electric parking brake mechanisms. When performing rear brake service on these vehicles,,

you'll need to retract the brake pads with the use of a laptop computer or electronic reset tool. BMW service literature calls for disconnecting the vehicle's battery and using an auxiliary power supply during this procedure.

Small parts, big value

Pads, rotors, and calipers are certainly the Big Three when it comes to service, but they don't represent all that goes into a proper and professional brake service. It's important to check flexible brake hoses for cracking or signs of abrasion that can compromise their integrity, leading to a huge safety risk. Ditto for the steel brake lines, which must be inspected for dangerous corrosion during every brake service, especially in areas where road salt or splashing salt water is to be expected. Remember, too, that irregular pad wear can be an indication that a brake hose has failed internally, preventing proper flow of brake fluid.

For example, if the hose has clogged so that fluid pressure to the cylinder



All genuine BMW rotors have minimum thickness specs cast into them. Part of the technician's responsibility is to project whether the remaining thickness of the rotor will last as long as the expected life of the pads.



Worn or damaged caliper mounting pins can cause calipers to bind, preventing even and reliable braking. Corroded sliding surfaces can result in similar brake problems.

is restricted, the car will most likely pull toward the opposite side when the brakes are applied. On the other hand, if the hose is restricted so that fluid pressure from the master cylinder can get through, but the weak retraction action of the square-cut piston seal can't force the fluid back out when the pedal is released, expect to find an overheated "blued" disc and vastly accelerated lining wear on that side.

One cause of hose restriction that is often overlooked is heavy rust on the bracket that holds the hose to the chassis. The iron oxide can build up to the point that it actually crushes the hose. New parts from your BMW dealer are called for.

Some important details make an appropriate conclusion:

- Be alert to vehicles that are fitted with aftermarket or mis-matched wheels and tires. Such modifications can confuse the ABS and ESP modules and can produce unusual symptoms and fault codes.
- Don't overlook the need for torquing all brake-related fasteners to specs. This includes wheel

lug bolts -- tightening them with an impact gun is a major cause of rotor warpage.

- On those BMWs that use spring steel retaining clips, check for cracks or flattening that can compromise their spring tension. Replace wear sensors as a matter of course. Be sure to inspect and adjust the parking brake shoes, and remember that BMW recommends flushing and replacing the brake fluid every two years, which is excellent insurance against expensive repairs.
- No brake service will be complete without resetting the CBS system, and the pad wear sensor warning system if it has been activated. Both of these operations vary according to the model and year, so log on to www.bmwtechinfo.com for the official details. We'll just mention here that the CBS system will convey the updated information to the remotes.
- Finally, it would be foolhardy not to thoroughly road-test the car before you declare the job complete. ●



When removing brake calipers for any service operation, it's important to properly support the caliper to avoid damaging the brake hose. Never let a caliper hang by its hose.

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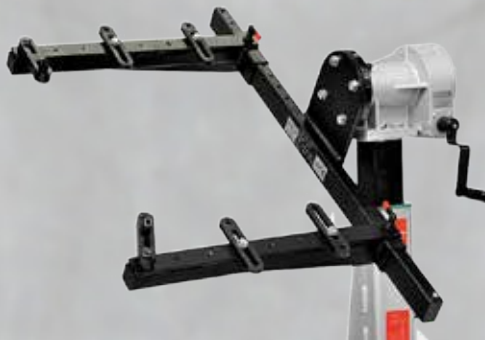
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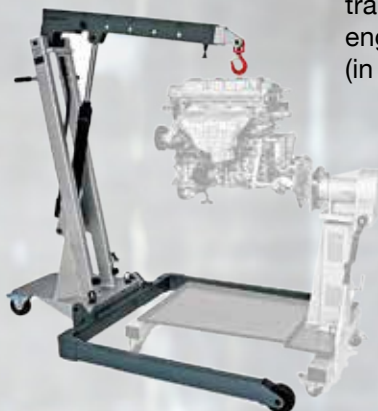
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Beating Around the Bushings:

Suspension & Steering Joints



BMW pioneered the all-aluminum vehicle suspension. The resulting weight reductions and strength gains helped pave the way for rapid adoption of multi-link suspension and four wheel independent systems. When diagnosing and repairing these complex suspensions, technicians must go beyond traditional bushing replacement. They must also consider the other components that may be affected by the bushing installation process, or, based on the age of the replaced bushings, are likely to also need replacement soon.

Unsprung: The Revolutionary BMW E39

The BMW E39 1995-2003 5-Series was the first production vehicle sold with almost all-aluminum front and rear suspension.

The axle carrier, control arms, outer strut tubes, steering knuckles, -- everything except the wheel bearings, were aluminum alloy. The result was a significant savings in unsprung weight, which benefitted handling, ride quality, and fuel economy.

Aluminum alloy control arms were lighter while simultaneously stronger and smaller. The increased space and power these smaller components provided allowed BMW engineers to pack even more chassis control technology onto the vehicles, even while decreasing overall weight.

Larger brake systems, double wishbone and double-pivot front and multi-link rear suspension, and higher

Left: In BMW's Electric Power Steering (EPS) system, a torque sensor measures the force the driver applies to the steering wheel, and adjusts the vehicle's steering characteristics. BMW calls the system "low maintenance" – translation: You can replace rubber boots and adjust alignment, but everything else is factory-sealed.

precision suspension angles were just a few of the benefits of aluminum alloy use. The BMW E39 quickly earned a reputation as a superior handling vehicle.

Absorb and Isolate

On the BMW E34, E28 and E32, the upper control arms are attached to the front subframe through bushings that handle a lot of the load on the front end when braking. These bushings are typically fluid-filled rubber cylinders surrounded by a metal sleeve. Bushings are typically used in BMW control arms and also in thrust arms.

On all but the sportiest platforms, BMW uses either soft rubber or hydraulic bushings for driving comfort. For racing applications, harder rubber and urethane compounds provide more durable bushings. These tougher bushings contribute to a stiffer suspension than is desired by most luxury vehicle owners. The bushing end of a control arm helps isolate the vehicle body from vibration and noise due to minor road surface roughness. Bushings also help maintain wheel positioning, preventing undesirable camber and toe changes as the vehicle moves over uneven road surfaces, or through hard turn or braking maneuvers.

The resulting torsional, or twisting, load on the bushings over time causes the rubber to weaken and the fluid to leak out. The driver will eventually notice reduced suspension performance and poor handling.

Dry cracks, leaks and rattles are signs of excessive bushing wear. Bushings can wear so much that, in extreme cases, the wheel can lean enough to touch suspension components.

But don't automatically assume that the bushings are the only parts that need replacement.

The Joint is Jumping!

The other end of the control arm typically contains a ball joint that functions as the interface between the arm and knuckle in a suspension system. The ball joint rotates and swivels in any direction to allow the wheel the maximum freedom of movement while still providing steering input, or helping maintain proper suspension angles. If the vehicle has six-figure mileage, it is likely that the ball joints have suffered significant wear.

An easy first check for wear is to raise the vehicle off the ground, grab the tire at the bottom and rock it toward the outside of the vehicle and back while squeezing the ball joint with your other hand. If you feel movement in the ball joint or hear a knocking sound, the joint needs replacing.

If you are unsure, measure ball joint play using a dial indicator. If there is more than 0.5 millimeter of play in the joint with the suspension unloaded, it is time for ball joint replacement.

Also, if the rubber cover has been torn or otherwise compromised, the joint will lose lubricant, take on water in wet weather, and be vulnerable to road debris and rust.

Lack of Control

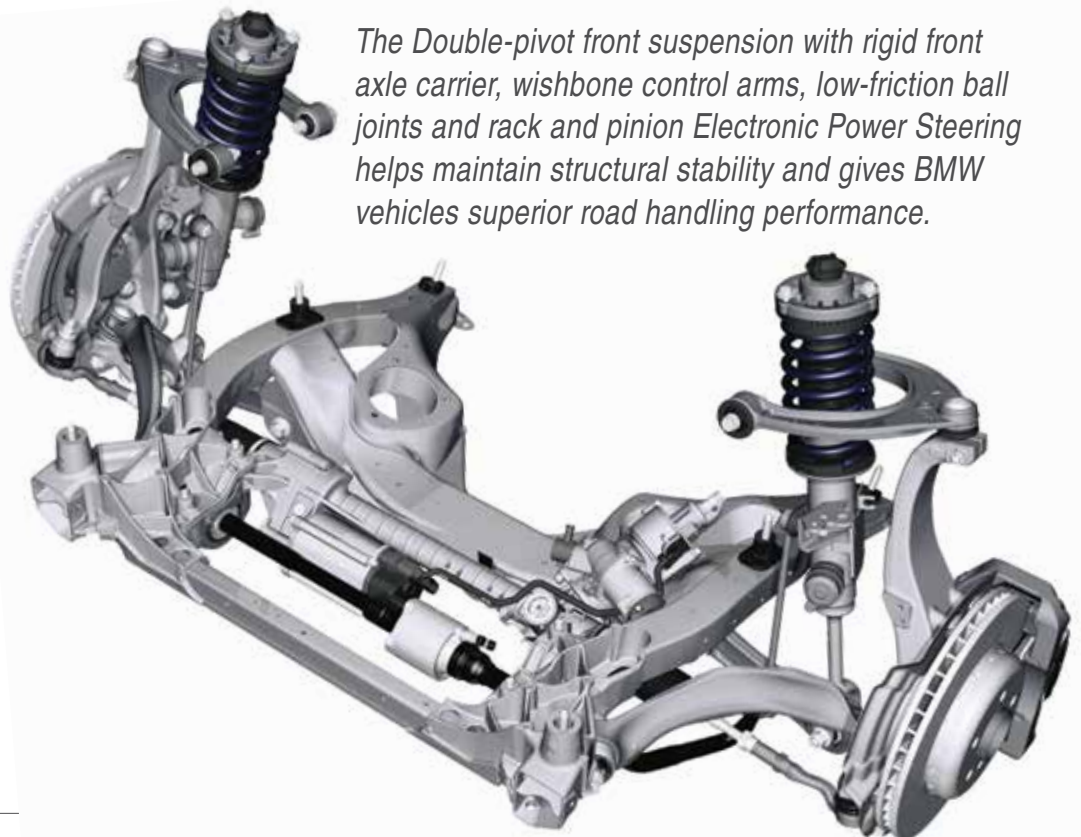
If the vehicle has also been driven in an environment of poor road conditions, you may have a bent control arm or thrust arm. You may be able to determine if the vehicle has damaged arms by taking it out on the highway for a careful and thorough test drive.

Bent control arms can cause steering vibration that becomes more noticeable at highway speed. A steering wheel vibration during braking is another sign of bent control arms. Excessive wheel movement, and noise while turning. One meeting with the wrong pothole can result in bent suspension components, although other causes of braking vibration, imprecise steering and noise while turning include bad tires, bent wheels, and warped brake rotors.

In addition to a road test, control arm and bushing problems may be discovered by means of a visual inspection, or with the car on an alignment rack.

Bushing, Ball Joint or Control Arm?

On many models, BMW gives technicians the option to press in new bushings. Use due care when



The Double-pivot front suspension with rigid front axle carrier, wishbone control arms, low-friction ball joints and rack and pinion Electronic Power Steering helps maintain structural stability and gives BMW vehicles superior road handling performance.

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The screenshot shows the website's home page. At the top, there's a navigation bar with links for Home, The Bimmer Pub, BMW TechDrive, BMW TechDrive Archives, Login, and Contact Us. A search bar is also present. The main content area features a large article titled "VANOS Variable Valve Timing: Evolution, Troubles, and Service" with a sub-image of the engine component. To the right of this article is a "Register here for FREE" button with a note that registration is required to view content. Below this are sections for "BMW Approved Vendors" featuring BASF and Castrol. The Castrol section includes the text: "Cleans, Restores, Protects BMW Group Fuel Systems Cleaner Plus with TECHRON® Technology". At the bottom of the screenshot, there are social media links for BMW Dealers and BMW Technicians.

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pressing bushings out and new ones in, so that you do not distort the aluminum control arm, which is more easily damaged than steel.

If you replace one or more bushings, replace both the driver and passenger sides. Wear on one side that was enough to cause steering issues or noise is a good indicator that the other side is close to also presenting problems.

Just pressing in new bushings may appeal to budget-conscious customers. However, if the bushings are worn, the ball joint on the other end of the control arm is likely to have also suffered significant wear. Measure ball joint play, especially on a vehicle with over 100,000 miles on the odometer.

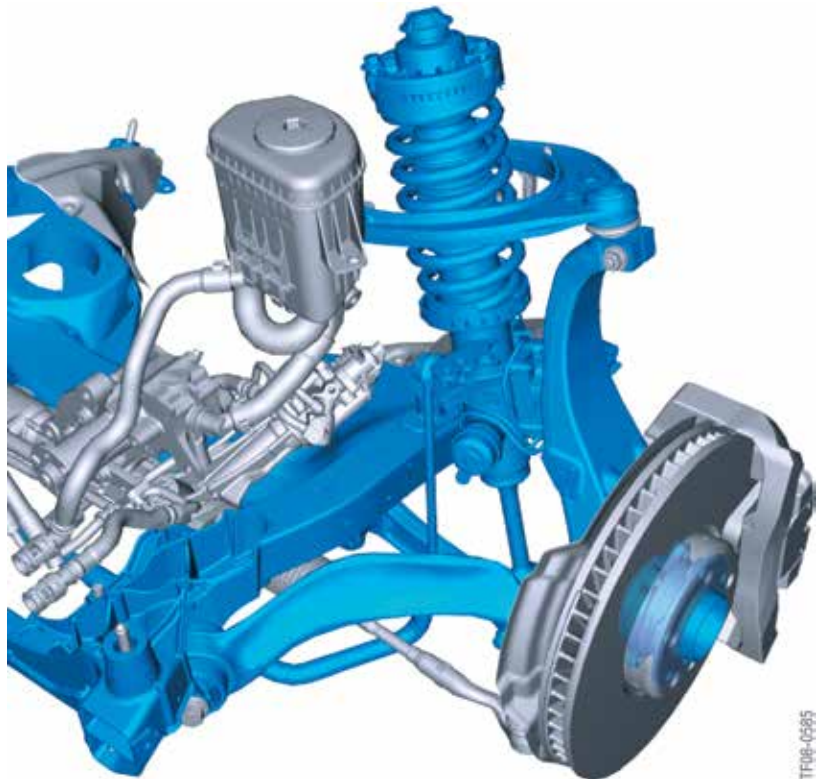
Even if the ball joints appear in decent shape, it may make sense to replace the entire control arm on a high mileage vehicle. The labor time to press in new bushings may bring it close to the cost of control arm replacement. Your BMW dealership parts department can supply you with fully-assembled control arms and thrust arms, ready for installation. This will also give your customer the confidence that he or she won't need to come back soon to address ball joints shortly after bushing replacement.

Ball joints are sold separately for some BMW models, generally those with steel control arms (E46, E53, etc.). However, complete control arm assemblies are the only option available for most newer BMW models; ball joints for these cars are not serviced separately. On those cars with replaceable ball joints, there are reports of cars returning with noise complaints shortly after ball joints have been pressed in. So it is prudent to simply secure a new control arm assembly from your BMW dealership parts department in order to preclude problems down the road.

Unintended Consequences

We've heard horror stories of people attempting to press out bushings using a large socket wrench or other inappropriate tool. They get the bushing out, but often not without also enlarging the inside diameter of the opening in which the replacement bushing must be seated. The new bushing can be loose, compromising vehicle handling and, potentially, driving safety as well. BMW and other suppliers offer special tools that allow bushing removal and installation with no seat damage.

If you find the need to replace bushings, be certain to only perform final tightening of related fasteners once the vehicle is back on the ground with the suspension in the normal loaded condition. Otherwise, if you final-tighten these fasteners with the wheels hanging free, when you put the vehicle on the ground the bushing will twist and remain in this tight, twisted state. This "pre-set" torsional load reduces the ability of the



The upper control arm reduces camber changes during jounce and rebound events. The arrangement of the front suspension includes bushings at multiple swivel points. This helps reduce friction, which allows the damper to respond extremely quickly to road surface irregularities.

bushing to handle suspension changes due to driving maneuvers and road conditions, and can result in erratic handling and much faster wear than normal.

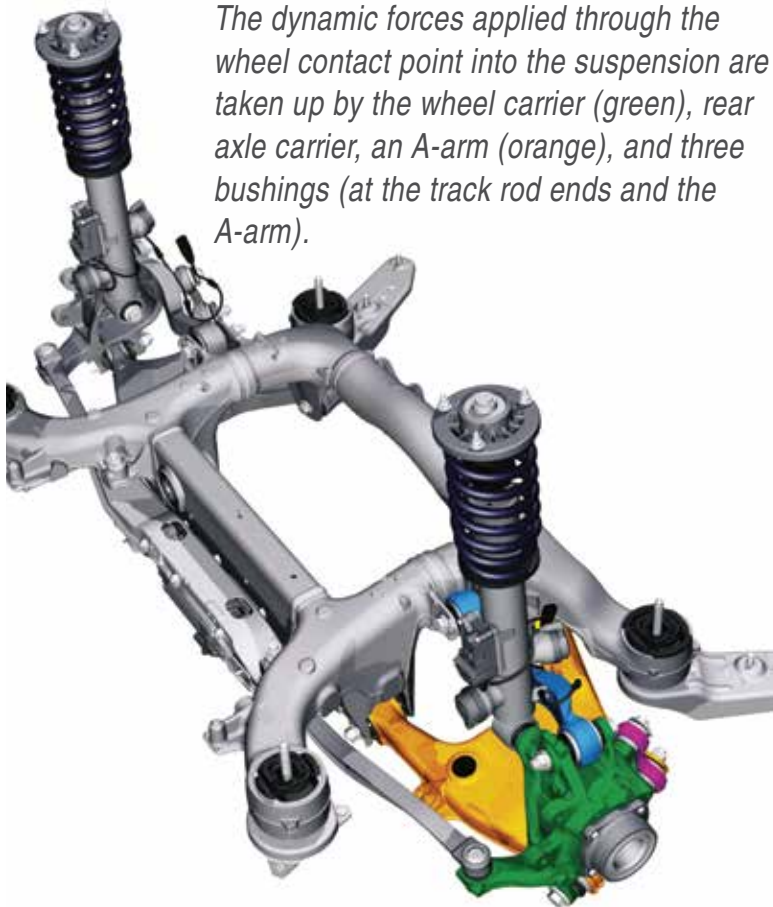
There are also related components whose functionality can be affected by something as simple as bushing or ball joint installation.

The Rubber Bushing Remover is used along with Sleeve 2 293 777, Spindle 0 496 553 and Nut 0 496 554 to remove the Upper Wishbone



Bushing. For complete instructions for this tool, refer to ISTA Repair Manual section 33 32 029. The same tool is also used to remove the bottom trailing arm bushing (see ISTA Manual section 33 32 031 for details).

The dynamic forces applied through the wheel contact point into the suspension are taken up by the wheel carrier (green), rear axle carrier, an A-arm (orange), and three bushings (at the track rod ends and the A-arm).



For example, on some BMW models the Antilock Braking System (ABS) wheel speed sensor is mounted in the steering knuckle and points to a toothed ring in or near the bearing. Bushings must be mounted a certain way in order to ensure that the wheel sensor is pointed exactly where it should be to support Antilock Braking System (ABS) function. Refer to BMW repair procedures to see if the vehicle you're repairing requires special procedures for precision mounting the bushings.

Another example is the Electronic Power Steering (EPS) system. You can replace the rubber boots and adjust alignment. Everything else is sealed at the factory, and therefore other components are not serviced separately.

Alignment Time

If you replaced worn bushings, ball joints, or control arms, it is time for wheel alignment. This will restore all suspension angles to factory specification, and is an important customer satisfaction tool. If the steering wheel was off center before your service, the customer will notice that it is now straight. He will certainly appreciate that the repaired vehicle handles noticeably better as well.

Just be sure to check the BMW service procedures for the alignment requirements of the vehicle. Some BMW models do not have provision for caster adjustment. Some can have camber adjustments, but require vehicle-specific procedures and special tools. Also, it may be necessary to unload the suspension in order to make camber adjustments. And, as usual, toe is the final adjustment to be made after caster (if adjustable...) and camber.

The next time a vehicle with steering shimmy, braking vibration, or noisy turning complaint comes your way, remember that worn bushings, ball joints, and control arms all impact vehicle handling. It often is cost-effective to replace all three simultaneously. ●

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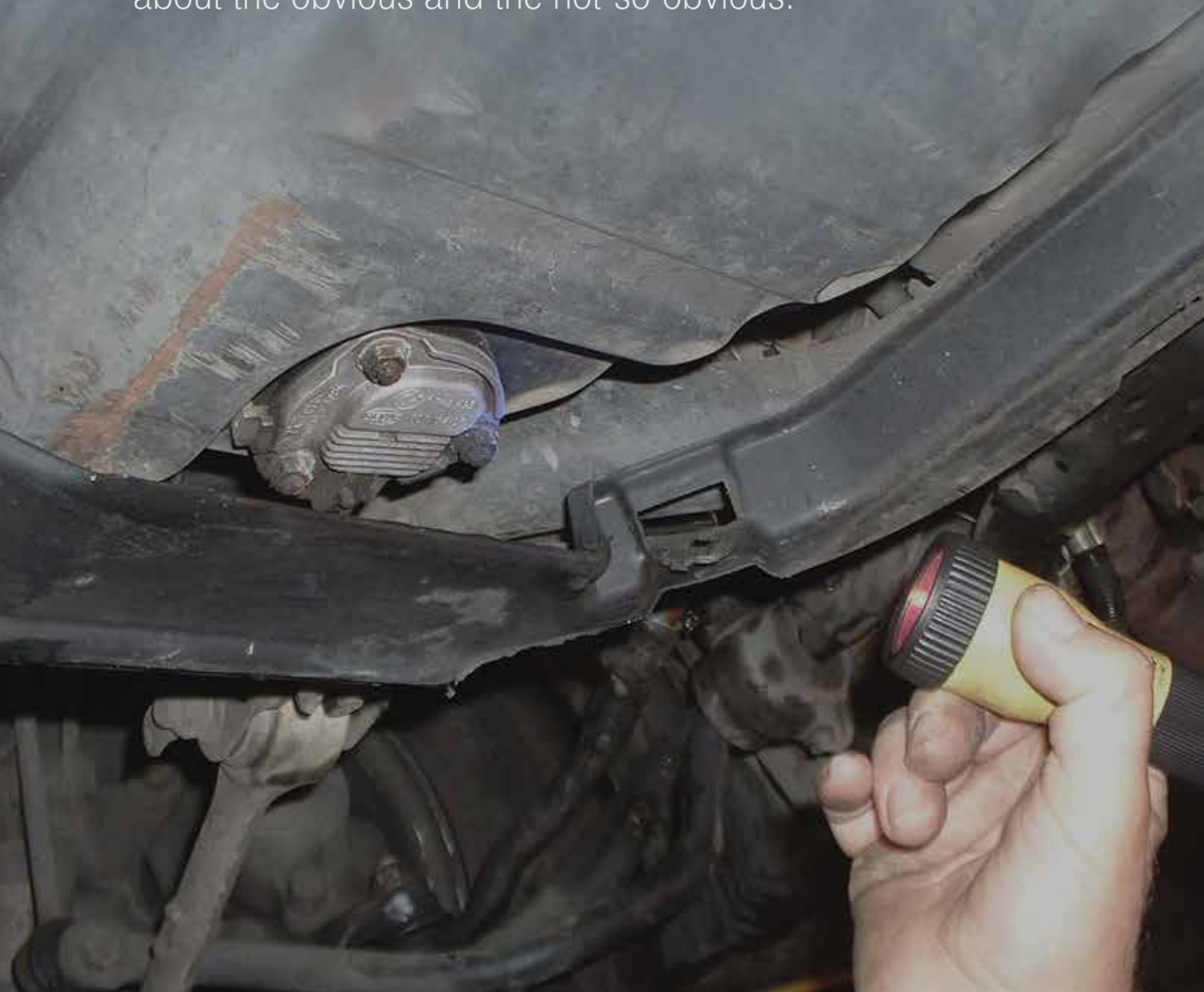
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Series	Engine	Production Years	Models	Reman Part Number
E30	M42	Up to 04/1991	318i, 318is	64 52 8 385 916
E31	M62 M60	M60: 9/1993 - 11/19/95 M62: From 05/1995	840Ci, 840i	64 52 8 385 908
E32	M60	From 06/1992	740i, 740iL	
E34	M60	From 01/1988	530i, 540i	
E34	M50	Up to 07/1993	525i	64 52 8 385 915
E36	M50, M52, S52	Up to 09/1992	320i, 323i, 325i, 325is, 328i, M3	64 52 8 385 909
E36	S50	From 11/1993	M3	
E38	M60, M62	Up to 09/1997	740i, 740iL	64 52 8 385 917
E38	M73, M73N	From 09/1997	750iL, 750iLP	64 52 6 911 348
E38	M73, M73N	04/1997 to 09/1997	750iL	64 52 2 147 456
E39	M52	Up to 09/1997	528i	64 52 8 385 919
E39	M62	Up to 09/1997	540i, 540iP	64 52 8 385 921
E46	M52, M54, M56, S54	M52, M54, M56: Up to 09/2002 S54: 09/1997 - 09/2002	320i, 323i, 323Ci, 325i, 325Ci, 325xi, 328i, 328Ci, 330i, 330xi, 330Ci, M3	64 52 6 911 340
E38, E39, E52	M62, S62	From 09/1997	740i, 740iL, 740iLP, 540i, 540iP, M5, ALPINA V8 Roadster, Z8 Roadster	64 52 6 911 342
E53	M62	From 10/1998	X5 4.4i / 4.6is	64 52 6 921 651
E53	M54	Up to 10/2002	X5 3.0i	64 52 6 921 650
E65, E66	N62, N62N, N73	Up to 4/2008	745i, 745iL, 750i, 750iL, 760i, 760iL	64 52 2 147 458
E60, E60N, E61	N52, N52N	Up to 9/2008	525i, 525xi, 528i, 528xi, 530i, 530xi	64 52 2 147 460
E46, E83	M54, M56, S54	From 09/2002	325i, 325Ci, 330Ci, M3, X3 2.5i / 3.0i	64 52 6 936 883
E60	M54	Up to 10/2005	525i, 525xi, 530i, 530xi	64 52 2 147 457
E60, E63, E64	N62, N62N	Up to 4/2008	545i, 550i, 645Ci, 650i	64 52 2 147 459
E82, E88	N51	Up to 3/2007	128i	64 52 2 151 495
E90, E90N, E91, E91N	N51, N52, N52N	Up to 10/2006	323i, 325i, 325xi, 328i, 328xi, 330i, 330xi	
E92	N51, N52N	N51: Up to 3/2007 N52N: Up to 10/2006	328i, 328xi	
E93	N51	Up to 3/2007	328i	
E82, E88	N54	From 11/2006	135i	64 52 2 151 496
E90	N54	From 3/2006	335i, 335xi	
E90N	N54	From 04/2008	335i, 335xi	
E92	N54	From 06/2005	335i, 335xi	
E93	N54	From 10/2005	335i	
E82	N51, N52N	N51: From 03/2007, N52N: From 10/2006	128i	64 52 2 153 227
E88	N51, N52N	N51: From 03/2007, N52N: From 10/2006	128i	
E90	N51, N52, N52N	N51: From 03/2007 N52, N52N: From 10/2006	323i, 325i, 325xi, 328i, 328xi, 330i, 330xi	
E90N	N51, N52N	N51: From 03/2007 N52N: From 10/2006	328i, 328xi	
E91	N52, N52N	From 10/2006	325xi 328i	
E91N	N52N	From 10/2006	328i, 328xi	
E92	N51, N52N	N51: From 03/2007 N52N: From 10/2006	328i, 328xi	
E93	N51, N52N	N51: From 03/2007 N52N: From 10/2006	328i	

There's Good Money in Maintenance

Today's BMWs are so dependable and durable that they need fewer repairs than they did in the past. That means performing scheduled maintenance has become a key profit opportunity for savvy shop owners, and something that will keep customers coming back. Here, we'll talk about the obvious and the not-so-obvious.



All motor vehicles, including BMWs, require periodic maintenance in order to keep them in top operating condition, to protect their factory warranty where appropriate, to maximize fuel economy and overall performance, and to keep up their value, which are all important factors for car owners. You already know that, but you may not be aware of all the profitable maintenance work you could be doing that'll save your customers from expensive repair bills and make a steady income for your shop. Also, providing such maintenance can be a door-opener for other service operations that can make your customers' visits an even better deal for both shop owner and car owner.

What about the warranty?

Often, the first question raised by technicians and owners of independent repair shops relates to vehicles' new-car warranties, which might seem to require that any work be done only in the service departments of authorized BMW dealerships. But the fact of the matter is, warranty support work can be performed in your facility, and if performed properly and thoroughly and dutifully documented, can protect the motorist's factory warranty.

New BMWs typically carry a four-year, 50,000-mile warranty. Certified pre-owned BMWs are covered by an additional warranty that can extend the original by as much as two years or an additional 50,000 miles, whichever comes first. So you might think that you won't see these cars until the factory warranty expires. But that's not necessarily the case.

As we said, scheduled maintenance and warranty support work can be performed by independent repair shops. It's important that you make the effort to provide the customer with a detailed receipt documenting all the various steps that have been taken so that the customer will be able to demonstrate to his BMW dealership that these services have been performed in the event that warranty repairs are needed. Of course, parts and service covered by the factory warranty must be performed by an authorized dealership.

Furthermore, you can advise your customers that the factory new-car and extended warranties can cover certain parts and services for much shorter periods of time. For instance, the BMW new-car warranty only covers wheel alignment, wheel balancing, and windshield wiper blades for the first 2,000 miles, making these services viable targets for your merchandising efforts.



Is that PCV assembly a "honker?" More frequent oil changes can head that off.

Why would a customer come to your shop for scheduled maintenance?

BMWs enjoy an extraordinarily high loyalty factor. Most often, when folks are ready to replace their BMWs, they will do so with another BMW product because they are so pleased with

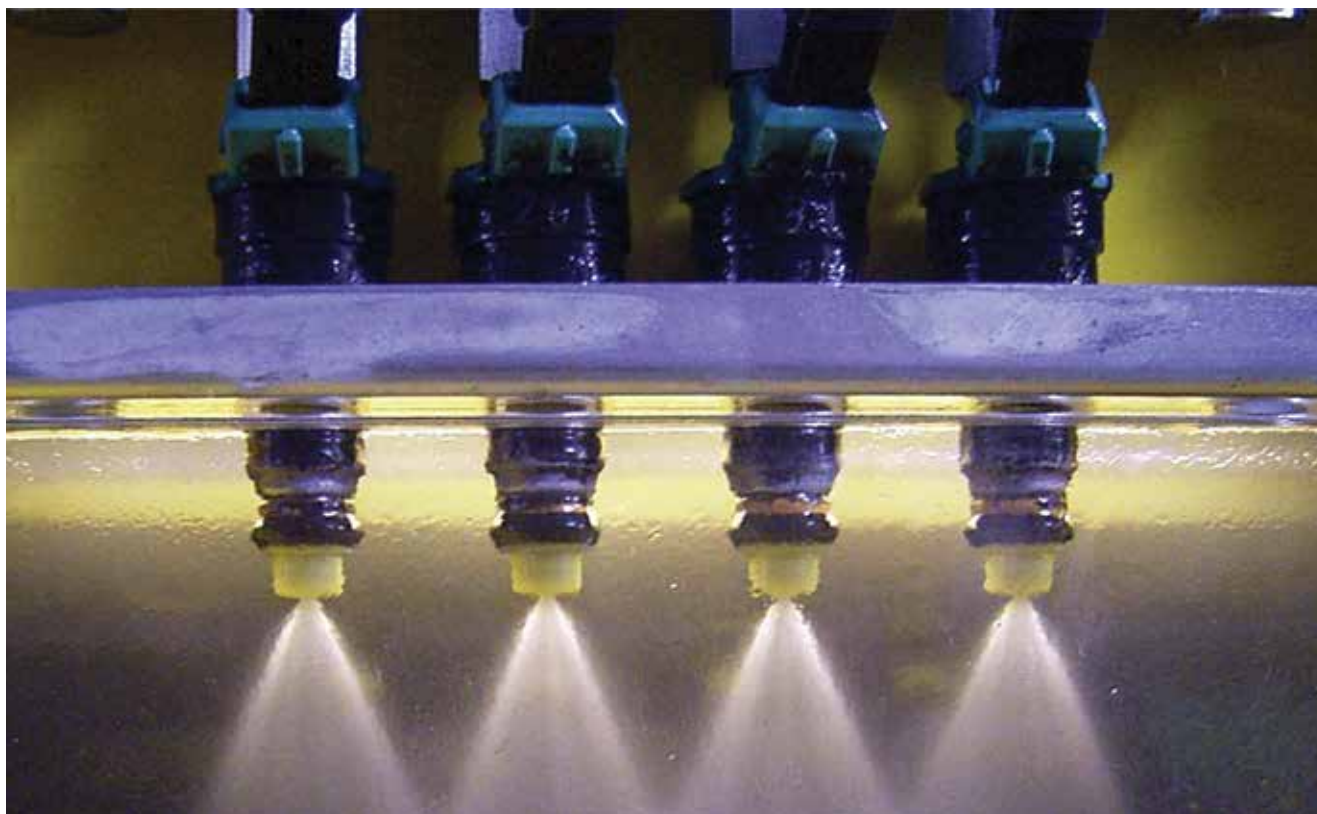
the performance, reliability, and status that come with BMW ownership. You're already servicing their BMWs, so when you learn that customers are looking to replace theirs, you should make a special point of informing them that you will be happy to perform warranty support work on their new acquisition.

At the same time, if your customer is selling an existing BMW privately, or perhaps passing it on to another family member, you should be able to continue servicing the older car, while adding your customer's new BMW to your customer base. And, since BMW owners may well travel in social circles that include other BMW owners, word-of-mouth can be your best friend in making it known that you can perform scheduled maintenance and warranty support work.

Of course, BMWs require periodic maintenance even after they're out of their factory warranty period, and you should promote your performance of such



For many years, BMW has specified the use of synthetic motor oil. Buying it from your local dealer's parts department is convenient and provides peace of mind.



These injectors have just been cleaned. Note the even spray and atomization that make for good performance and emissions control. Injector and intake tract cleaning are great services that will make customers happy with you.

maintenance to help your customers protect the investment they have in their cars.

When and how will the customer know?

In an ideal world, motorists would read and digest their owners' manuals and heed every instruction and recommendation. But we don't live in an ideal world, and, unfortunately, most motorists only refer to their owners' manuals when some sort of problem crops up. That's one of the reasons that automakers have devised service reminder systems that monitor vehicles and provide a visual signal that service attention is needed.

The most obvious indication that a BMW is due for maintenance is made visually apparent by the Condition Based Service (CBS) system. This "intelligent" vehicle analysis system monitors a variety of parameters and uses algorithms to determine the optimum intervals for various service operations, and alerts the driver accordingly. Among other factors, the CBS system monitors:

- Miles driven
- High or low vehicle speeds

- High or low engine speeds
- Short or long trips
- Condition and level of engine oil
- Condition and remaining life of brake pads

When the CBS system determines that work is needed, it provides an alert on the vehicle's Service Interval Display. This catches the driver's attention and informs him or her that it's time to take the vehicle to a shop. The CBS system can also show due dates or distance remaining for tasks like changing engine oil and replacing disc brake pads.

Another opportunity for you to sell scheduled maintenance to your BMW customers is when vehicles are brought in for state-mandated inspection. Many states require annual safety inspection and perhaps emission inspection as well, and in most cases these inspections can be performed by state-certified independent repair shops. If yours is one of those, you get an opportunity to check the vehicle's lights, brakes, and other vital safety systems, but you also have the chance to sell the owner a comprehensive maintenance package as spelled out in their maintenance booklet.

So exactly what maintenance is scheduled?

There is a long list of tasks spelled out in BMW service booklets. As you'll see in the accompanying pages from just such a book, the list is lengthy and detailed. It encompasses virtually all of the vehicle's key systems -- ignition, fuel, emissions, and other engine management systems and components, plus brakes, lighting, tires, battery, steering and suspension, and more.

Intervals for parts replacement vary with the expected life of the component or system, which makes detailed record-keeping all the more important. Here are



Although BMW offers a great reman transmission program, a replacement transmission is still such a large expense that trans failure is a common reason for scrapping an otherwise serviceable vehicle.

some noteworthy examples:

- Change engine oil and filter at every service interval as directed by the CBS.
- Change spark plugs at either 45,000 miles or 100,000 miles, depending on the model.
- Change the brake fluid every two years.
- Change the engine air filter every third oil change or as directed by the CBS.
- Change the automatic transmission fluid every 100,000 miles.
- Change the oxygen sensor(s) every 120,000 or 150,000 miles, depending on the model.

Other recommended services are on an as-needed basis, such as brake pad replacement. And note that still other services, such as replacement of the cabin air filter, which BMW refers to as the ventilation microfilter, is not a parameter monitored by the CBS. So you'll need to perform a visual inspection and replace as necessary.



An ATF flush and change is a true benefit for the customer. Look at that fluid after only 30K miles! It's a pretty easy sale.

Over the years, we tech editors at the bimmer pub have identified yet more important maintenance services that may or may not be mentioned in BMW owners' manuals, and are both beneficial to your customers and profitable from the perspective of independent shop owners:

- Fuel filters are sometimes overlooked, but failing to replace them at reasonable intervals can result in an expensive repair -- clogged filters make the



Given today's sophisticated antifreeze formulas, it makes sense to use BMW's own brand.



The interval for cabin air filter replacement varies according to the conditions the car lives in, so do frequent visual inspections.

pump work much harder, resulting in a shorter life. Tip: Save the old one so you can show the customer how hard it is to blow through.

- Intake tract cleaning can make a BMW run like new again, eliminating stumble and rough idle among other things. It not only removes carbon and other deposits from the injectors, it also blasts deposits from the combustion chambers and the backs of the valves.
- Belt and hose failures leave motorists stranded, perhaps in dangerous locales, more often than just about anything else. Serpentine belts should be carefully examined for cracking, chunking, and shredding, and hoses should be checked for softening and bulging (replacement every four years is commonly recommended). Overlook this at the peril of your reputation and the risk of liability.
- Even though all modern BMWs come from the factory with long-life antifreeze, that doesn't mean forever. Except for oil changes, nothing is more important for engine longevity than a well-maintained cooling system. So don't be shy about recommending coolant service using a combination of BMW-spec antifreeze and pure water.
- Tires need care, too. Rotation is recommended, of course, but so is rebalancing if your road test reveals that the ride isn't smooth. This is a customer pleaser.



A visual indication of the need for brake fluid changes can be provided by test strips, which can be stapled to repair orders. A flush and change every two years is recommended.

- Speaking of rolling rubber, make sure you're vigilant about the tires on your customers' cars. Replacement can be considered regular maintenance, and you only want to use tires that come up to BMW O.E. quality and performance standards. Chances are your local BMW dealer's parts department carries the best tires available at a reasonable price considering the value offered.
- A power steering fluid flush and refill can save your customers from expensive rack and pinion wear and leaks. Just make sure you use the highest-quality PS fluid available, such as that offered by your BMW dealer.
- Is that battery four years old? If so, it's likely that it hasn't got much life left. Capacity testing is certainly a justifiable maintenance procedure that may head off an inconvenient, and even perilous, breakdown. Going with O.E. here will assure long, dependable service.
- Manual transmission and rear axle/differential fluid gets dirty and breaks down eventually. Draining and replacing it with the synthetic gear lube your BMW dealer sells is often-overlooked maintenance that will keep those gears and



Although you can do a power steering fluid flush/refill without one, a relatively inexpensive purpose-built flushing machine will make the procedure faster, neater, and more complete. Use the right stuff!

bearings in shape for the life of the car, all the while assuring smooth, quiet operation.

Looking over this extensive list of recommended checks, inspections, services, and replacements, it's easy to see that a conscientious effort to perform and document all these various steps, including the recommended road test, can easily take two hours of a technician's time, give or take. That's time that should certainly be billed out at full labor rate, since most of these tasks require a skilled and knowledgeable technician to perform them. Note, too, that seemingly simple tasks can be inordinately time-consuming. For instance, simply accessing the battery on new-generation M5 models can easily take the better part of an hour, time that should properly be billed out to the customer if such access is necessary.

But wait! There's more!

Nowhere is it written that you must wait for the CBS or some other indicator in order to perform preventive maintenance. Many BMW owners prefer to protect their investment with more frequent maintenance than may be indicated by the CBS. Certainly you should oblige those who request such service.

Further, consider that the service triggered by the CBS could be considered the minimum required to protect the owner's new-car warranty. Many savvy independent BMW technicians are aware that new-generation BMWs are fitted with low-tension oil control rings on the pistons. As such, blow-by is not uncommon in higher-mileage cars, as evidenced by ruptures in the self-regulating PCV valve caused by a build-up of sludge. These ruptures can result in a moaning sound that leads many to refer to this as the "honker" valve, and makes a strong case for more frequent oil changes to forestall buildup of such sludge in the first place.

Note also that performing a thorough inspection entailing all of these steps

and systems may well uncover the need for the replacement of certain parts. Inasmuch as BMWs are especially well-built, and given the fact that replacement intervals for many of these parts are quite long, it makes good business sense to obtain replacement parts from your local BMW dealer. This will assure that the parts you install will last as long and perform as well as the parts being replaced, and will afford your customer the best possible value for what is likely their second-largest investment, next to their home.

Finally, when your inspection and service are complete and you've de-briefed your customer on your findings, be certain to provide them with a detailed written report of your work. You can even photocopy the service/maintenance pages from their owner's manual and physically check off each item as you perform the specified task. This check list, combined with a detailed repair order, will provide your customer with the documentation needed if repairs are ever needed under the terms of his or her factory warranty. ●



Manual transmission and rear axle/differential fluid changes assure smooth operation and "forever" longevity.

Don't Fall for Fake Parts

Counterfeit parts can damage your customers' cars and your reputation as well.

There's a popular phrase that folks use, "Imitation is the sincerest form of flattery." That may be true, but it doesn't make for good business in auto repair. Increasingly parts are showing up in official-looking BMW packaging that purport to be genuine BMW parts but are, instead, counterfeit parts in fake packaging. These parts show up in various channels of distribution, including from folks who may show up at your shop selling parts out of the back of a plain white van. And while their appearance may be convincing and these parts may appear to be genuine BMW parts, they practically never are.

These parts may range from easily-made oil and air filters, to more complex parts like brake pads, spark plugs, fan clutches, and even quart bottles of engine oil and wheel rims. They are typically made with part numbers and branding on the product that make them look genuine, and they appear in packaging that appears to be authentic as well.

But beware. Unless you're certain of the source and heritage of parts you're installing, you could be installing trouble instead. Counterfeit parts are attractive because they're usually sold at well below market value. But the economies are short-lived, because these parts can and do fail prematurely, and sometimes even catastrophically, jeopardizing not only your reputation and the reliability of the vehicle, but also putting the lives of your customers and their passengers at risk.

For example, counterfeit oil filters can delaminate and collapse, allowing unfiltered oil to reach critical engine parts. This can lead to failure of engine bearings, piston rings, and valve train components, requiring expensive repairs that would not be covered by a warranty. Imitation spark plugs can misfire, causing detonation and even resulting in melted pistons.

Other fake parts can be safety-related. Do you really want to risk your reputation and your customers' lives on brake pads whose quality is unknown? Or is it really a good risk to install a questionable fan clutch that could fail catastrophically, perhaps even throwing a fan blade through the hood of an expensive new BMW?

While mechanical parts are the most common counterfeit parts in circulation, accessory items have recently become the target of counterfeiters, who can knock out poorly-designed copies of items like power mirrors, grilles, even motor oil and floor mats. It's only common sense to realize that cheap imitation parts will not provide the performance and durability of genuine BMW parts.

So how to avoid these inferior parts and accessories? The answer is simple. Buy your BMW replacement parts from the most reliable source there is -- the parts department of your local authorized BMW dealer.

Don't risk your reputation or compromise your customers' safety with parts of questionable heritage. Make sure the BMW replacement parts you're buying and installing are the Real McCoy. ●

Collision Corner:

Working with Aluminum Panels



BMW's quest to make vehicles stronger, lighter and more fuel efficient is never ending. In order to achieve these goals, new ways of thinking and new materials are necessary. That translates into new repair procedures.



In an effort to both clean up the air we breathe and reduce petroleum consumption, government regulations require lower emissions and improved fuel economy. You may think this is a job for the engineers who build engines and powertrain management system. You would be right, but this is only part of the equation. Engineers design these systems to work with a specific load. The weight of the vehicle and its aerodynamics affect this both under acceleration and at speed. If you can lighten the load, you will take stress off of components, increase fuel economy and reduce overall emissions.

So, the weight of a vehicle is as important as any other engineering criterion in improving a vehicle's overall performance. One of the efforts made by manufacturers to reduce weight is the increased use of aluminum. This light-weight metal can replace steel without sacrificing structural integrity and passenger safety. Of course, different construction techniques are required to maximize aluminum's characteristics, and with these come new repair procedures. In order to provide your customers with the same safe body structure they had before any crash damage, you need to adhere to the proper repair techniques specified for aluminum.

Aluminum 101

You may wonder what has driven the change to aluminum. First, aluminum is about one-third the mass of steel. But that doesn't mean you can save two-thirds of the weight. First, aluminum is not strong enough by itself for automotive applications. It needs to be alloyed with other metals to exploit its characteristics. Also, if we want to maintain the same strength as steel we need to use more of this alloy. As a result of the need to be an alloy, aluminum has multiple manufacturing benefits. The most common form is sheets, but it can be cast or extruded to form sub-structures. Different alloy blends will highlight different characteristics and these are identified by the series number. For example, a 2000 series alloy has relatively more copper in it. This makes for a fairly strong, workable panel that can be easily stamped. A 3000 series alloy has manganese, which makes for a stronger panel. A 4000 series alloy will melt at a

lower temperature, so is used in welding wire. In the 5000 series, aluminum is blended with magnesium, so in addition to being stronger it is also corrosion-resistant. This series is also strong enough to be used in sub-structures. By adding silicon to the 5000 series, you get a 6000 series alloy that is stronger yet. Adding zinc to the mix yields the 7000 series, which is both strong and corrosion resistant. This alloy is strong enough to be used in bumpers and their reinforcements. Whatever the alloy and depending on its application, on average the overall weight savings ends up around 40% over steel.

Another benefit of aluminum is its ability to conduct electricity. It is an excellent ground path for electrical systems. By the way, as more aluminum is used in manufacturing, its cost-effectiveness increases.

Various aluminum alloys react differently to heat-treating. The 3000, 4000 and 5000 series are not heat treatable. That's why some of these are used for welding wire. This means they will not strengthen with heat, but they will strengthen by working the metal. To a small degree, you can anneal them, but be careful. These alloys do not show warning signs of excessive heat, so you can easily damage the panel. Use heat-reactive crayons or tape to keep track of the panel temperature if annealing is necessary. Try not to put the metal through too many heat cycles, which can actually make the panel weaker.

The bare aluminum area is the portion of the panel that will be bonded to its adjoining section. Pyrosil supplies a kit to chemically clean the surface, and you also heat the area. You can then apply the bead of the adhesive and join the parts.



On the other hand, 2000, 6000 and 7000 series alloys will strengthen with both work-hardening and heat. You still need to be careful of the temperature as you can do more harm than good by overheating. This is important. Remember that whenever you repair a dent in a panel the damaged area is work hardened. When attempting to remove the dent, the surrounding metal may warp since it is not work hardened. Heating the damaged area softens the metal making it easier to work with. In the "heat-shrinking" process, you apply heat around the dent. This forces the metal to return somewhat to its original shape, which translates into less working of the panel. With more severe accident damage, the panel may not be worth repairing and may call for replacement. Heat can also be used to soften bonding agents between adjoining panels that cannot be welded together. With BMW using more aluminum in its vehicles and mating this metal with steel structures, new bonding methods and materials need to be learned.

Preparation

When an aluminum panel is initially stamped it has either a water-soluble dry-type film, or a water-free dry-type lubricant. These lubricants protect the metal during stamping and must be removed before any welding or painting takes place. Any contaminants on the aluminum during welding can result in porosity in the weld. This happens when

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hydrogen gas stays in suspension with the molten aluminum. As the aluminum cools, the hydrogen escapes leaving behind a porous weld. In addition to cleaning off metal-forming lubricants, you will also need to clean off the oxide layer that naturally forms on bare aluminum, which requires special solvents. If you purchase a genuine BMW replacement panel, it comes already primed so there is no need to perform all this additional work, something to think about since time is a big factor in profitability.

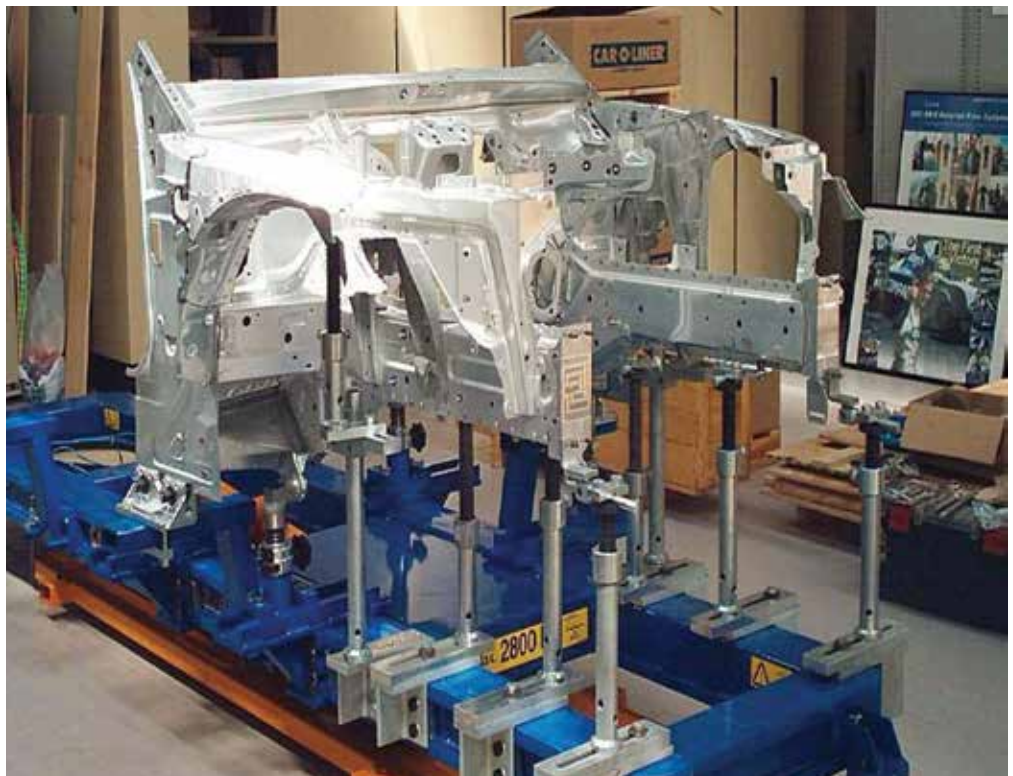
It is as important for the work area to be clean as it is for the panel to be clean. While prep work is often relegated to the apprentice, here it is one of the most important parts of the repair. Any cross-contamination from other jobs going on in the shop can have an adverse affect, especially on painting when it is often too late. Steel and aluminum chemically react with one another over time. If steel particles from sanding or grinding were to end up on an aluminum panel, the reaction would cause “fisheye” within the paint layer. To avoid steel contamination, the section of the shop working on aluminum must be protected from the rest of the shop with dividers. It is strongly recommended that you maintain a separate set of body tools made

of aluminum to be used only on aluminum panel repairs. Even the cart the tools are stored on should be aluminum and clean of any outside debris. If you were to use your steel tools, you would have to thoroughly clean them of any ferrous particles, which is next to impossible considering how dust can hide in a tool’s cracks and crevices. If contamination were to occur, you would have to take the panel back down to bare metal and repaint. This is a waste of time that can take the profit right out of a repair.

Keeping your employees safe is another concern. Aluminum chips are combustible, so welding or the heat source for annealing can ignite them. It is imperative that you have a vacuum evacuation system to extract contaminants and dust away from the work area. In addition, the entire vehicle should be covered with a plastic drop cover except for the damaged portion.

Before and after any aluminum panel work is performed, you must inspect for cracks. You can coat the panel with colored dyes that will fill channels and highlight cracks. Use a magnifying glass to inspect the surface. Cracks that are too small to be seen

The 2004 BMW 5 Series has an entirely aluminum nose section from the firewall forward. It should not be pulled or heated/welded, so must be replaced as a unit. However, you can repair non-structural body panels such as fenders.





by the naked eye can cause blemishes during the painting process. Vibration and stress can increase the size of the crack over time, and require further bodywork in the near future. It is also important clean any dye out of the crack before it dries as this type of contamination can interfere with welding and painting -- have a solvent ready.

Panel Straightening

If accident damage is no too severe, you can attempt to straighten the panel instead of replacing it. Locate the highest and lowest points of the dent as you do with steel, but unlike steel you should you should start straightening in the middle of the dent and gradually work your way outward. Just as with "paintless" dent repairs, you should start by pressing out the dent using wood, plastic or aluminum hammers. Avoid using any tool with too

When using a two-part adhesive, "equalize" the mixture by applying one inch of bonding material to a piece of paper and then attaching the mixing tube. Squeeze out another ½ inch or so to make sure you have the proper mix of bonding agent and hardener.



Notice how the reinforcement panels are chemically bonded and also supported by structural rivets. Do not worry about adhesive squeezing out of the joint. Simply wipe away excess material and prep the surface for the basecoat.

sharp an edge as it is easy to do more harm than good. Do not “stretch” an aluminum panel. The more you stretch, the weaker it will become.

When the dent has been straightened out as much as possible, it is time to “draw in” the aluminum. Once again, first clean the panel surface of all contaminants. With a neutral welding flame, heat the area in and around the dent. Keep the flame between 300 and 850 deg. F. With heat crayon or tape you can modulate the heat to stay between these two temperatures. Try to cool off the panel quickly and the panel should try to resume its original contours. Heating the panel softens the metal and cooling it allows the outer undamaged areas to pull the dent out.

If more extensive work is needed to straighten out the panel try to keep the metal temperature between 475 and 575 deg. F. This will keep the metal soft enough for you to strike with your wood, plastic or aluminum hammers. Without this heat, the panel becomes “springy” and tries to resume its damaged state. If you apply too much heat, the metal will distort the damaged and undamaged areas as well. Remember to gradually raise the metal temperature and work the panel. If you can, avoid heating the panel a second and third time as this will make the metal weaker overall. After all “tin knocking” is done, re-check for cracks and repair accordingly.

Chemical Bonding.

As seen on the 2004 BMW 5 series, the entire nose section is aluminum. The rest of the body is a steel structure. These two dissimilar metals cannot be welded. In order to join these two sections you need to thoroughly clean and treat the contact surfaces with a Pyrosil kit. Through your BMW parts supplier, you should be able to order the Dow adhesive BMW recommends for chemical bonding. When using a static mixer or mixing tip on your applicator, equalize the mixture by squeezing out

one inch before applying the tip, and ½ inch with the tip installed. Apply a sufficient bead to coat the joining surface and, using a chassis jig, join the nose section to the body. You will have to rent the Celette chassis jig for this big job if you do not have one.

Next, install the mechanical fasteners, which in this case are rivets. Use only rivets supplied by BMW (the same goes for any mounting bolts). The rivets are made of a special non-corrosive/reactive metal to protect the attachment seam. For this structural repair, BMW forbids any pulling of the front structure or heating/welding. Mounting screws need to be of the Electro Magnetic Conductivity type (EMC) so they do not adversely react with the aluminum components.

It is this attention to detail that will allow you to provide a safely and responsibly repaired vehicle, and that will give you peace of mind about guaranteeing your work. ●



When dealing with an aluminum front rail, there are inserts that fit inside to add structural strength. These inserts are held in place with special aluminum bolts that go through the frame into the insert. Using any other type of bolt will cause the contact surface to corrode and eventually fail.

Photos courtesy of the “Write-it-Right” Committee, Collision Industry Conference 2004

Original BMW Parts

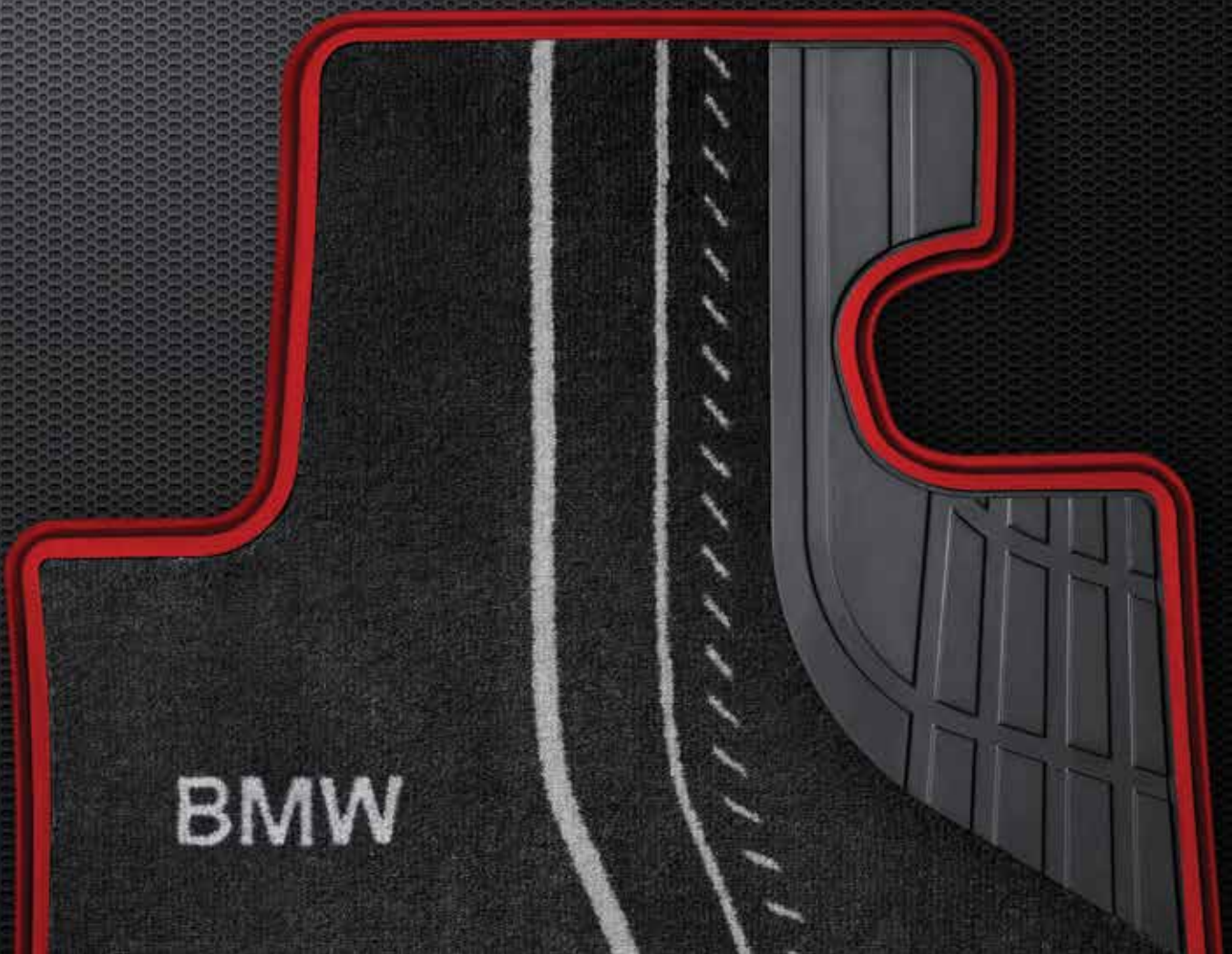


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