

BMW 3 Series

Service Manual

M3, 323i, 325i, 325xi, 328i, 330i, 330xi
Sedan, Coupe, Convertible, Sport Wagon
1999, 2000, 2001, 2002, 2003, 2004, 2005



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How to Use This Manual

WARNING!

Your common sense and good judgment are crucial to safe and successful service work. Read procedures through before starting them. Think about whether the condition of your car, your level of mechanical skill, or your level of reading comprehension might result in or contribute in some way to an occurrence that might cause you injury, damage your car, or result in an unsafe repair. If you have doubts for these or other reasons about your ability to perform safe repair work on your car, have the work done at an authorized BMW dealer or other qualified shop.

The manual is divided into ten sections:

- ◆ 0 GENERAL DATA AND MAINTENANCE
- ◆ 1 ENGINE
- ◆ 2 TRANSMISSION
- ◆ 3 SUSPENSION, STEERING AND BRAKES
- ◆ 4 BODY
- ◆ 5 BODY EQUIPMENT
- ◆ 6 ELECTRICAL SYSTEM
- ◆ 7 EQUIPMENT AND ACCESSORIES

- ◆ ELE ELECTRICAL WIRING DIAGRAMS
- ◆ OBD ON BOARD DIAGNOSTICS

0 GENERAL DATA AND MAINTENANCE covers general vehicle information (Repair Group 010) as well as the recommended maintenance schedules and service procedures to perform BMW scheduled maintenance work (Repair Group 020).

The next seven sections (Repair Groups 1 through 7) are repair based and organized by three digit repair groups. Most major sections begin with a General repair group, e.g. 100 Engine-General. These "00" (double zero) groups are mostly descriptive in nature, covering topics such as theory of operation and troubleshooting. The remainder of the repair groups contain the service and repair information. The last two major sections contains detailed electrical wiring schematics and scan tool codes.

A master listing of the individual repair groups can be found on the inside front cover. A comprehensive index can be found at the back of the manual.

Warnings, cautions and notes

Throughout this manual are many passages with the headings WARNING, CAUTION, or NOTE. These very important headings have different meanings.

WARNING!

The text under this heading warns of unsafe practices that are very likely to cause injury, either by direct threat to the person(s) performing

the work or by increased risk of accident or mechanical failure while driving.

CAUTION!

A caution calls attention to important precautions to be observed during the repair work that will help prevent accidentally damaging the car or its parts.

Note:

A note contains helpful information, tips that will help in doing a better job and completing it more easily.

Please read every WARNING, CAUTION, and NOTE at the front of the manual and as they appear in repair procedures. They are very important. Read them before you begin any maintenance or repair job.

WARNING!

- ♦ ***Never run the engine in the work area unless it is well-ventilated. The exhaust should be vented to the outside. Carbon monoxide (CO) in the exhaust kills.***
- ♦ ***Remove all neckties, scarfs, loose clothing, or jewelry when working near running engines or power tools. Tuck in shirts. Tie long hair and secure it under a cap. Severe injury can result from these things being caught in rotating parts.***
- ♦ ***Remove rings, watches, and bracelets. Aside from the dangers of moving parts, metallic jewelry conducts electricity and may cause***

shorts, sparks, burns, or damage to the electrical system when accidentally contacting the battery or other electrical terminals.

- ♦ ***Disconnect the battery negative (-) cable whenever working on or near the fuel system or anything that is electrically powered. Accidental electrical contact may damage the electrical system or cause a fire.***
- ♦ ***Fuel is highly flammable. When working around fuel, do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.***
- ♦ ***The fuel system is designed to retain pressure even when the ignition is off. When working with the fuel system, loosen the fuel lines slowly to allow the residual pressure to dissipate gradually. Take precautions to avoid spraying fuel.***
- ♦ ***Illuminate the work area adequately and safely. Use a portable safety light for working inside or under the car. A fluorescent type light is best because it gives off less heat. If using a light with a normal incandescent bulb, use rough service bulbs to avoid breakage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.***
- ♦ ***Keep sparks, lighted matches,***

and any open flame away from the top of the battery. Hydrogen gas emitted by the battery is highly flammable. Any nearby source of ignition may cause the battery to explode.

- ♦ ***Never lay tools or parts in the engine compartment or on top of the battery. They may fall into confined spaces and be difficult to retrieve, become caught in belts or other rotating parts when the engine is started, or cause electrical shorts and damage to the electrical system.***

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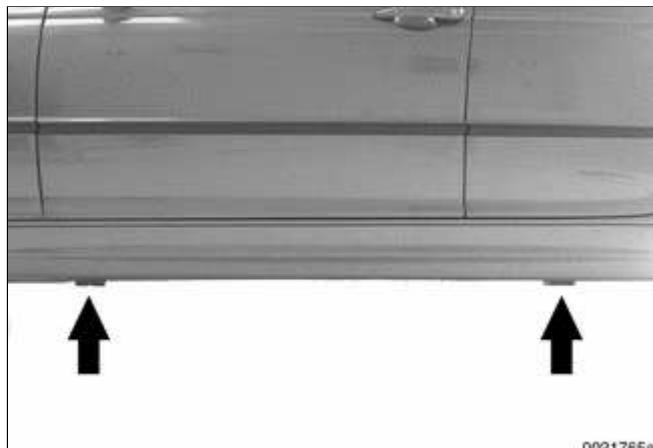
Getting Started

Most of the necessary maintenance and minor repair that an automobile will need can be done with ordinary tools. Below is some important information on how to work safely, a discussion of what tools will be needed and how to use them.

Safety

Although an automobile presents many hazards, common sense and good equipment can help ensure safety. Many accidents happen because of carelessness. Pay attention and stick to safety rules in this manual.

Lifting the car



The proper jacking points should be used to raise the car safely and avoid damage. The jack supplied with the car can only be used at the four side points (arrows)—just behind the front wheels or just in front of the rear wheels.

WARNING!

- ♦ ***Never work under a lifted car unless it is solidly supported on jack stands that are intended for that purpose.***

- ♦ ***When raising the car using a floor jack or a hydraulic lift, carefully position the jack pad to prevent damaging the car body. Plastic pads are provided for this purpose by the manufacturer at the jacking***

points.

- ◆ **Watch the jack closely. Make sure it stays stable and does not shift or tilt. As the car is raised, it may roll slightly and the jack may shift.**

Raising car safely

- Park car on flat, level surface.
- If changing a tire, loosen lug bolts before raising car. See ⇒ [Changing a tire.](#)



- ◀ Place jack into position. Make sure jack is resting on flat, solid ground. Use a board or other support to provide a firm surface for the jack, if necessary
- Raise car slowly while constantly checking position of jack and car.
 - Once car is raised, block wheel that is opposite and farthest from jack to prevent car from unexpectedly rolling.

WARNING!

- ◆ **Do not rely on the transmission or the emergency brake to keep the car from rolling. They are not a substitute for positively blocking the opposite wheel.**
- ◆ **Never work under a car that is supported only by a jack. Use jack stands that are designed to support the car. See ⇒ [Tools.](#)**

Working under car safely

- Disconnect negative (-) cable from battery so that no one can start car. Let others know what you will be doing.

CAUTION!

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

- Raise car slowly as described above.
- Use at least two jack stands to support car. Use jack stands designed for the purpose of supporting a car. For more information on jack stands, see ⇒ [Tools](#).

WARNING!

- ♦ *A jack is a temporary lifting device and should not be used alone to support the car while you are under it.*
- ♦ *Do not use wood, concrete blocks, or bricks to support a car. Wood may split. Blocks or bricks, while strong, are not designed for that kind of load, and may break or collapse.*
- Place jack stands on firm, solid surface. If necessary, use a flat board or similar solid object to provide a firm footing.

- Lower car slowly until its weight is fully supported by jack stands. Watch to make sure that the jack stands do not tip or lean as the car settles on them.
- Observe all jacking precautions again when raising car to remove jack stands.

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Advice for the Beginner

The tips in the paragraphs that follow are general advice to help any do-it-yourself BMW owner perform repairs and maintenance tasks more easily and more professionally.

Planning ahead

To prevent getting in too deep, know what the whole job requires before starting. Read the procedure thoroughly, from beginning to end, in order to know just what to expect and what parts will have to be replaced.

Cleanliness

Keeping things organized, neat, and clean is essential to doing a good job. When working under the hood, fender covers will protect the finish from scratches and other damage. Make sure the car finish is clean so that dirt under the cover does not scratch the finish.

Any repair job will be less troublesome if the parts are clean. For cleaning old parts, there are many solvents and parts cleaners commercially available.

For cleaning parts prior to assembly, commercially available aerosol cans of parts cleaner or brake cleaner are handy to use, and the cleaner will evaporate completely.

WARNING!

Most solvents used for cleaning parts are highly flammable as well as toxic, especially in aerosol form. Use with extreme care. Do not smoke. Do not use these products indoors or near any source of heat, sparks or flame.

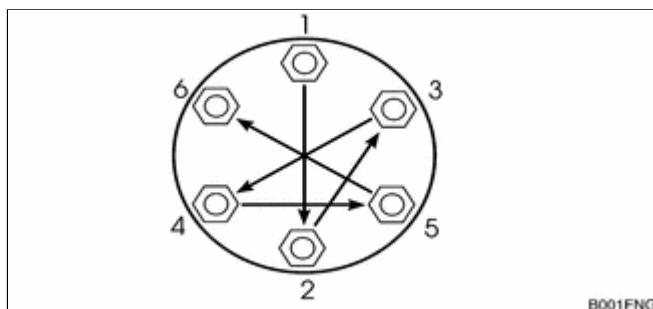
Non-reusable fasteners

Many fasteners used on the cars covered by this manual must be replaced with new ones once they are removed. These include but are not limited to: bolts, nuts (self-locking, nylock, etc.), cotter pins, studs, brake fittings, roll pins, clips and washers. Genuine BMW parts should be the only replacement parts used for this purpose.

Some bolts are designed to stretch during assembly and are permanently altered rendering them unreliable once removed. These are known as torque-to-yield fasteners. Always replace fasteners where instructed to do so. Failure to replace these fasteners could cause vehicle damage and personal injury. See an authorized BMW dealer for applications and ordering information.

Tightening fasteners

When tightening the bolts or nuts that attach a component, it is always good practice to tighten the bolts gradually and evenly to avoid misalignment or over stressing any one portion of the component. For components sealed with gaskets, this method helps to ensure that the gasket will seal properly.



- ◀ Where there are several fasteners, tighten them in a sequence alternating between opposite sides of the component. Repeat the sequence until all the bolts are evenly tightened to the proper specification.

For some repairs a specific tightening sequence is necessary, or a particular order of assembly is required. Such special conditions are noted in the text, and the necessary sequence is described or illustrated. Where no specific torque is listed, ⇒ [Table a](#) can be used as a general guide for tightening fasteners.

WARNING!

⇒ [Table a](#) is a general reference only. Th

values listed in the table are not intended to be used as a substitute for torques specifically called out in the text.

Note:

- ◆ Metric bolt classes or grades are marked on the bolt head.
- ◆ Do not confuse wrench size with bolt diameter. For a listing of the common wrenches used on various bolt diameters, see ⇒ [Basic tool requirements](#).

Table a. General bolt tightening torques in Nm (max. permissible)

Bolt diameter	Bolt Class (according to DIN 267)					
	5.6	5.8	6.8	8.8	10.9	12.9
M5	2.5	3.5	4.5	6	8	10
M6	4.5	6	7.5	10	14	17
M8	11	15	18	24	34	40
M10	23	30	36	47	66	79
M12	39	52	62	82	115	140
M14	62	82	98	130	180	220
M16	94	126	150	200	280	340
M18	130	174	210	280	390	470

Gaskets and seals

Gaskets are designed to crush and become thinner as the mating parts are bolted together. Once a gasket has been used, it is no longer capable of making as good a seal as when new, and is much more likely to leak. For this reason, gaskets should not be reused.

Some gaskets—such as head gaskets—are directional. Make sure that these are installed correctly. This same logic applies to any part used for sealing, including rubber O-rings and copper sealing washers.

In places where a shaft must pass through a housing, flexible lip seals are used to keep the lubricating oil or grease from leaking out past the rotating shaft. Seals should never be reused once they have been removed. When removing a seal, be careful not to damage the metal surfaces.

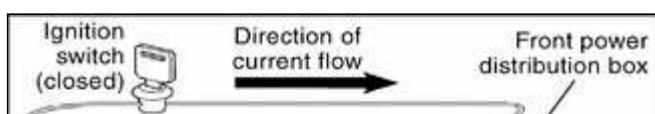
The key to seal installation is to get the seal in straight without damaging it. Use a seal driver that is the same diameter as the seal housing to gently and evenly install into place. If a proper size seal driver is not available, a socket of the right size will do.

Some seals are directional and special installation instructions apply. Make sure a seal is installed with the lip facing the correct way. Note the installation direction of the old seal before removing it.

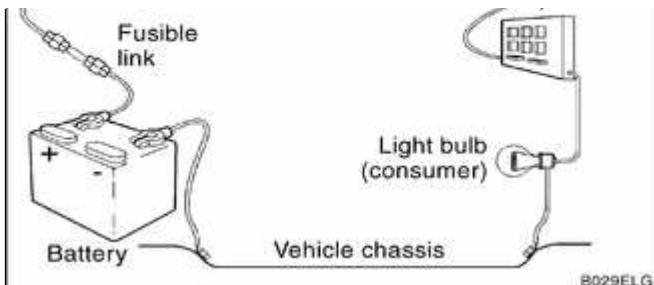
Electrical testing

Many electrical problems can be understood and solved with only a little fundamental knowledge of how electrical circuits function

Electric current only flows in a complete circuit. To operate, every electrical device in the car requires a complete circuit including a voltage source and a path to ground. The positive (+) side of the battery is the original voltage source, and ground is any return path to the negative (-) side of the battery, whether through the wiring harness or the car body. Except for portions of the charging system, all electrical current in the car is direct current (DC) and flows from positive (+) to negative (-).



- Switches are used to turn components on or off by completing or interrupting the circuit.



switch is “open” when the circuit is interrupted, and “closed” when the circuit is completed. See ⇒ [600 Electrical System-General](#) for electrical troubleshooting.

Wire repairs

Repairs to a wiring harness require special care to make the repair permanent. The wire ends must be clean. If frayed or otherwise damaged, cut off the end. If the wire is too short, splice in a new piece of wire of the same size and make two connections.

Use connectors that are designed for the purpose. Crimped-on or soldered-on connectors are best. Crimp connectors and special crimping pliers are widely available. If soldering, use needlenose pliers to hold the wire near the solder joint and create a “heat dam”. This keeps the heat and the solder from traveling up the wire. Always use a solder made specifically for electrical work (rosin core).

Note:

Twisting wires together to make a repair is not recommended. Corrosion and vibration will eventually spoil the connection and may lead to irreparable damage to sensitive electronic components.

Insulate the finished connection. Electronics stores can supply heat-shrinkable insulating tubing that can be placed onto the wire before connecting, slid over the finished joint, and shrunk to a tight fit with a heat gun or hair dryer. The next best alternative is electrical tape. Make sure the wire is clean and free of solder flux or other contamination. Wrap the joint tightly to seal out moisture. See ⇒ [600 Electrical System-General](#) for more information.

Buying Parts

Many of the maintenance and repair tasks in this manual call for the installation of new parts, or the use of new gaskets and other materials when reinstalling parts. Most often, the parts that will be needed should be on hand before beginning the job. Read the introductory text and the complete procedure to determine which parts will be needed.

Note:

For some bigger jobs, partial disassembly and inspection are required to determine a complete parts list. Read the procedure carefully and, if necessary, make other arrangements to get the necessary parts while your car is disassembled.

Genuine BMW parts

Genuine BMW replacement parts from an authorized BMW dealer are designed and manufactured to the same high standards as the original parts. They will be the correct material, manufactured to the same specifications, and guaranteed to fit and work as intended by the engineers who designed the car. Some genuine BMW parts have a limited warranty.

Many independent repair shops make a point of using genuine BMW parts, even though they may at times be more expensive. They know the value of doing the job right with the right parts. Parts from other sources can be as good, particularly if manufactured by one of BMW's original equipment suppliers, but it is often difficult to know.

BMW is constantly updating and improving their cars, often making improvements during a given model year. BMW may recommend a newer, improved part as a replacement, and your authorized dealer's parts department will know about it and provide it. The BMW parts organization is best equipped to deal with any BMW parts needs.

Non-returnable parts

Some parts cannot be returned, even for credit. The best example is electrical parts, which are almost universally considered non-returnable. Buy electrical parts carefully, and be as sure as possible that a replacement is needed, especially for expensive parts such as electronic control units. It may be wise to let an authorized BMW dealer or other qualified shop confirm your diagnosis before replacing an expensive non-returnable part.

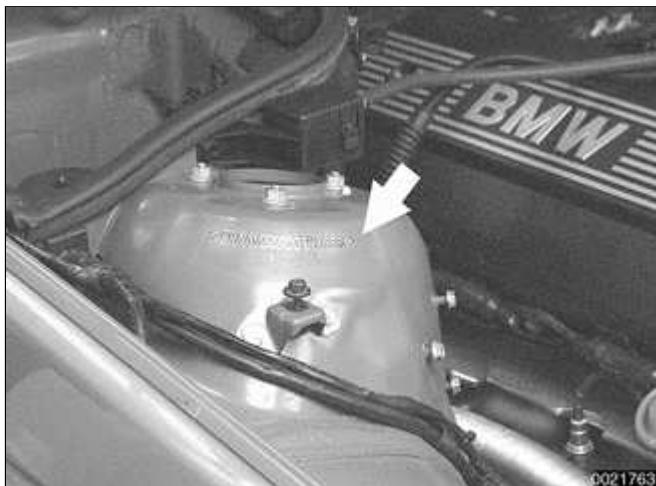
Information you need to know

Model. When ordering parts it is important that you know the correct model designation for your car. Models covered in this E46 manual are 323i/Ci, 325i/Ci, 325Xi, 328i/Ci, 330i/Ci 330Xi in Sedan, Coupe, Convertible and Sport Wagon body styles.

Model year. This is not necessarily the same as date of manufacture or date of sale. A 1999 model may have been manufactured in late 1998, and perhaps not sold until early 2000. It is still a 1999 model. Model years covered by this manual are 1999 to 2001.

Date of manufacture. This information is necessary when ordering replacement parts or determining if any

of the warranty recalls are applicable to your car. The label on the driver's door below the door latch will specify the month and year that the car was built.



◀ Vehicle Identification Number (VIN). This is a combination of letters and numbers that identify the particular car. The VIN appears on the state registration document, and on the car itself. One location is on the right front strut tower in the engine compartment (arrow), another in the lower left corner of the windshield.

Engine code. 3 Series cars covered in this manual are powered by 6-cylinder engines. For information on engine codes and engine applications, see ⇒ [100 Engine-General](#).

Transmission code. The transmission type with its identifying code may be important when buying clutch parts, seals, gaskets, and other transmission-related parts. For information on transmission codes and applications, see ⇒ [200 Transmission-General](#).

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Tools

Most maintenance can be accomplished with a small selection of the right tools. Tools range in quality from inexpensive junk, which may break at first use, to very expensive and well-made tools for the professional. The best tools for most do-it-yourself BMW owners lie somewhere in between.

Many reputable tool manufacturers offer good quality, moderately priced tools with a lifetime guarantee. These are your best buy. They cost a little more, but they are good quality tools that will do what is expected of them. Sears' Craftsman® line is one such source of good quality tools.

Some of the repairs covered in this manual require the use of special tools, such as a custom puller or specialized electrical test equipment. These special tools are called out in the text and can be purchased through an authorized BMW dealer. As an alternative, some special tools mentioned may be purchased from the following tool manufacturers and/or distributors:

Assemacher Specialty Tools
6440 Odell Place, Boulder, CO
80301
303-530-2424
<http://www.asttool.com>

Baum Tools Unlimited, Inc.
P.O. Box 5867, Sarasota, FL
34277-5867
800-848-6657
<http://www.baumtools.com>

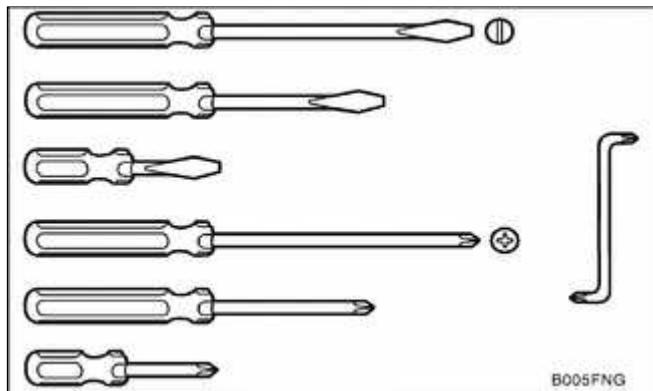
Schley Products, Inc.
5350 E. Hunter Ave., Anaheim Hills,
CA 92807
714-693-7666

<http://www.sptool.com>

Zelenda Machine and Tool Corp.
65-60 Austin Street, Forest Hills, NY
11374-4695
718-896-2288
<http://www.zelenda.com>

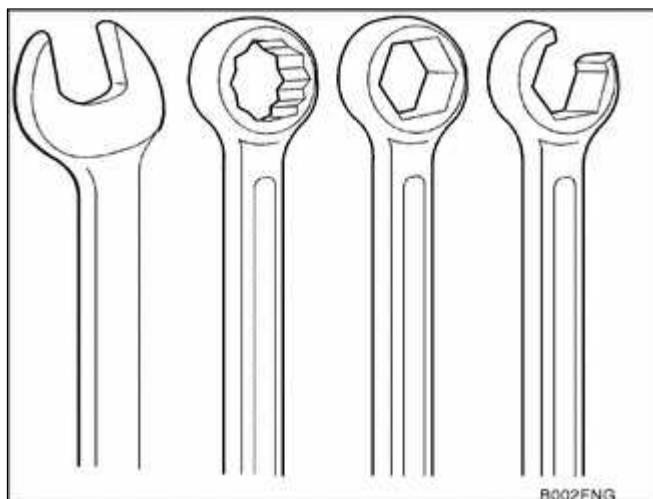
Basic tool requirements

The basic hand tools described below can be used to accomplish most of the simple maintenance and repair tasks.



◀ Screwdrivers. The common flat-blade type and the Phillips type will handle almost all screws used on BMWs. Two or three different sizes of each type will be required, since a screwdriver of the wrong size will damage the screw head.

A complete set of screwdrivers should also include Torx® type screwdrivers.



◀ Wrenches. Wrenches come in different styles, including open-end, 12-point box-end, 6-point box-end and flare nut. The basic open-end wrench is the most widely used, but grips on only two sides. The box-end wrench has better grip on all six sides of a nut or bolt.

A 12-point box-end can loosen a nut or bolt where there is less room for movement, while a 6-point box-end provides better grip. For hex fasteners on fluid lines, like brake lines and fuel lines, a flare-nut wrench offers the advantages of a box-end wrench with a slot that allows it to fit over the line.

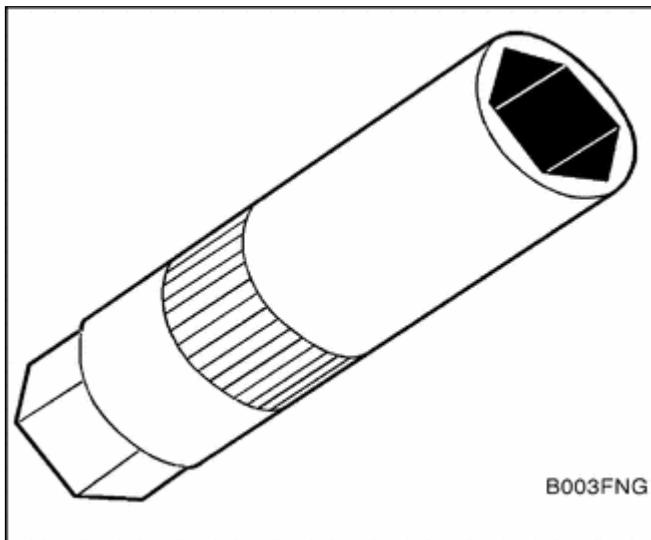
The combination wrench is the most universal. It has one open-end and one box-end. 10 mm and 13 mm wrenches are the most common sizes needed. A more complete set of wrenches would include 6 mm through 19 mm sizes.

Sockets. Sockets are used with a ratchet handle for speed and convenience and can be combined with extensions and universal joints (swivels) to reach fasteners more easily. The most common drive sizes are 1/4 in., 3/8 in., and 1/2 in.

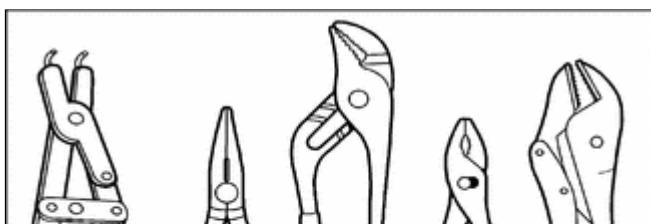
Sockets come in 6-point and 12-point styles. The 6-point offers a better grip on tight nuts and bolts. 6mm to 19mm sockets are the most needed sizes. Below is a list of typical bolt diameters and the corresponding wrench sizes.

Common bolt diameters and wrench sizes

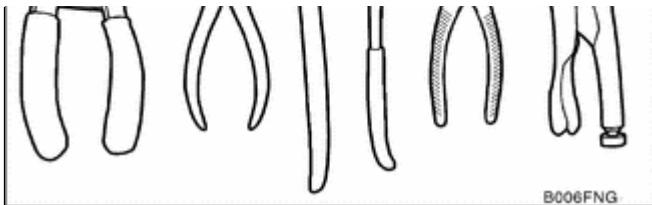
M5	8 mm
M6	10 mm
M8	12 mm or 13 mm
M10	17 mm
M12	19 mm
M14	22 mm



◀ Spark plug socket. A special socket for spark plugs is the correct size, is deep enough to accommodate a spark plug's length, and includes a rubber insert to both protect the spark plug from damage and grip it for easier removal.



◀ Pliers. There are many types of pliers including snap-ring, needlenose, adjustable-joint, slip-joint (Channellock®), and locking (Vise-Grip®) most of which are used for

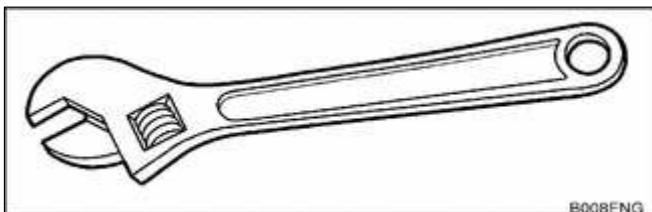


holding irregular objects, bending, or crimping. Some have special applications.

Needlenose pliers are used for gripping small and poorly accessible objects, and are useful for wiring and other electrical work. Locking pliers such as the Vise-Grip® are useful because of their tight grip.

Snap-ring and circlip pliers with special tipped jaws are used to remove and install snap-rings or circlips.

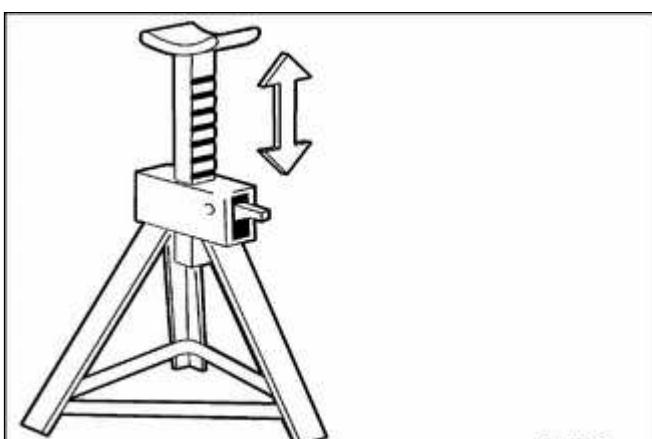
Channel-lock® or water pump pliers have adjustable jaws that can be quickly changed to match the size of the object being held to give greater leverage.



◀ An adjustable wrench can be a useful addition to a small tool kit. It can substitute in a pinch if two wrenches of the same size are needed to remove a nut and bolt. Use extra care with adjustable wrenches, as they tend to loosen, slip, and damage fasteners.

Compared to a wrench of the correct size, an adjustable wrench is always second best. They should only be used when the correct size wrench is not available. Choose one of average size range, about 6 to 8 inches in length.

Jack stands



◀ Strong jack stands are extremely important for any work that is done under the car. Use only jack stands that are designed for the purpose. Blocks of wood, concrete, bricks, etc. are not safe or suitable substitutes.

WARNING!

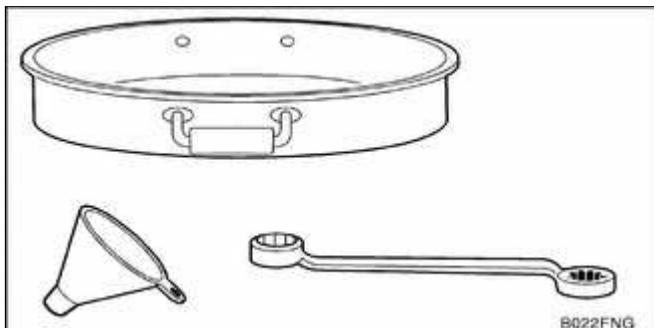
A jack should be used only to raise the vehicle and should not be used



**to support the car for a long period.
Always use jack stands to support a raised vehicle.**

Jack stands are available in several styles. The best ones are made of heavy material for strength, have a wide base for stability, and are equipped to positively lock in their raised positions. Get the best ones available.

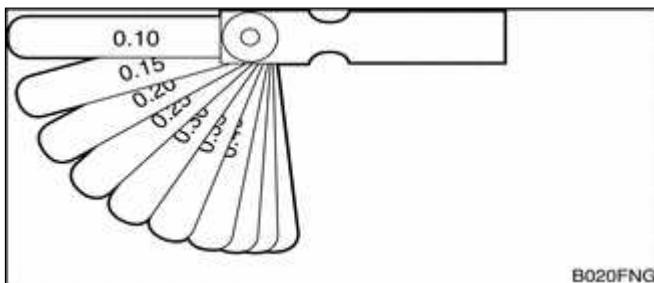
Oil change equipment



◀ Changing engine oil requires a 17 mm socket or wrench to loosen and tighten the drain plug and a drain pan (at least 8 qt. capacity). A wide, low drain pan will fit more easily under the car. Use a funnel to pour the new oil into the engine.

The M52/M54 engines use an oil filter canister with a disposable filter cartridge insert. Therefore, an oil filter wrench is not required. See ⇒ [020 Maintenance](#) for oil change instructions.

Feeler gauges

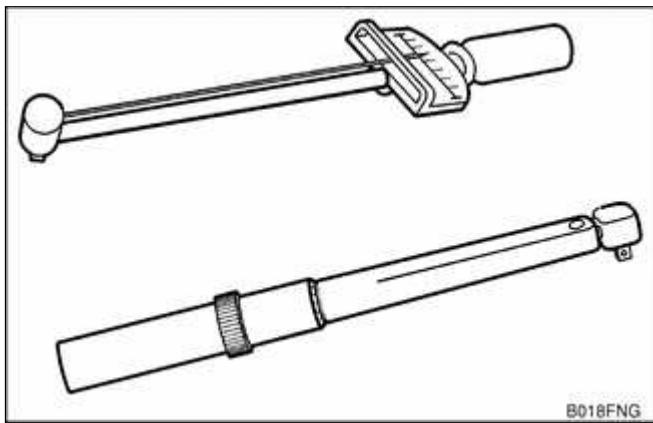


◀ Feeler gauges are thin metal strips of precise thickness, used to measure small clearances. They are normally available as a set, covering a range of sizes.

Torque wrench

A torque wrench is used to precisely tighten threaded fasteners to a predetermined value. Many of the

repair procedures in this manual include BMW-specified torque values in Newton-meters (Nm) and the equivalent values in foot-pounds (ft-lb).



◀ Several types of torque wrenches are available. An inexpensive beam-type (top) is adequate but must be read visually. A ratchet-type (bottom) can be preset to indicate (click) when the torque value has been reached. They all do the same job, but offer different convenience features at different prices. The most convenient ones have a built-in ratchet, and can be preset to indicate when a specific torque value has been reached. Follow the wrench manufacturer's directions for use to achieve the greatest accuracy.

A torque wrench with a range up to about 150 Nm (185 ft-lb) has adequate capacity for most of the repairs covered in this manual. For recommended torque values of 10 Nm or below, the English system equivalent is given in inch-pounds (in-lb). These small values may be most easily reached using a torque wrench calibrated in inch-pounds. To convert inch-pounds to foot-pounds, divide by 12.

Digital multimeter



◀ Many of the electrical tests in this manual call for the measurement of resistance (ohms) or voltage values. For safe and accurate tests of sensitive electronic components and systems, a multimeter or Digital Volt/Ohmmeter (DVOM) with high input impedance (at least 10,000 ohms) should be used. Some meters have automotive functions such as dwell and pulse width that are useful for troubleshooting ignition and fuel injection problems.

CAUTION!

Vehicle electronic systems may be damaged by the high current draw of a test light with a normal incandescent bulb. As a general rule, use a high impedance digital multimeter or an LED test light for all electrical testing.

BMW special tools

Many repairs covered in this manual call for the use of BMW special tools. This, however, does not automatically mean that the job is too complicated or out of reach of the do-it-yourselfer.

Many of the BMW special tools mentioned in this manual are simply the best thing to use to do the job correctly. In these cases, the tool is identified with a BMW part number. See your authorized BMW dealer parts department for information on how to order special tools.

There are some jobs for which expensive special tools are essential, and not a cost-effective purchase for one-time repair by the do-it-yourself owner. This manual includes such repairs for the benefit of those with the necessary experience and access to tools. For the do-it-yourselfer, the need for special tools is noted in the text, and whether or not BMW dealer service is recommended.

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Emergencies

Changing a tire

- Stop car on as flat a surface as possible, in a place where you can be easily seen by other drivers. Avoid stopping just over the crest of a hill.
- Turn on emergency flashers, and set out flares or emergency markers well behind car. Chock wheel (wheel chock located in trunk) diagonally opposite to the one being changed. Passengers should get out of car and stand well away from road.

WARNING!

If a tire goes flat while driving, pull well off the road. Changing a tire on a busy street or highway is very dangerous. If necessary, drive a short distance on the flat tire to get to a safe place. It is much better to ruin a tire or rim than to risk being hit.

- Take jack and tools from tool area beneath trunk mat. Remove spare tire from tire storage tray.
- Loosen wheel bolts while car is on ground, but leave them a little snug.



- Place jack in lifting point nearest wheel being changed. Use a board to provide a firm footing for jack if ground is soft. Raise car only far enough so that wheel is fully off ground and then





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remove wheel nuts and wheel.

- Install spare wheel. Install wheel nuts and tighten them hand tight using lug nut wrench.
- Lower car. With all wheels on ground, fully tighten nuts in a crisscross pattern. Torque wheel nuts when installing wheel. Check inflation pressure of spare tire.

Tightening torque

Wheel to wheel hub	$100 \pm 10 \text{ Nm} (74 \pm 7 \text{ ft-lb})$
--------------------	--

Car will not start

If the engine turns over slowly or not at all, especially on cold mornings, the battery may not be sufficiently charged. Jump-starting the battery from another car may help.

CAUTION!

On cars with manual transmission, push starting (or tow starting) a car is not recommended by BMW.

If the engine is turning over at normal speed with the starter motor, the battery and starter are fine. If the starter will not operate, see ⇒ [121 Battery, Alternator, Starter](#) for information on the starter and starter immobilization systems.

Check to make sure that there is fuel in the tank. Do not rely on the fuel gauge as it may be faulty. Instead, remove the gas filler cap and rock the car. If there is gas in the tank, you should hear a sloshing sound at the filler neck.

See ⇒ [OBD On Board Diagnostics](#) at

the rear of this manual for diagnostic code reading procedures.

Jump starting

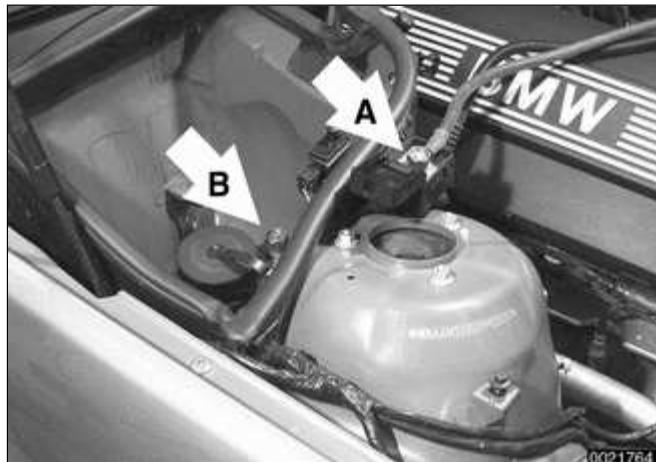
Cars with discharged or dead batteries can be jump-started using the good battery from another car. When jump-starting the engine, always note the following warnings.

WARNING!

- ♦ *Battery acid (electrolyte) can cause severe burns, and will damage the car and clothing. If electrolyte is spilled, wash the surface with large quantities of water. If it gets into eyes, flush them with water for several minutes and call a doctor.*
- ♦ *Batteries produce explosive and noxious gasses. Keep sparks and flames away. Do not smoke near batteries.*
- ♦ *Do not jump-start the engine if you suspect that the battery is frozen. Trapped gas may explode. Allow the battery to thaw first.*
- ♦ *Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.*
- Place cars close together, but do not allow them to touch each

other.

- Turn off engine of car with good battery.
- Turn off ignition switch of car with discharged battery.



- ◀ Connect one end of positive (+) cable to positive (+) post of good battery. Remove cover from the positive (+) junction post (**A**) in engine compartment and connect other end of the positive (+) cable to the junction post.
- Connect one end of negative (-) cable to negative (-) battery post of good battery. Connect opposite end of negative cable (-) to ground lug (-) in engine compartment (**B**).
 - Start car with good battery and run engine at about 2,000 rpm, then start car with dead battery.
 - With engine at idle, switch on blower motor and rear window defogger to avoid a damaging voltage surge from alternator.
 - Carefully disconnect jumper cables, starting with negative cable on ground lug. Turn all electrical consumers off.

Note:

The engine should be run for at least an hour to recharge the battery.

Indicator and warning lights

Many of the vehicle systems are self-monitored both statically and dynamically while driving. Generally, a red warning lamp that comes on during driving should be considered serious. If you cannot immediately determine the seriousness of the warning light, stop the vehicle in a safe place and turn the engine off as soon as possible. Consult the owner's manual in the glove box for additional information on the warning lamp and the recommended action.

If the Malfunction Indicator Lamp (MIL), "Check Engine" or "SERVICE ENGINE SOON" warning light, comes on or flashes, it indicates that an emissions-related fault has occurred. Faults such as a faulty oxygen sensor or a faulty fuel injector can cause the exhaust or evaporative emissions to exceed a specified limit. When these limits are exceeded, the MIL will be turned on. The car can be safely driven with the light on, although the emission systems should be checked as soon as possible. See ⇒ [OBD On Board Diagnostics](#) for more information on the MIL and the On-board diagnostic system.

Towing

The cars covered by this manual should be towed with a tow truck using wheel lift or flat bed equipment. Do not tow the car on all four wheels except for very short distances to move it to a safe place.

CAUTION!

Do not tow with sling-type equipment. The front spoilers and bumper covers may sustain damage.



- ◀ To access threaded towing eye socket, pry open trim (**arrow**) on front or rear



0021507

bumper.

Note:

A towing eye is provided in the luggage compartment tool kit. The towing eye can be screwed into the front or rear bumper.



0021508

◀ Install towing eye into threaded hole.

- Standard transmission: A maximum towing distance of 20 miles is acceptable with the rear wheels on the ground and the transmission out of gear. If the car needs to be towed further, have the rear wheels placed on dollies.
- Automatic transmission: If absolutely necessary, car can be towed with rear wheels on ground, but the tow should not exceed 25 miles (40 km), at speeds at or below 30 mph (48 km/h).
- Be sure transmission fluid has been topped off before starting tow.
- Always tow car with transmission lever in "N" (neutral). If tow must exceed 25 miles (40 km), add one quart of ATF to transmission, or better yet, remove driveshaft.
- Be sure to drain or pump out added fluid once tow has been completed.

Note:

- ◆ *ATF draining and filling is covered in ⇒ [240 Automatic Transmission](#). Be sure to read the filling and draining procedure, as special service equipment is required to check the fluid level.*
- ◆ *Driveshaft removal is covered in ⇒ [260 Driveshaft](#).*

Spare parts kit

Carrying a basic set of spare parts can prevent a minor breakdown from turning into a major annoyance. Many of the following items won't allow you to do major repair work on the car, but they will help in the event of the failure of something that can disable the car or compromise its safety.

Spare parts kit – basic

- ◆ Poly-ribbed drive belt(s)
- ◆ Engine oil (one or two quarts)
- ◆ Engine coolant (1 gallon of premixed 50/50 BMW anti-freeze and water)
- ◆ Fuse assortment (7.5A, 10A, 15A, 20A, 30A, 50A)
- ◆ Radiator hoses (upper and lower)

Spare parts kit – additional contents

Spare parts kit – additional contents

- ◆ Exterior lighting bulbs
(headlight, brake light, turn signal, and taillight)
- ◆ Wiper blades
- ◆ Brake fluid (new unopened bottle, DOT 4 specification)
- ◆ Main relay for DME system

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General

The information given in this repair group includes the routine checks and maintenance steps that are both required by BMW under the terms of the vehicle warranty protection and recommended by BMW to ensure long and reliable vehicle operation.

Note:

Aside from keeping your car in the best possible condition, proper maintenance plays a role in maintaining full protection under BMW's new-car warranty coverage. If in doubt about the terms and conditions of your car's warranty, an authorized BMW dealer should be able to explain them.

Service Interval Indicator (SII)

For the 1999 and later 3 Series (E46), BMW introduced an extended oil change interval of approximately 15,000 miles depending on engine operating conditions. The introduction of BMW High Performance Synthetic Oil has made this longer interval possible.

1999 to 6/2000 models. BMW uses a unique system to determine maintenance intervals. BMW's Service Interval Indicator (SII), calculates maintenance intervals based not only on elapsed mileage, but also on such inputs as engine speed, engine temperature, number of starts, length of trips, and the amount of fuel used. At the appropriate time, the system indicates, through lights in the instrument cluster, when the next routine maintenance is due.

6/2000 and later models. For the

mid-2000 models BMW introduced new service interval software which calculates service based on the amount of fuel used. When SII detects total fuel consumption that equals the preset limits (in gallons), the instrument cluster indicates that service is required.

Using a 328i as an example:

- ◆ Standard transmission model: SII illuminates after consumption of 601 gallons of fuel.
- ◆ Automatic transmission model: SII illuminates after consumption of 667 gallons.

After the service is performed the SII can be reset to zero.

◀ The SII displays the mileage remaining before service is due. The type of service (OIL SERVICE or INSPECTION) is also illuminated in the display.

Note:

An OIL SERVICE interval will always be followed by an INSPECTION interval, which will then be followed by an OIL SERVICE interval, and so on.



When the ignition is turned on, the service recommendation and miles remaining are displayed for a few seconds. A flashing message and a negative (-) symbol in front of the number indicate that the service interval has been exceeded by the distance displayed.

The On-Board Computer uses the rate of fuel consumption in the period immediately preceding to calculate the mileage before the next service is due.

Service Interval Indicator (SII), resetting

The SII signals the need for basic routine maintenance:

- ◆ Engine oil and oil filter change, after the engine has been warmed up.
- ◆ BMW-recommended additional maintenance as listed in ⇒ [Table a](#).

Note:

For reference, the BMW oil service requirements are approximately equivalent to the maintenance that other European manufacturers specify at intervals with a maximum of every 15,000 miles or 12 months.

When the specified maintenance has been carried out, the SII memory should be reset.

1999 to 6/2000 models



In vehicles equipped with the DLC in the right side engine compartment, the SII may be reset using BMW service and scan tool DIS or MoDiC, or a specialty tool from another manufacturer. Plug the tool (**arrow**) into the DLC

CAUTION!

Follow the manufacturer's directions when resetting the SII. If the reset procedures are done incorrectly, the reset tool or the electronic Service Interval Indicator may be damaged.

Aftermarket reset tools that can reset all models with the DLC can be purchased from one of the following suppliers:

Assemacher Specialty Tools
6440 Odell Place, Boulder, CO
80301
303-530-2424
<http://www.asttool.com>

Baum Tools Unlimited, Inc.
P.O. Box 5867, Sarasota, FL
34277-5867
800-848-6657
<http://www.baumtools.com>

Peake Research, Automotive Products Division
P.O. Box 28776, San Jose, CA 95159
408-369-0406
<http://www.peakeresearch.com>

6/2000 and later models

On vehicles without the data link connector (DLC) in the engine compartment the reset tool can no longer be used. Instead, the SII can be reset with the trip odometer reset button in the instrument cluster:

- ◆ The ignition key must be in OFF position.
- ◆ Press and hold trip odometer button in instrument cluster, and turn ignition key to ACCESSORY position.
- ◆ Keep button pressed for approx. 5 more seconds until any of the following appear in the display: "Oil Service" or "Inspection", with "Reset" or "Re".

- ◆ Press button again and hold for approx. 5 seconds until "Reset" or "Re" flash.
- ◆ While display is flashing, press button briefly to reset SII.
- ◆ After display has shown new interval, the following will appear in display for approx. 2 seconds: "End SIA".

The system can only be reset again after the vehicle has been driven approx. 50 to 75 miles (consumes at least 2.5 gal. fuel). If the display shows "Reset" or "Re" when resetting, the minimum driving distance has been fulfilled and the system can be reset again. It is possible to interrupt and end the reset procedure by changing the position of the ignition key.

Inspection I and Inspection II

The Service Interval Indicator signals the need for more comprehensive maintenance and inspection. There are two sets of inspection requirements. These inspections alternate throughout a car's maintenance history. If the last inspection interval was Inspection I, the next inspection interval (following an oil service) will be Inspection II, the next after that will be Inspection I, and so on.

Inspection I tasks are listed in ⇒ [Table b](#). Inspection II includes most of the tasks from Inspection I with additional Inspection II tasks. A complete listing of Inspection II tasks is in ⇒ [Table c](#).

Note:

For reference, the BMW Inspection I

and Inspection II requirements are approximately equivalent to the maintenance requirements that other European manufacturers specify. Inspection I is normally due at intervals with a maximum of 30,000 miles or 24 months. Inspection II is normally due at intervals with a maximum of 60,000 miles or 48 months.

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Maintenance Tables

The intervals for most tasks listed in the maintenance table below are determined by the SII.

Except where noted, the maintenance items listed apply to all models and model years covered by this manual. The columns on the right side of each table give quick-reference information about the job. The text in the "additional repair information" column refers to repair groups.

Table a. Oil service					
Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
Engine compartment maintenance					
Change oil and oil filter					⇒ 020
Reset Service Interval Indicator (SII).					⇒ 020
Replace interior ventilation microfilter.					⇒ 020
Under car maintenance					
Check overall thickness of front and rear brake pads. If replacement is necessary: Examine brake disc surfaces. Clean brake pad contact points in calipers. Grease wheel centering hubs (alloy wheels only). Check thickness of parking brake linings only when replacing rear brake pads. Check operation of parking brake and adjust as necessary.					⇒ 340
Check and adjust tire pressures, including spare					⇒ 020

Table b. Inspection I service

Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
Under car maintenance					
Change engine oil and filter.					⇒ 020
Check transmission and differential(s) for external leaks.					⇒ 230 ⇒ 240
Check CV joint boots for damage or leaks.					⇒ 311 ⇒ 331
Visually check fuel tank, fuel lines and connections for leaks.					⇒ 160
Check condition, position, and mounting of exhaust system. Visually check for leaks.					⇒ 180
Check power steering system for leaks. Check power steering fluid level and adjust if necessary.					⇒ 320
Check steering rack and tie rods for tightness. Check condition of front axle joints, steering linkage and steering shaft joints.					⇒ 320
Check overall thickness of front and rear brake pads using special BMW tool. If replacement is necessary: Examine brake disc surfaces. Clean brake pad contact points in calipers. Grease wheel					⇒ 340

Table b. Inspection I service

Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
centering hubs (alloy wheels only). Check thickness of parking brake linings only when replacing rear brake pads. Check operation of parking brake and adjust as necessary.					
Check front control arm bushings for damage or wear.					⇒ 310
Check brake system connections and lines for leaks, damage and incorrect positioning.					⇒ 340
Check parking brake actuator. Adjust if necessary.					⇒ 340
Check all tire pressures (including spare) and correct if necessary. Check condition of tires (outer tread surfaces), tread wear pattern; in case of uneven tread wear, perform a wheel alignment if requested.					⇒ 020
Inspect entire body according to terms of rust perforation limited warranty. (Must be performed at least every two years.)					
Engine compartment maintenance					
Read out on-board diagnostic (OBD II) system.					⇒ 100 ⇒ 130

Table b. Inspection I service

Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
Check engine coolant system/heater hose connections for leaks. Check coolant level and antifreeze protection level. Add coolant as necessary.					⇒ 170
Check windshield washer fluid level and antifreeze protection. Add washer fluid as necessary.					⇒ 611
Replace ventilation microfilter. (Note: reduce replacement intervals in dusty operating conditions).					⇒ 020
Reset service interval indicator.					⇒ 020
Body/electrical					
Check operation of air conditioner.					⇒ 640
Check operation of headlights, parking lights, back-up lights, license plate lights, interior lights, glove box light, engine compartment light, trunk light, turn signals, emergency flashers, stop lights, horns, headlight flasher and dimmer switch					⇒ 630
Check instrument panel and dashboard lights.					⇒ 620
Check wipers and windshield washer					⇒ 611

Table b. Inspection I service

Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
system. Check aim of washer jets and adjust if necessary.					
Check condition and function of seat belts.					⇒ 720
Visually examine all airbag units for torn covers, obvious damage or attachment of decals, decorations or accessories.					⇒ 721
Check central locking system and double lock.					⇒ 515
Replace batteries for alarm remote controls in all master keys.					⇒ 515
Check operation and condition of all door, hood and trunk latches.					⇒ 410 ⇒ 515
Check heater, air conditioner blower, and rear window defogger operation.					⇒ 640
Convertible models: Activate automatic roll-over protection system via diagnostic link. Note: first remove hardtop or lower convertible top.					⇒ 541
Check all warning/indicator lights, check control.					⇒ 620
Check operation of rear view mirrors.					
Road test					

Table b. Inspection I service

Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
Check braking performance, steering, heating, air conditioner operation. Check manual transmission and clutch operation or automatic transmission operation.					

Table c. Inspection II service

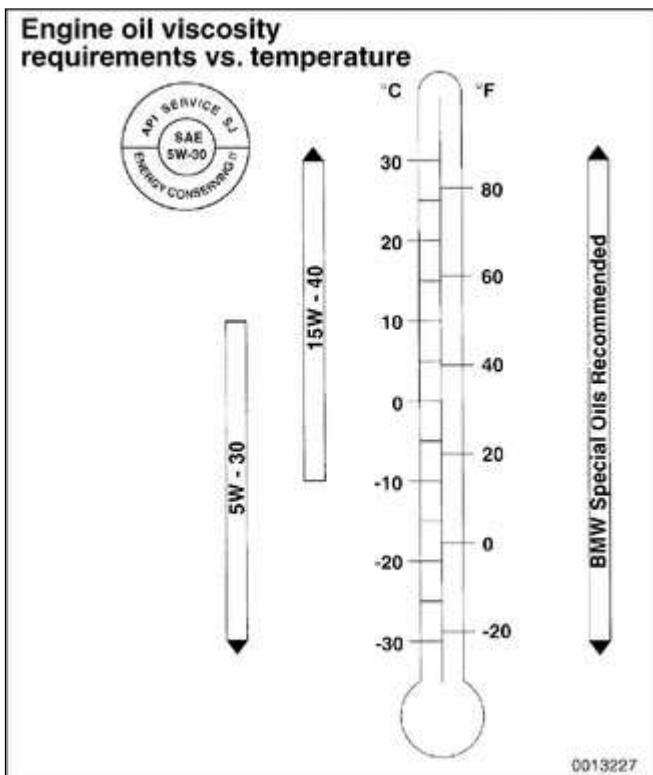
Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
Engine compartment maintenance					
Replace air filter element. (Note: reduce replacement intervals in dusty operating conditions).					⇒ 020
Brake system service					
Replace brake fluid every 2 years (time interval begins from vehicle production date).					⇒ 340
Cooling system service					
Replace coolant every 4 years (time interval begins from vehicle production date).					⇒ 170
Oxygen sensor service					
Replace oxygen sensor every 100,000 miles.					⇒ 180

Table c. Inspection II service

Maintenance item	Tools required	New parts required	Warm engine required	Dealer service recommended	Additional repair information
Spark plug service					
Replace spark plugs every 100,000 miles.					⇒ 020

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Fluid and Lubricant Specifications



The illustration shows engine oil viscosity (SAE grade) vs. operating temperature range for the BMW engines covered in this manual.

Fluid and lubricant capacities and specifications for E46 cars are listed in ⇒ [Table d.](#)

WARNING!

The use of fluids that do not meet BMW's specifications may impair performance and reliability, and may void warranty coverage.

Table d. Fluids and lubricants

Fluid	Approximate capacity	Specification
-------	----------------------	---------------

Engine oil with filter change

Rear wheel drive	6.5 liters (6.9 US qt.)	Synthetic oil with API rating SH or higher
All wheel drive	7.5 liters (8 US qt.)	

Manual transmission oil

Getrag S5D 250G	1.1 liters (1.15 US qt.)	BMW 83 22 9 408 942 (MTF-LT-1)
ZF S5D 320Z	1.3 liters (1.37 US qt.)	
ZF S5D 280Z	1.35 liters (1.42 US qt.)	

Automatic transmission fluid (ATF) (drain and fill) (additional fluid required when installing a dry torque converter)

Table d. Fluids and lubricants

Fluid	Approximate capacity	Specification
ZF A5S 325Z	Complete refill: 9.0 liters (9.5 US qt.)	BMW 83 22 9 407 807 (Exxon LT 71141)
GM A5S 360R	Oil and filter change: 4.0 liters (4.2 US qt.)	BMW 83 22 0 024 359 (Texaco ETL 8072B)
GM A5S 390R		
Differential, front or rear (drain and fill) (Lifetime fluid; no fluid change required)		
Front differential	Fill: 0.7 liter (0.74 US qt.) Refill: 0.6 liter (0.63 US qt.) Rear wheel drive: 0.9 liter (0.95 US qt.)	BMW SAF-XO synthetic oil
Rear differential	All wheel drive: 1.0 liter (1.06 US qt.)	
Power steering fluid		
All models	Permanently sealed (no drain plug)	Dexron III® ATF
Brake fluid		
All models		SAE DOT4
Engine coolant		
All models	8.4 liters (8.9 US qt.)	50% BMW anti-freeze/ 50% distilled water

CAUTION!***Multi-viscosity engine oils should not be***

used in the manual transmission. Use of such an oil could shorten the service life of the transmission.

Brake fluid

Brake fluid absorbs moisture easily, and moisture in the fluid affects brake performance and reliability. This is why brake fluid should be flushed from the system every two years. When replacing or adding brake fluid, use only new fluid from previously unopened containers. Do not use brake fluid that has been bled from the system, even if it is brand new. Use only DOT 4 brake fluid.

Note:

See ⇒ [340 Brakes](#) for more brake fluid information.

Engine coolant (anti-freeze)

BMW recommends coolant that is a 50/50 mixture of distilled water and phosphate/nitrate free anti-freeze containing ethylene glycol. Anti-freeze raises the boiling point and lowers the freezing point of the coolant. It also contains additives that help prevent cooling system corrosion.

Differential gear oil

BMW recommends using only a specially formulated synthetic gear oil (SAF-XO) that is available through an authorized BMW dealer parts department. For additional information on this lubricant and any other lubricants that may be compatible, contact an authorized BMW dealer service department.

Power steering fluid

The power steering fluid is Dexron III® ATF, or equivalent. The system is permanently filled and does not have a drain. Routinely adding ATF is not required unless the system is leaking.

Transmission fluid, automatic

The automatic transmissions installed in the E46 models are filled with special automatic transmission fluids, depending on transmission type and model year.

Note:

- ◆ *The transmission lubricant type can be found on the "type-plate" on the side of the transmission. See ⇒ [240 Automatic Transmission](#).*

- ◆ *Consult an authorized BMW dealer for alternate fluid use and the most-up-to-date information regarding transmission operating fluids.*

Transmission fluid, manual

The manual transmissions installed in the E46 models are normally filled with a special lifetime fluid (MTF-LT-1). Consult ⇒ [230 Manual Transmission](#) for further information.

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Engine Oil Service

With the introduction of synthetic oil and extended oil change intervals, a new oil filter with improved filter paper design was introduced. The new filter paper resists deterioration caused by high oil temperatures over an extended time.

Note:

Early style oil filter numbers with BMW part numbers 11 42 1 427 908 or 11 42 1 745 390 should not be used in the 1999 and later BMW models.

Use any synthetic low viscosity oil to top off the engine oil level between oil changes, as long as it meets the API classification SH. Castrol is now the supplier of both the mineral based oil used in earlier models and the synthetic based oil used from model year 1999.

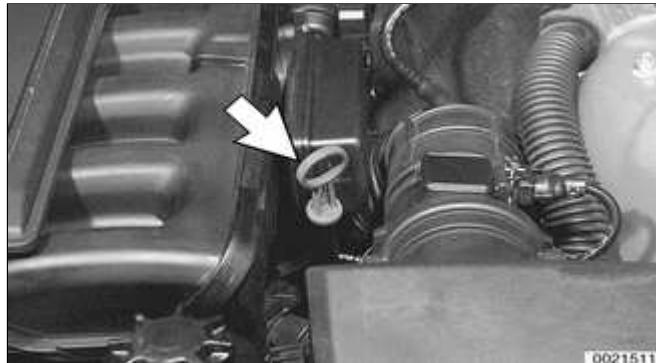
Oil recommendation	
BMW High Performance Synthetic (part number 07 51 0 017 866)	5W-30

Note:

- ◆ *The use of engine oil additives is not recommended when using BMW High Performance Synthetic engine oil.*
- ◆ *BMW is constantly upgrading recommended maintenance procedures and requirements. The information contained here is as accurate as possible at the time of*

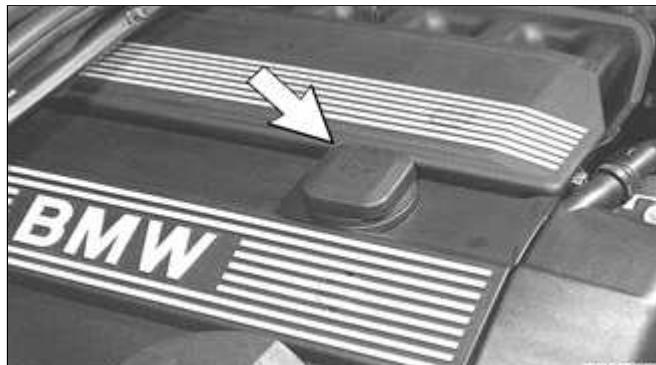
publication. If there is any doubt about what procedures apply to a specific model or model year, or what intervals should be followed, remember that an authorized BMW dealer has the latest information on factory-recommended maintenance.

Engine oil, checking level



- ◀ Engine oil level is checked with a dipstick (**arrow**) in engine block.

- ◆ Check oil level with car on a level surface, after engine has been stopped for at least a few minutes.
- ◆ Check level by pulling out dipstick and wiping it clean. Reinsert it all way and withdraw it again.
- ◆ Oil level is correct if it is between two marks near end of stick.



- ◀ Add oil through filler cap (**arrow**) on top of cylinder head. Add only amount needed to bring oil level to MAX mark on dipstick, using an oil of correct viscosity and grade. Too much oil can be just as harmful as too little.

Engine oil and filter, changing

A complete oil change requires new oil, a new oil filter insert kit, and a new drain plug sealing washer. The tools needed, a 17 mm drain plug socket or box wrench and a drain pan (8 - 10 US

qt. capacity), are described in ⇒ [010 General](#).

Note:

If using a "fast-lube" service facility for oil changes, make sure the technician hand-starts and torques the engine oil drain plug using hand-tools. Power tools can strip the threads of the plug and the oil pan.

- Run engine for a few minutes to warm engine oil. Shut engine off.
- With car on level ground, place drain pan under oil drain plug.



- ◀ Using a 36 mm wrench, loosen and remove oil filter housing cover (**arrow**). Remove filter cartridge and discard any O-rings.



- ◀ On Coupe or Convertible model:
Remove oil drain plug access panel in center of front end reinforcement plate below engine.



- ◀ Using a socket or box wrench, loosen drain plug at oil drain pan. Remove plug by hand and let oil drain into pan.

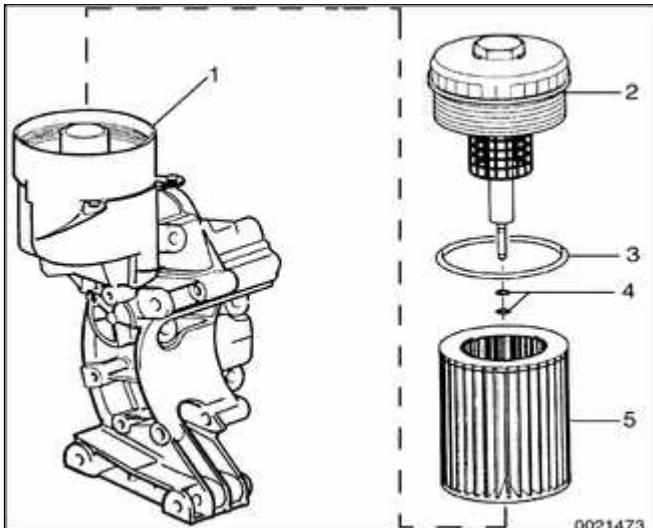
**CAUTION!**

Pull the loose plug away from the hole quickly to avoid being scalded by hot oil. It will run out quickly when the plug is removed. If possible, use gloves to protect your hands.

- When oil flow has diminished to an occasional drip, reinstall drain plug with a new metal sealing washer and torque plug.

Tightening torques

Engine oil drain plug (M12 bolt)	25 Nm (18 ft-lb)
----------------------------------	------------------

**Working at oil filter housing:**

- ◆ Lubricate and install new oil filter O-rings.
 - ◆ Install a new filter cartridge and housing cover.
 - ◆ Tighten cover.
- 1 - Filter housing
2 - filter housing cover -tighten to 25 Nm (18 ft-lb)
3 - O-ring (always replace)
4 - O-rings (always replace)
5 - Filter element

Tightening torque

Oil filter cover filter housing	25 Nm (18 ft-lb)
---------------------------------	------------------

- Refill crankcase with oil. Approximate oil capacity is listed in ⇒ [Table d](#). Use dipstick to check correct oil level.
- Start engine and check that oil pressure warning light immediately goes out.
- Allow engine to run for a few minutes to circulate new oil, then check for leaks at drain plug and oil filter. Stop engine and recheck oil level.

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Engine Compartment Maintenance

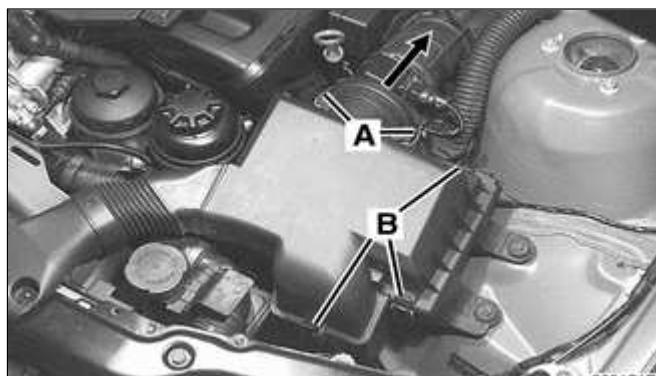
The information under this heading describes routine maintenance other than oil change done in the engine compartment. It is not necessary for the car to be raised and supported off the ground. Information on oil change is given earlier in this group.

Accelerator linkage

The accelerator and throttle linkage should be lubricated periodically. Use a general purpose oil on the joints and bearings of the linkage. Use a multipurpose grease on the bearing points of the throttle plate.

Air filter, replacing

The specified replacement intervals for the air filter are based on normal use. If the car is operated primarily in dusty conditions, the air filter should be serviced more frequently.



- ◀ Release mass air flow sensor clips (**A**) and pull sensor assembly out of air filter upper housing (**arrow**).
 - Release upper air filter housing clips (**B**).



- ◀ Lift air filter upper housing, and then remove filter element insert from cartridge.
 - On installation, install O-ring for



mass air flow sensor (**arrow**) into retaining clips in air filter upper housing.

Cooling system service

Routine cooling system maintenance consists of maintaining the coolant level and inspecting hoses. Because the coolant's anti-corrosion and anti-freeze additives gradually lose their effectiveness, replacement of the coolant every four years is recommended.

CAUTION!

Use only BMW approved phosphate-free anti-freeze when filling the cooling system. Use of anti-freeze containing phosphates is considered to be harmful to the cooling system.



- ◀ The float in the radiator tank indicates coolant level, and should be inspected while the coolant is cold. When the upper mark on the float is level with the top of the filler neck, coolant is at the minimum allowable level. When the lower mark on the float is level with the top of the filler neck, the coolant is at the maximum level.

Hose connections should be tight and dry. Coolant seepage indicates either that the hose clamp is loose, that the hose is damaged, or that the connection is dirty or corroded. Dried coolant has a chalky appearance. Hoses should be firm and springy. Replace any hose that is cracked, that has become soft and limp, or has been contaminated by oil.

- ◀ As a preventive measure, replacement of the cooling system hoses every four years is also recommended. The



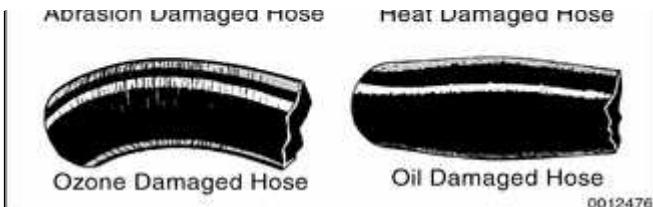


illustration shows examples of damage to coolant hoses. Any of conditions shown is cause for replacement.
(Courtesy of Gates Rubber Company, Inc.)

Engine drive belt service

Drive belts and pulleys transfer power from the engine crankshaft to various accessories. E46 models use two poly-ribbed (serpentine) belts:

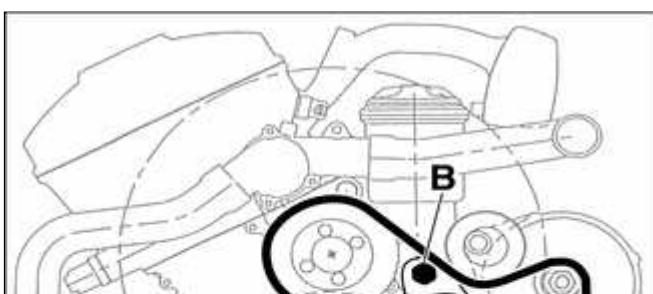
- ◆ The outer belt only turns the A/C compressor
- ◆ The inner, longer belt activates the alternator, coolant pump and power steering.

Automatic belt tensioners are used to keep the belts tensioned properly. Unless a tensioner mechanism malfunctions, the poly-ribbed belts do not require tension adjustment.

Inspect drive belts with the engine off. If the belt shows signs of wear, cracking, glazing, or missing sections, it should be replaced immediately. To reduce the chance of belt failure while driving, replacement of the belts every four years is recommended.

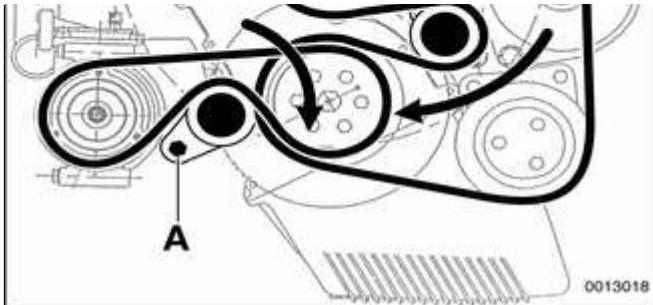
Note:

When belts are replaced with new ones, store the old set in the luggage compartment for emergency use.



◀ To remove drive belts:

- ◆ Use long-handled wrench to turn A/C belt tensioner release lug (A) clockwise (against spring tension). Remove A/C belt.



- ◆ Similarly, turn main engine drive belt tensioner lug (B) clockwise and remove belt.

WARNING!

Observe care when replacing belts. Personal injury could result if a tensioner springs back into position uncontrollably.

CAUTION!

Mark drive belt rotation direction if removing and reusing an old belt.

- When installing a new belt, gently pry it over the pulleys. Too much force may damage the belt or the accessory.

Idle speed

Engine idle speed can change due to a number of factors, including normal wear. The idle speed in E46 models is electronically adaptive and non-adjustable. See ⇒ [130 Fuel Injection](#) for more information.

Oxygen sensors

The engine management system in E46 models is equipped with multiple oxygen sensors. A regulating sensor is mounted before each catalytic converter and a monitoring sensor downstream of each converter. The regulating sensor monitors engine combustion efficiency and helps to control the fuel injection system and exhaust emissions. The monitoring sensor is used by the on-board diagnostic (OBD II) system to monitor the function of the catalytic converter.

OBD II enhanced emission standards require the engine control module (ECM) to monitor the oxygen content in the exhaust both before and after the catalytic converter. This allows for tighter control of the tail pipe emissions and also allows the ECM to diagnose converter problems. If the ECM detects that catalytic converter or oxygen sensor efficiency has degraded past a certain pre-programmed limit, it will turn on the Check Engine light, and store a diagnostic trouble code (DTC) in the ECM. See ⇒ [OBD On Board Diagnostics](#) in the rear of this manual for more information on OBD systems.

Replacement of oxygen sensors at the specified intervals ensures that the engine and emission control system will continue to operate as designed. Extending the replacement interval may void the emission control warranty coverage. See ⇒ [180 Exhaust System](#) for information on replacing the oxygen sensors.

Tightening torque

Oxygen sensor to exhaust manifold	50 Nm (37 ft-lb)
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Note:

A special socket for replacing the oxygen sensor is available from most automotive parts stores. The socket has a groove cut down one side to allow the sensor to be installed without damaging the wire harness.

Power steering fluid, checking level



To check power steering fluid level in fluid reservoir: