

BMW 3- & 5-Series Service and Repair Manual

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(1948-256-11AA3)

Models covered

3-Series (E30)

316 (83 to 88), 316i (88 to 91), 318i (83 to 91), 320i (87 to 91), 325i (87 to 91).

Also Touring and Convertible versions of these models

5-Series (E28)

518 (81 to 85), 518i (85 to 88), 525i (81 to 88), 528i (81 to 88), 535i (85 to 88), M535i (85 to 88)

5-Series (E34)

518i (90 to 91), 520i (88 to 91), 525i (88 to 91), 530i (88 to 91), 535i (88 to 91)

Engines covered

1596 cc, 1766 cc, 1795 cc, 1990 cc, 2494 cc, 2788 cc, 2986 cc & 3430 cc

Does not cover Diesel, dohc or V8 engines, or four-wheel-drive models

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Introduction to the BMW 3- and 5-Series

The E30 3-Series range first became available in the UK in March 1983, and continued in production until April 1991, when the revised E36 3-Series range (not covered by this manual) was introduced. Convertible and Touring (Estate) models were introduced for 1988, and these models have continued in E30 form to date.

The E28 5-Series models were introduced in October 1981, and were superseded in June 1988 by the revised E34 5-Series range, Touring versions of which became available from March 1992. Throughout this manual, E28 models are also referred to as "old-shape", while E34 models are designated "new-shape".

The models covered by this manual are equipped with single overhead cam in-line four- and six-cylinder engines. Early 316 and 518 models are fitted with carburettors, but all other models are fitted with fuel injection systems. Transmissions are a five-speed manual, or three- or four-speed automatic. The transmission is mounted to the back of the engine, and power is transmitted to the fully-independent rear axle through a two-piece propeller shaft. The final drive unit is bolted solidly to a frame crossmember, and drives the rear wheels through driveshafts

equipped with inner and outer constant velocity joints.

The front suspension is of MacPherson strut type, with the coil spring/shock absorber unit making up the upper suspension link. The rear suspension is made up of coil spring-over-shock absorber struts, or coil springs and conventional shock absorbers, depending on model.

The brakes are disc type at the front, with either drums or discs at the rear, depending on model. Servo assistance is standard on all models. Some later models are equipped with an Anti-lock Braking System (ABS).

All models are manufactured to fine limits, and live up to the BMW reputation of quality workmanship. Although many of the models covered by this manual appear complex at first sight, they should present no problems to the home mechanic.

Note for UK readers

The greater part of this manual was originally written in the USA. Some of the photographs used are of American-market models, but the procedures given are fully applicable to right-hand-drive models (or have been amended where necessary).

Acknowledgements

Thanks are due to Champion Spark Plug, who supplied the illustrations showing spark plug conditions. Thanks are also due to Sykes-Pickavant Limited, who provided some of the workshop tools, and to all those people at Sparkford who helped in the production of this manual. Technical writers who contributed to this project include Robert Maddox, Mark Ryan and Mike Stubblefield.

We take great pride in the accuracy of information given in this manual, but vehicle manufacturers make alterations and design changes during the production run of a particular vehicle of which they do not inform us. No liability can be accepted by the authors or publishers for loss, damage or injury caused by any errors in, or omissions from, the information given.

Project vehicles

The main project vehicle used in the preparation of this manual for the UK market was a 1988 BMW 318i with an M40/B18 engine.



BMW 320i Saloon (E30)



BMW 325i Touring (E30)



BMW 325i Convertible (E30)



BMW 518i (E28)



BMW 535i (E34)

Working on your car can be dangerous. This page shows just some of the potential risks and hazards, with the aim of creating a safety-conscious attitude.

General hazards

Scalding

- Don't remove the radiator or expansion tank cap while the engine is hot.
- Engine oil, automatic transmission fluid or power steering fluid may also be dangerously hot if the engine has recently been running.

Burning

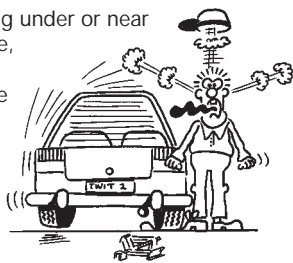
- Beware of burns from the exhaust system and from any part of the engine. Brake discs and drums can also be extremely hot immediately after use.

Crushing

- When working under or near a raised vehicle, always supplement the jack with axle stands, or use drive-on ramps.

Never venture under a car which is only supported by a jack.

- Take care if loosening or tightening high-torque nuts when the vehicle is on stands. Initial loosening and final tightening should be done with the wheels on the ground.

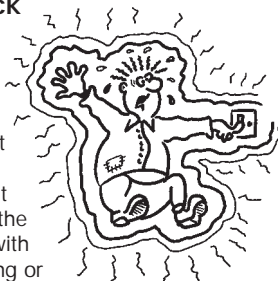


Fire

- Fuel is highly flammable; fuel vapour is explosive.
- Don't let fuel spill onto a hot engine.
- Do not smoke or allow naked lights (including pilot lights) anywhere near a vehicle being worked on. Also beware of creating sparks (electrically or by use of tools).
- Fuel vapour is heavier than air, so don't work on the fuel system with the vehicle over an inspection pit.
- Another cause of fire is an electrical overload or short-circuit. Take care when repairing or modifying the vehicle wiring.
- Keep a fire extinguisher handy, of a type suitable for use on fuel and electrical fires.

Electric shock

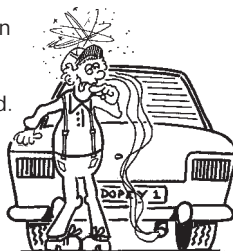
- Ignition HT voltage can be dangerous, especially to people with heart problems or a pacemaker. Don't work on or near the ignition system with the engine running or the ignition switched on.



- Mains voltage is also dangerous. Make sure that any mains-operated equipment is correctly earthed. Mains power points should be protected by a residual current device (RCD) circuit breaker.

Fume or gas intoxication

- Exhaust fumes are poisonous; they often contain carbon monoxide, which is rapidly fatal if inhaled. Never run the engine in a confined space such as a garage with the doors shut.
- Fuel vapour is also poisonous, as are the vapours from some cleaning solvents and paint thinners.



Poisonous or irritant substances

- Avoid skin contact with battery acid and with any fuel, fluid or lubricant, especially antifreeze, brake hydraulic fluid and Diesel fuel. Don't syphon them by mouth. If such a substance is swallowed or gets into the eyes, seek medical advice.
- Prolonged contact with used engine oil can cause skin cancer. Wear gloves or use a barrier cream if necessary. Change out of oil-soaked clothes and do not keep oily rags in your pocket.
- Air conditioning refrigerant forms a poisonous gas if exposed to a naked flame (including a cigarette). It can also cause skin burns on contact.

Asbestos

- Asbestos dust can cause cancer if inhaled or swallowed. Asbestos may be found in gaskets and in brake and clutch linings. When dealing with such components it is safest to assume that they contain asbestos.

Special hazards

Hydrofluoric acid

- This extremely corrosive acid is formed when certain types of synthetic rubber, found in some O-rings, oil seals, fuel hoses etc, are exposed to temperatures above 400°C. The rubber changes into a charred or sticky substance containing the acid. *Once formed, the acid remains dangerous for years. If it gets onto the skin, it may be necessary to amputate the limb concerned.*
- When dealing with a vehicle which has suffered a fire, or with components salvaged from such a vehicle, wear protective gloves and discard them after use.

The battery

- Batteries contain sulphuric acid, which attacks clothing, eyes and skin. Take care when topping-up or carrying the battery.
- The hydrogen gas given off by the battery is highly explosive. Never cause a spark or allow a naked light nearby. Be careful when connecting and disconnecting battery chargers or jump leads.

Air bags

- Air bags can cause injury if they go off accidentally. Take care when removing the steering wheel and/or facia. Special storage instructions may apply.

Diesel injection equipment

- Diesel injection pumps supply fuel at very high pressure. Take care when working on the fuel injectors and fuel pipes.



Warning: Never expose the hands, face or any other part of the body to injector spray; the fuel can penetrate the skin with potentially fatal results.

Remember...

DO

- Do use eye protection when using power tools, and when working under the vehicle.
- Do wear gloves or use barrier cream to protect your hands when necessary.
- Do get someone to check periodically that all is well when working alone on the vehicle.
- Do keep loose clothing and long hair well out of the way of moving mechanical parts.
- Do remove rings, wristwatch etc, before working on the vehicle – especially the electrical system.
- Do ensure that any lifting or jacking equipment has a safe working load rating adequate for the job.

DON'T

- Don't attempt to lift a heavy component which may be beyond your capability – get assistance.
- Don't rush to finish a job, or take unverified short cuts.
- Don't use ill-fitting tools which may slip and cause injury.
- Don't leave tools or parts lying around where someone can trip over them. Mop up oil and fuel spills at once.
- Don't allow children or pets to play in or near a vehicle being worked on.

Anti-theft audio system

General information

Some models are equipped with an audio system having an anti-theft feature that will render the stereo inoperative if stolen. If the power source to the stereo is cut, the stereo won't work even if the power source is immediately re-connected. If your vehicle is equipped with this anti-theft system, do not disconnect the battery or remove the stereo unless you have the individual code number for the stereo.

Refer to the owner's handbook supplied

with the vehicle for more complete information on this audio system and its anti-theft feature.

Unlocking procedure

1 Turn on the radio. The word "CODE" should appear on the display.

2 Using the station preset selector buttons, enter the five-digit code. If you make a mistake when entering the code, continue the five-digit sequence anyway. If you hear a "beep," however, stop immediately and

start the sequence over again. **Note:** *You have three attempts to enter the correct code. If the correct code isn't entered in three tries, you'll have to wait one hour, with the radio on, before you enter the codes again.*

5 Once the code has been entered correctly, the word "CODE" should disappear from the display, and the radio should play (you'll have to tune-in and enter your preset stations, however).

6 If you have lost your code number, contact a BMW dealer service department.

Instrument panel language display

On some later models, disconnecting the battery may cause the instrument panel display to default to the German language (this does not usually apply to UK models). If it is necessary to reset the correct language after the battery is reconnected, proceed as follows. With all the doors shut and the

ignition on (engine not running), press the trip reset button until the panel displays the desired language. There are eight languages available. If you wish to bypass a particular selection, release the reset button and press again - this will cause the display to advance to the next language. Once the correct

language has been selected, continue holding the reset button until the display reads "I.O. Version 2.0". Continue holding the button until it reads "H.P. Version 3.4", then release the button.

Jacking, towing and wheel changing

Jacking and wheel changing

The jack supplied with the vehicle should be used only for raising the vehicle when changing a tyre or placing axle stands under the frame.



Warning: *Never crawl under the vehicle or start the engine when this jack is being used as the only means of support.*

When changing a wheel, the vehicle should be on level ground, with the handbrake firmly applied, and the wheels chocked. Select reverse gear (manual transmission) or Park (automatic transmission). Prise off the hub cap (if equipped) using the tapered end of the wheel brace. Loosen the wheel bolts half a turn, leaving them in place until the wheel is raised off the ground.

Position the head of the jack under the side of the vehicle, making sure it engages with the

pocket made for this purpose (just behind the front wheel, or forward of the rear wheel). Engage the wheel brace handle and turn it clockwise until the wheel is raised off the ground. Unscrew the bolts, remove the wheel and fit the spare.

Refit the wheel bolts and tighten them finger-tight. Lower the vehicle by turning the wheel brace anti-clockwise. Remove the jack and tighten the bolts in a diagonal pattern to the torque listed in the Chapter 1 Specifications. If a torque wrench is not available, have the torque checked by a BMW dealer or tyre fitting specialist as soon as possible. Refit the hubcap.

Towing

Vehicles with manual transmission can be towed with all four wheels on the ground, if necessary. Automatic transmission-equipped vehicles can only be towed with all four

wheels on the ground providing that the speed does not exceed 35 mph and the distance is not over 50 miles, otherwise transmission damage can result. For preference, regardless of transmission type, the vehicle should be towed with the driven (rear) wheels off the ground.

Proper towing equipment, specifically designed for the purpose, should be used, and should be attached to the main structural members of the vehicle, not to the bumpers or bumper brackets. Sling-type towing equipment must **not** be used on these vehicles.

Safety is a major consideration while towing. The handbrake should be released, and the transmission should be in neutral. The steering must be unlocked (ignition switch turned to position "1"). Remember that power-assisted steering (where fitted) and the brake servo will not work with the engine switched off.

Jump starting

HAYNES HiNT

Jump starting will get you out of trouble, but you must correct whatever made the battery go flat in the first place. There are three possibilities:

- 1** The battery has been drained by repeated attempts to start, or by leaving the lights on.
- 2** The charging system is not working properly (alternator drivebelt slack or broken, alternator wiring fault or alternator itself faulty).
- 3** The battery itself is at fault (electrolyte low, or battery worn out).

When jump-starting a car using a booster battery, observe the following precautions:

- ✓ Before connecting the booster battery, make sure that the ignition is switched off.
- ✓ Ensure that all electrical equipment (lights, heater, wipers, etc) is switched off.

- ✓ Make sure that the booster battery is the same voltage as the discharged one in the vehicle.
- ✓ If the battery is being jump-started from the battery in another vehicle, the two vehicles **MUST NOT TOUCH** each other.
- ✓ Make sure that the transmission is in neutral (or PARK, in the case of automatic transmission).



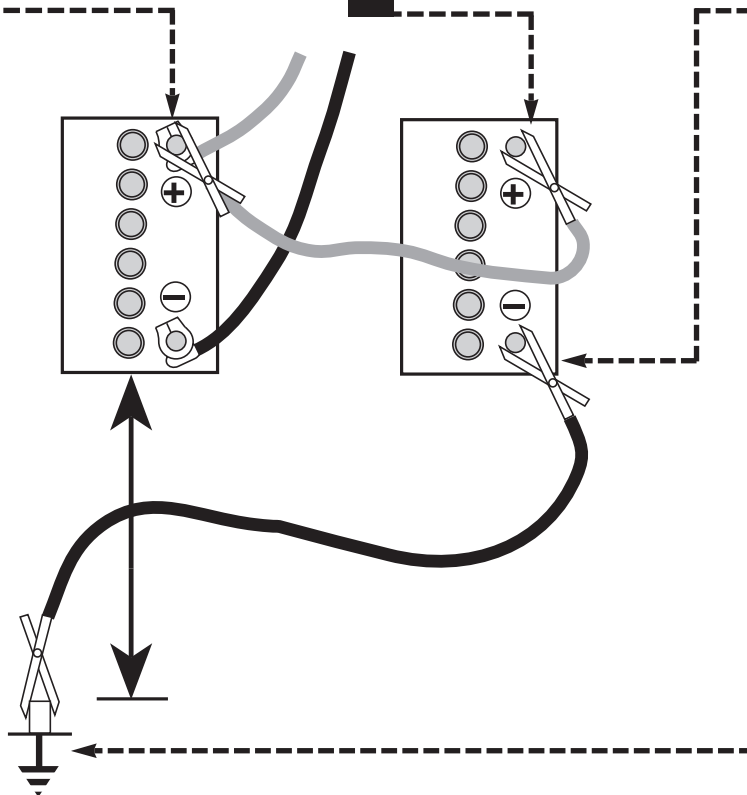
1 Connect one end of the red jump lead to the positive (+) terminal of the flat battery



2 Connect the other end of the red lead to the positive (+) terminal of the booster battery.



3 Connect one end of the black jump lead to the negative (-) terminal of the booster battery



4 Connect the other end of the black jump lead to a bolt or bracket on the engine block, well away from the battery, on the vehicle to be started.

5 Make sure that the jump leads will not come into contact with the fan, drivebelts or other moving parts of the engine.

6 Start the engine using the booster battery, then with the engine running at idle speed, disconnect the jump leads in the reverse order of connection.

Identifying leaks

Puddles on the garage floor or drive, or obvious wetness under the bonnet or underneath the car, suggest a leak that needs investigating. It can sometimes be difficult to decide where the leak is coming from, especially if the engine bay is very dirty already. Leaking oil or fluid can also be blown rearwards by the passage of air under the car, giving a false impression of where the problem lies.



Warning: Most automotive oils and fluids are poisonous. Wash them off skin, and change out of contaminated clothing, without delay.

HAYNES
HINT

The smell of a fluid leaking from the car may provide a clue to what's leaking. Some fluids are distinctively coloured. It may help to clean the car carefully and to park it over some clean paper overnight as an aid to locating the source of the leak.

Remember that some leaks may only occur while the engine is running.

Sump oil



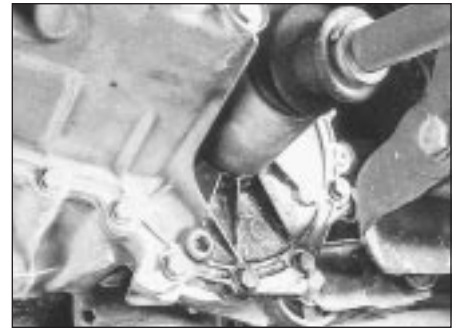
Engine oil may leak from the drain plug...

Oil from filter



...or from the base of the oil filter.

Gearbox oil



Gearbox oil can leak from the seals at the inboard ends of the driveshafts.

Antifreeze



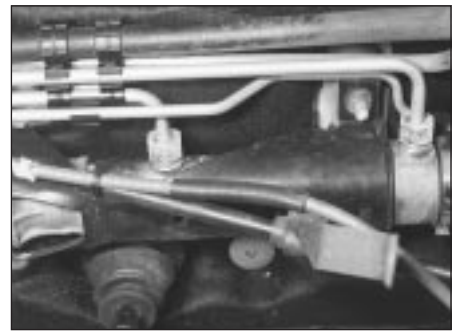
Leaking antifreeze often leaves a crystalline deposit like this.

Brake fluid



A leak occurring at a wheel is almost certainly brake fluid.

Power steering fluid



Power steering fluid may leak from the pipe connectors on the steering rack.

Chapter 1






Routine maintenance and servicing

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Fuel filter renewal	30		

1

Degrees of difficulty

Easy , suitable for novice with little experience 	Fairly easy , suitable for beginner with some experience 	Fairly difficult , suitable for competent DIY mechanic 	Difficult , suitable for experienced DIY mechanic 	Very difficult , suitable for expert DIY or professional 
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Specifications

Engine

Oil filter	
M10 engines	Champion C121
M20 engines	Champion C160
M30 engines	
3-Series	Champion C160
5-Series	Champion X115
M40 engines	Champion X120
Valve clearances (intake and exhaust)	
M10 engines	
Cold	0.20 mm
Hot	0.25 mm
M20 engines	
Cold	0.25 mm
Hot	0.30 mm
M30 engines	
Cold	0.30 mm
Hot	0.35 mm
M40 engines	Hydraulic adjusters

Cooling system

Antifreeze mixture	40% antifreeze/60% water
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Fuel system

Idle speed

3-Series, E30	
316 with M10/B18 engine	850 ± 50 rpm
316i with M40/B16 engine	800 ± 40 rpm
318i with M10/B18 engine (manual transmission)	850 ± 50 rpm
318i with M10/B18 engine (automatic transmission)	750 ± 50 rpm
318i with M40/B18 engine	800 ± 40 rpm
320i with M20/B20 engine (L-Jetronic)	800 ± 50 rpm
320i with M20/B20 engine (Motronic)	760 ± 40 rpm
325i with M20/B25 engine	760 ± 40 rpm
5-Series, E28 ("old-shape")	
518 and 518i with M10/B18 engine	800 ± 50 rpm
All other models	850 ± 50 rpm
5-Series, E34 ("new-shape")	
518i with M40/B18 engine	800 ± 40 rpm
520i with M20/B20M engine	760 ± 40 rpm
525i with M20/B25M engine	760 ± 40 rpm
530i with M30/B30M engine	800 ± 50 rpm
535i with M30/B35M engine	850 ± 50 rpm

CO% at 3000 rpm

3-Series, E30	
316 with M10/B18 engine	0.5 to 1.0
316i and 318i with M40/B16 engine	0.7 ± 0.5
318i with M10/B18 engine	1.0 maximum
320i with M20/B20 engine (L-Jetronic)	1.0 ± 0.5
320i with M20/B20 engine (Motronic)	0.7 ± 0.5
325i with M20/B25 engine	1.0 ± 0.5
5-Series, E28 ("old-shape")	
518 and 518i with M10/B18 engine	1.0 maximum
525i with M30/B25 engine	1.0 ± 0.5
528i with M30/B28 engine	1.5 maximum
535i with M30/B34 engine	0.3 to 1.5
M535i with M30/B34 engine	0.3 to 1.5
5-Series, E34 ("new-shape")	
All models	0.7 ± 0.5

Air filter element

M10 engines	Champion W155 (round) or U504 (square)
M20 engines	Champion U504 or U527
M30 engines	Champion U504 or U527
M40 engines	Champion U527
Fuel filter (all fuel injection engines)	Champion L206

Ignition system

Spark plug type

M10, M20 and M30 engines	Champion N9YCC
M40 engines	Champion C9YCC

Spark plug gap* 0.8 mm

Spark plug (HT) leads Champion type not available

* The spark plug gap quoted is that recommended by Champion for their specified plugs listed above. If spark plugs of any other type are to be fitted, refer to their manufacturer's spark plug gap recommendations.

Brakes

Disc brake pad thickness (minimum)	2.0 mm
Drum brake shoe lining thickness (minimum)	2.0 mm

Wiper blades

Windscreen

3-Series	Champion X-5103
3-Series passenger side from 1991	Champion X-5103 (20 inch) or Champion X-5303 (21 inch)
5-Series, E28 ("old-shape")	Champion X-4503
5-Series, E34 ("new-shape")	Champion type not available

Tailgate

3-Series	Champion X-4503
5-Series	Champion type not available

Tyre pressures (cold) - bars (psi)

	Front	Rear
3-Series, E30		
316	1.9 (28)	2.1 (30)
316i		
Saloon	2.0 (29)	2.1 (30)
Estate	2.0 (29)	2.2 (32)
318i	1.8 (26)	1.9 (28)
320i	1.9 (28)	2.0 (29)
325i	2.2 (32)	2.3 (33)
5-Series, E28 ("old-shape")		
518 and 518i	2.0 (29)	2.0 (29)
525i and 528i	2.2 (32)	2.2 (32)
535i and M535i	2.3 (33)	2.5 (36)
5-Series, E34 ("new-shape")		
518i	2.0 (29)	2.0 (29)
520i	2.2 (32)	2.1 (30)
525i, 530i and 535i	2.0 (29)	2.3 (33)

Torque wrench settings

	Nm
Automatic transmission sump bolts	
Three-speed	8 to 9
Four-speed	5 to 7
Spark plugs	
M10 engines	20 to 30
Except M10 engines	30 to 33
Oxygen sensor	30 to 33
Wheel bolts	100

Lubricants and fluids

Component or system

Component or system	Lubricant type/specification
Engine	Multigrade engine oil, viscositySAE 10W/40 to 20W/50, to API SG
Cooling system	Ethylene glycol-based antifreeze with corrosion inhibitors
Manual transmission*	Gear oil, viscosity SAE 80 to API-GL4, or single-grade mineral-based engine oil, viscosity SAE 20, 30 or 40 to API-SG
Automatic transmission	Dexron II type ATF
Final drive	BMW-approved hypoid gear oil, viscosity SAE 90**
Brake and clutch hydraulic systems	Hydraulic brake fluid to SAE J 1703 or DOT 4
Power steering	Dexron II type ATF

* E34 520i & 525i with air conditioning, E34 530i & 535i - Dexron II type ATF)

** Only available in bulk; refer to your BMW dealer

Capacities*

Engine oil		Manual transmission	
M10 engines	4.0 litres	ZF	1.2 litres
M20 engines	4.3 litres	Getrag	1.0 to 1.5 litres
M30 engines	5.8 litres	Automatic transmission (refill)	
M40 engines	4.0 litres	3-speed	2.0 litres
Cooling system		4-speed	3.0 litres
M10 engines	7.0 litres	Final drive capacity (drain and refill)	
M20 engines	10.5 litres	3-Series, E30	0.9 litres
M30 engines	12.0 litres	5-Series, E28 ("old-shape")	0.9 litres
M40 engines	7.0 litres	5-Series, E34 ("new-shape")	1.7 litres
Fuel tank		<i>*All capacities approximate</i>	
3-Series, E30			
Saloon	55 litres (early), 64 litres (later)		
Estate	63 litres (early), 70 litres (later)		
5-Series			
E28 ("old-shape")	70 litres		
E34 ("new-shape")	81 litres		

Maintenance schedule

The following maintenance intervals are based on the assumption that the vehicle owner will be doing the maintenance or service work, as opposed to having a dealer service department do the work. Although the time/mileage intervals are loosely based on factory recommendations, most have been shortened to ensure, for example, that such items as lubricants and fluids are checked/changed at intervals that promote maximum engine/driveline service life. Also, subject to the preference of the individual owner interested in keeping his or her vehicle in peak condition at all times, and with the vehicle's ultimate resale in mind, many of the maintenance procedures may be performed more often than recommended in the following schedule. We encourage such owner initiative.

When the vehicle is new, it should be serviced initially by a factory-authorised dealer service department, to protect the factory warranty. In many cases, the initial maintenance check is done at no cost to the owner (check with your dealer service department for more information).

Every 250 miles or weekly, whichever comes first

- Check the engine oil level (Section 4)
- Check the engine coolant level (Section 4)
- Check the brake fluid level (Section 4)
- Check the clutch fluid level (Section 4)
- Check the washer fluid level (Section 4)
- Check the tyres and tyre pressures (Section 5)

Every 6000 miles or 6 months, whichever comes first

All items listed above, plus:

- Change the engine oil and oil filter (Section 6)
- Check the power steering fluid level (Section 7)
- Check the tyres, and rotate if necessary (Section 9)
- Check the automatic transmission fluid level (Section 8)
- Check the underbonnet hoses (Section 10)
- Check/adjust the drivebelts (Section 11)
- Check engine idle speed and CO (Section 12)

Every 12 000 miles or 12 months, whichever comes first

All items listed above, plus:

- Check/service the battery (Section 13)
- Check the spark plugs (Section 14)
- Check/renew the HT leads, distributor cap and rotor (Section 15)
- Check/top-up the manual transmission lubricant (Section 16)
- Check the differential oil level (Section 17)
- Check the valve clearances, and adjust if necessary - does not apply to M40 engines (Section 18)
- Check and lubricate the throttle linkage (Section 19)
- Renew the air filter (Section 20)
- Check the fuel system (Section 21)
- Inspect the cooling system (Section 22)
- Inspect the exhaust system (Section 23)
- Inspect the steering and suspension components (Section 24)
- Check the driveshaft gaiter(s) (Section 25)
- Inspect the brakes (Section 26)
- Inspect/renew the windscreen wiper blades (Section 27)

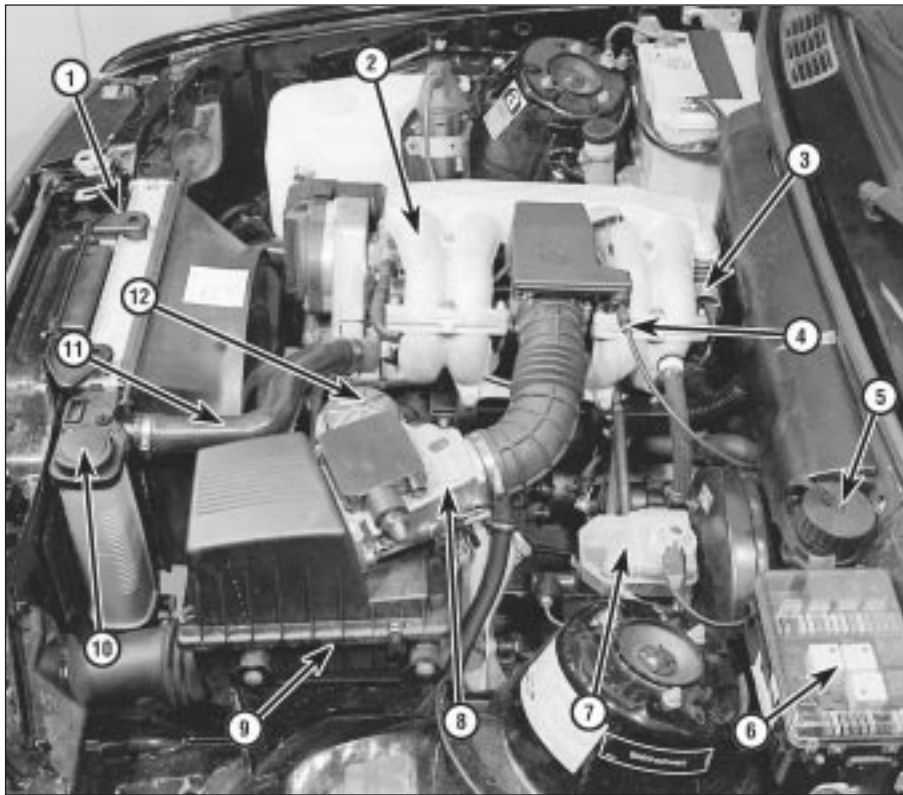
Every 24 000 miles or 2 years, whichever comes first

All items listed above plus:

- Change the automatic transmission fluid and filter (Section 28)
- Drain, flush and refill the cooling system (Section 29)
- Renew the spark plugs (Section 14)
- Check/renew the spark plug HT leads (Section 15)
- Renew the fuel filter (Section 30)
- Change the manual transmission lubricant (Section 31)
- Change the differential oil (Section 32)
- Check the evaporative emissions system, where applicable (Section 33)
- Reset the service indicator lights (Section 34)
- Renew brake fluid by bleeding (see Chapter 9)
- Check the handbrake operation (see Chapter 9)

Every 60 000 miles

- Renew the timing belt (Section 35)



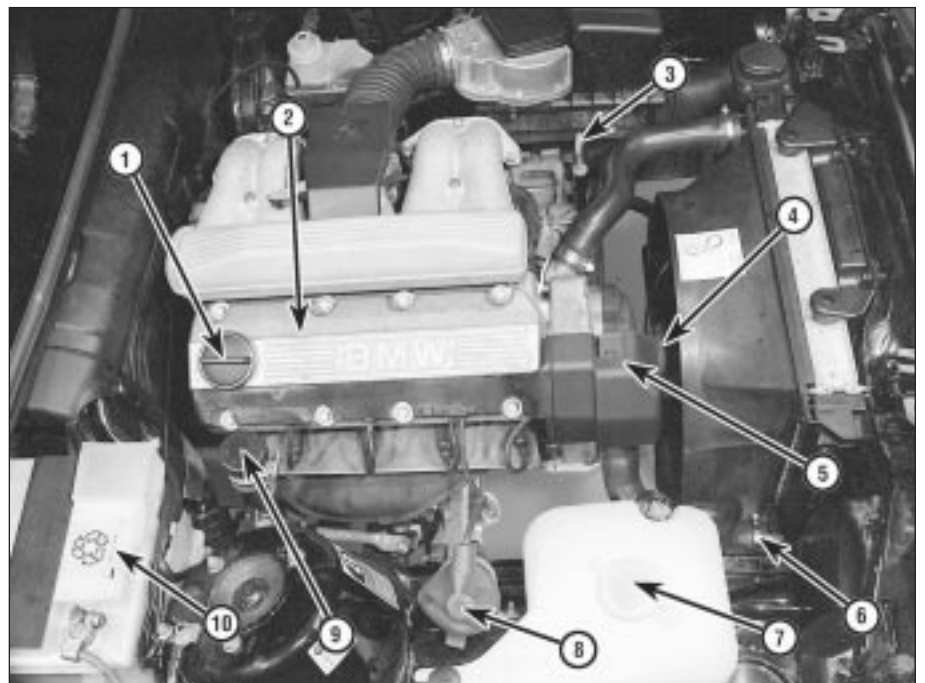
Underbonnet view (left-hand side) of a UK model 318i (1988)

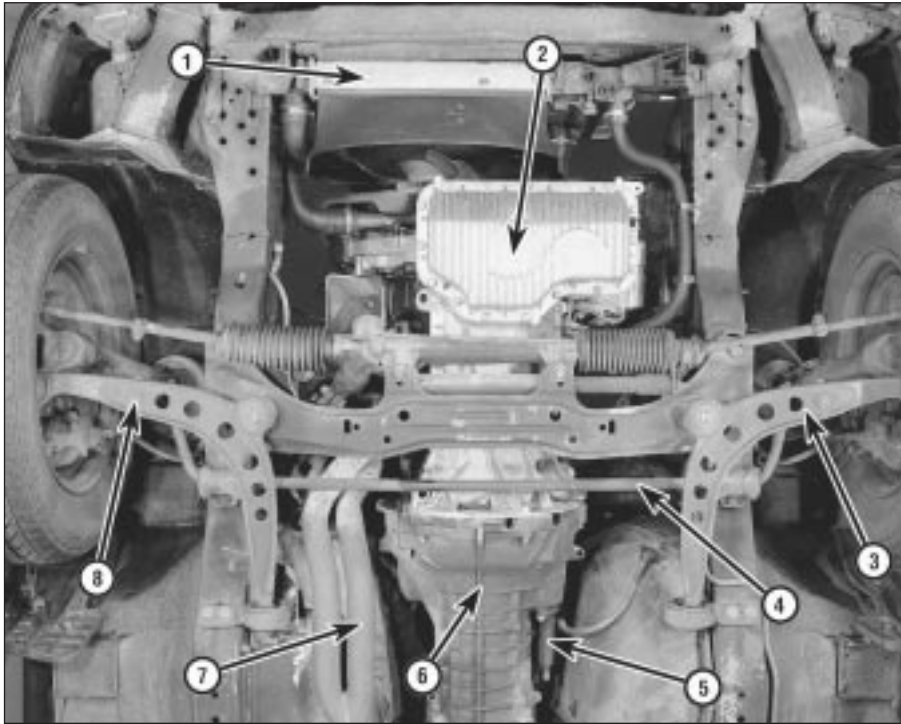
- 1 Radiator
- 2 Intake manifold
- 3 Idle control valve
- 4 Accelerator cable
- 5 Diagnostic/service indicator resetting socket
- 6 Fuse/relay box
- 7 Brake hydraulic fluid reservoir
- 8 Airflow meter
- 9 Air cleaner unit
- 10 Radiator filler cap
- 11 Radiator top hose
- 12 Oil filter housing

1

Underbonnet view (right-hand side) of a UK model 318i (1988)

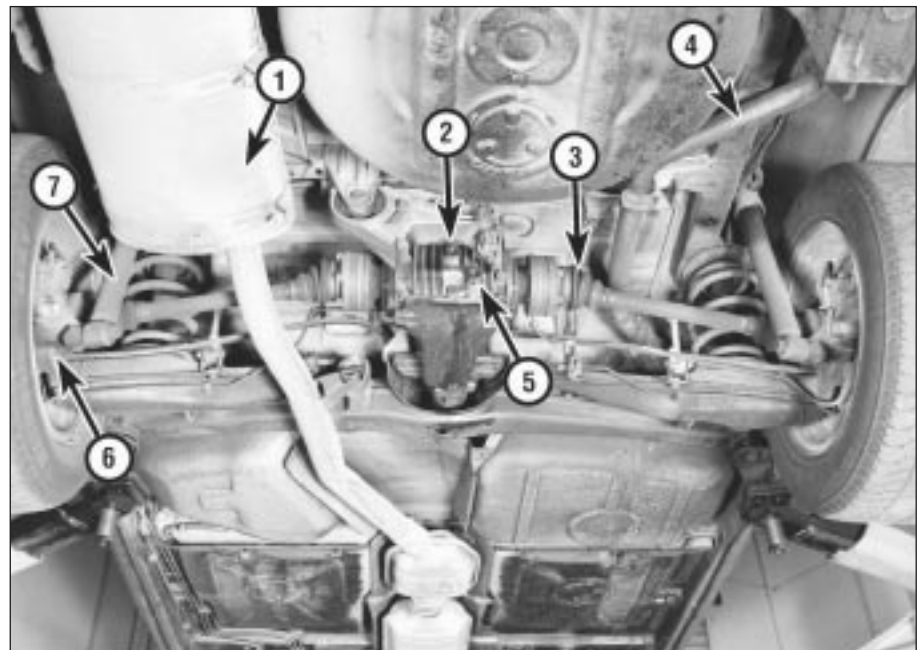
- 1 Oil filler cap
- 2 Valve cover
- 3 Engine oil filler dipstick
- 4 Viscous cooling fan
- 5 Distributor cap cover
- 6 Bottom hose
- 7 Windscreen washer fluid reservoir
- 8 Ignition coil
- 9 Clutch hydraulic fluid reservoir
- 10 Battery





Front underbody view of a UK model 318i (1988)

- 1 Radiator
- 2 Engine oil drain plug
- 3 Front suspension control arm (left-hand side)
- 4 Front anti-roll bar
- 5 Clutch slave cylinder
- 6 Transmission
- 7 Exhaust downpipe
- 8 Front suspension control arm (right-hand side)



Typical rear underside components

- 1 Exhaust system
- 2 Differential fill/check plug
- 3 Driveshaft boot
- 4 Fuel tank filler tube
- 5 Differential drain plug
- 6 Rear brake
- 7 Rear shock absorber

1 Introduction

This Chapter is designed to help the home mechanic maintain his or her vehicle with the goals of maximum performance, economy, safety and reliability in mind. Included is a master maintenance schedule, followed by procedures dealing specifically with each item on the schedule. Visual checks, adjustments, component renewal and other helpful items are included. Refer to the accompanying illustrations of the engine compartment and the underside of the vehicle for the locations of various components. Servicing the vehicle, in accordance with the mileage/time maintenance schedule and the step-by-step procedures, will result in a planned maintenance programme that should produce a long and reliable service life. Keep in mind that it is a comprehensive plan, so maintaining some items but not others at specified intervals, will not produce the same results.

2 Routine maintenance

As you service the vehicle, you will discover that many of the procedures can - and should - be grouped together, because of the nature of the particular procedure you're performing, or because of the close proximity of two otherwise-unrelated components to one another. For example, if the vehicle is raised for chassis lubrication, you should inspect the exhaust, suspension, steering and fuel

systems while you're under the vehicle. When the wheels are removed for other work, it makes good sense to check the brakes, since the wheels are already removed. Finally, let's suppose you have to borrow a torque wrench. Even if you only need it to tighten the spark plugs, you might as well check the torque of as many critical nuts and bolts as time allows.

The first step in this maintenance programme is to prepare yourself before the actual work begins. Read through all the procedures you're planning to do, then gather up all the parts and tools needed. If it looks like you might run into problems during a particular job, seek advice from a mechanic or an experienced do-it-yourselfer.

3 Engine "tune-up" - general information

The term "tune-up" is used in this manual to represent a combination of individual operations rather than one specific procedure.

If, from the time the vehicle is new, the routine maintenance schedule is followed closely, and frequent checks are made of fluid levels and high-wear items, as suggested throughout this manual, the engine will be kept in relatively good running condition, and the need for additional work will be minimised.

More likely than not, however, there will be times when the engine is running poorly due to a lack of regular maintenance. This is even more likely if a used vehicle, which has not received regular and frequent maintenance checks, is purchased. In such cases, an engine tune-up will be needed outside of the regular maintenance intervals.

The first step in any tune-up or diagnostic procedure to help correct a poor-running engine is a cylinder compression check. A compression check (see Chapter 2B) will help determine the condition of internal engine components, and should be used as a guide for tune-up and repair procedures. If, for instance, a compression check indicates serious internal engine wear, a conventional tune-up will not improve the performance of the engine, and would be a waste of time and money. Because of its importance, the compression check should be done by someone with the right equipment, and the knowledge to use it properly.

The following procedures are those most often needed to bring a generally poor-running engine back into a proper state of tune.

Minor tune-up

- Check all engine-related fluids (Section 4)
- Check all underbonnet hoses (Section 10)
- Check and adjust the drivebelts (Section 11)
- Clean, inspect and test the battery (Section 13)
- Renew the spark plugs (Section 14)
- Inspect the spark plug HT leads, distributor cap and rotor (Section 15)
- Check the air filter (Section 20)
- Check the cooling system (Section 22)

Major tune-up

- All items listed under minor tune-up, plus . . .*
- Check the ignition system (see Chapter 5)
 - Check the charging system (see Chapter 5)
 - Check the fuel system (see Chapter 4)
 - Renew the spark plug HT leads, distributor cap and rotor (Section 15)

Weekly checks

4 Fluid level checks



Note: The following are fluid level checks to be done on a 250-mile or weekly basis. Additional fluid level checks can be found in specific maintenance procedures which follow. Regardless of intervals, be alert to fluid leaks under the vehicle, which would indicate a fault to be corrected immediately.

1 Fluids are an essential part of the lubrication, cooling, brake and windscreen washer systems. Because the fluids gradually become depleted and/or contaminated during normal operation of the vehicle, they must be periodically replenished. See "Lubricants and fluids" at the beginning of this Chapter before adding fluid to any of the following components. **Note:** The vehicle must be on level ground when any fluid levels are checked.

Engine oil

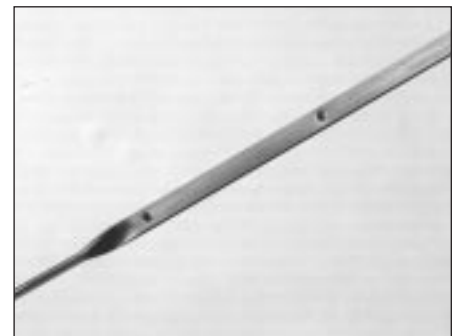
2 Engine oil is checked with a dipstick, which is located on the side of the engine (refer to the underbonnet illustrations in this Chapter for dipstick location). The dipstick extends through a metal tube down into the sump.

3 The engine oil should be checked before the vehicle has been driven, or at least 15 minutes after the engine has been shut off.

HAYNES
HINT *If the oil is checked immediately after driving the vehicle, some of the oil will remain in the upper part of the engine, resulting in an inaccurate reading on the dipstick.*

4 Pull the dipstick out of the tube, and wipe all of the oil away from the end with a clean rag or paper towel. Insert the clean dipstick all the way back into the tube, and pull it out again. Note the oil at the end of the dipstick. At its highest point, the oil should be between

the two notches or marks (see illustration).
5 It takes one litre of oil to raise the level from the lower mark to the upper mark on the dipstick. Do not allow the level to drop below the lower mark, or oil starvation may cause



4.4 The oil level should be kept between the two marks, preferably at or near the upper one - if it isn't, add enough oil to bring the level to the upper mark



4.6a The threaded oil filler cap is located in the valve cover - always make sure the area around the opening is clean before unscrewing the cap



4.6b Topping-up the engine oil



4.9a On some models, the expansion tank (coolant reservoir) is mounted on the radiator - make sure the level is kept at or near the FULL mark (arrowed)

engine damage. Conversely, overfilling the engine (adding oil above the upper mark) may cause oil-fouled spark plugs, oil leaks, or oil seal failures.

6 To add oil, remove the filler cap located on the valve cover (see illustrations). After adding oil, wait a few minutes to allow the level to stabilise, then pull the dipstick out and check the level again. Add more oil if required. Refit the filler cap, tightening it by hand only.

7 Checking the oil level is an important preventive maintenance step. A consistently low oil level indicates oil leakage through damaged seals or defective gaskets, or oil burning (internal leakage past worn rings or valve guides). The condition of the oil should also be noted. If the oil looks milky in colour or has water droplets in it, the cylinder head gasket may be blown, or the head or block may be cracked. The engine should be repaired immediately. Whenever you check the oil level, slide your thumb and index finger up the dipstick before wiping off the oil. If you see small dirt or metal particles clinging to the dipstick, the oil should be changed (see Section 6).

Engine coolant



Warning: Do not allow antifreeze to come in contact with your skin, or with the vehicle

paintwork. Rinse off spills immediately with plenty of water. Antifreeze is highly toxic if ingested. Never leave antifreeze lying around in an open container, or in puddles on the floor; children and pets are attracted by its sweet smell, and may drink it. Check with local authorities about disposing of used antifreeze. Local collection centres may exist, to see that antifreeze is disposed of safely.

8 All vehicles covered by this manual are equipped with a pressurised coolant recovery system. On most models, a white plastic expansion tank (or coolant reservoir) located in the engine compartment is connected by a hose to the radiator. As the engine heats up during operation, the expanding coolant fills the tank. As the engine cools, the coolant is automatically drawn back into the cooling system, to maintain the correct level.

9 The coolant level in the reservoir (see illustrations) should be checked regularly. Add a 40%/60% mixture of ethylene glycol-based antifreeze to water (see illustration).

Warning: Do not remove the expansion tank cap or radiator cap to check the coolant level, unless the engine is completely cold! The level in the reservoir varies with the temperature of the engine. When the engine is cold, the coolant level should be

above the LOW mark on the reservoir. Once the engine has warmed up, the level should be at or near the FULL mark. If it isn't, allow the engine to cool, then remove the cap from the reservoir.

10 Drive the vehicle and recheck the coolant level. If only a small amount of coolant is required to bring the system up to the proper level, plain water can be used. However, repeated additions of water will dilute the antifreeze. In order to maintain the proper ratio of antifreeze and water, always top-up the coolant level with the correct mixture.

11 If the coolant level drops consistently, there must be a leak in the system. Inspect the radiator, hoses, filler cap, drain plugs and water pump (see Section 29). If no leaks are noted, have the expansion tank cap or radiator cap pressure-tested by a BMW dealer.

12 If you have to remove the cap, wait until the engine has cooled completely, then wrap a thick cloth around the cap and turn it to the first stop. If coolant or steam escapes, let the engine cool down longer, then remove the cap.

13 Check the condition of the coolant as well. It should be relatively clear. If it's brown or rust-coloured, the system should be drained, flushed and refilled. Even if the coolant appears to be normal, the corrosion



4.9b On other models, the expansion tank (coolant reservoir) is located on the side of the engine compartment - remove the cap to add coolant



4.9c On some 5-Series models, the expansion tank (coolant reservoir) is located on the bulkhead



4.9d Adding antifreeze mixture



4.15 Adding hydraulic fluid to the clutch fluid reservoir

inhibitors wear out, so it must be renewed at the specified intervals.

Brake and clutch fluid



Warning: Brake fluid can harm your eyes and damage painted surfaces, so use extreme caution when handling or pouring it. Do not use brake fluid that has been standing open or is more than one year old. Brake fluid absorbs moisture from the air, which can cause a dangerous loss of brake effectiveness. Use only the specified type of brake fluid. Mixing different types (such as DOT 3 or 4 and DOT 5) can cause brake failure.

14 The brake master cylinder is mounted at the left rear corner of the engine compartment. The clutch fluid reservoir (manual transmission models) is mounted on the right-hand side.

15 To check the clutch fluid level, observe the level through the translucent reservoir. The level should be at or near the step moulded into the reservoir. If the level is low, remove the reservoir cap to add the specified fluid (see illustration).

16 The brake fluid level is checked by looking through the plastic reservoir mounted on the master cylinder (see illustration). The fluid level should be between the MAX and MIN lines on the reservoir. If the fluid level is low, first wipe the top of the reservoir and the cap with a clean rag, to prevent contamination of the system as the cap is unscrewed. Top-up with the recommended brake fluid, but do not overfill.

17 While the reservoir cap is off, check the master cylinder reservoir for contamination. If rust deposits, dirt particles or water droplets are present, the system should be drained and refilled.

18 After filling the reservoir to the proper level, make sure the cap is seated correctly, to prevent fluid leakage and/or contamination.

19 The fluid level in the master cylinder will drop slightly as the disc brake pads wear. There is no need to top up to compensate for this fall provided that the level stays above the MIN line; the level will rise again when new pads are fitted. A very low level may indicate



4.16 The brake fluid level should be kept above the MIN mark on the translucent reservoir - unscrew the cap to add fluid

worn brake pads. Check for wear (see Section 26).

20 If the brake fluid level drops consistently, check the entire system for leaks immediately. Examine all brake lines, hoses and connections, along with the calipers, wheel cylinders and master cylinder (see Section 26).

21 When checking the fluid level, if you discover one or both reservoirs empty or nearly empty, the brake or clutch hydraulic system should be checked for leaks and bled (see Chapters 8 and 9).

Windscreen washer fluid

22 Fluid for the windscreen washer system is stored in a plastic reservoir in the engine compartment (see illustration).

23 In milder climates, plain water can be used in the reservoir, but it should be kept no more than two-thirds full, to allow for expansion if the water freezes. In colder climates, use windscreen washer system antifreeze, available at any car accessory shop, to lower the freezing point of the fluid. This comes in concentrated or pre-mixed form. If you purchase concentrated antifreeze, mix the antifreeze with water in accordance with the manufacturer's directions on the container.



Caution: Do not use cooling system antifreeze - it will damage the vehicle's paint.



5.2 Use a tyre tread depth indicator to monitor tyre wear - they are available at car accessory shops and service stations, and cost very little



4.22 The windscreen washer fluid reservoir is located in the right front corner of the engine compartment on most models

5 Tyre and tyre pressure checks



1 Periodic inspection of the tyres may save you the inconvenience of being stranded with a flat tyre. It can also provide you with vital information regarding possible problems in the steering and suspension systems before major damage occurs.

2 Tyres are equipped with bands that will appear when tread depth reaches 1.6 mm, at which time the tyres can be considered worn out. This represents the legal minimum tread depth; most authorities recommend renewing any tyre on which the tread depth is 2 mm or less. Tread wear can be monitored with a simple, inexpensive device known as a tread depth indicator (see illustration).

3 Note any abnormal tyre wear (see illustration overleaf). Tread pattern irregularities such as cupping, flat spots and more wear on one side than the other are indications of front end alignment and/or wheel balance problems. If any of these conditions are noted, take the vehicle to a tyre specialist to correct the problem.

4 Look closely for cuts, punctures and embedded nails or tacks. Sometimes, after a nail has embedded itself in the tread, a tyre will hold air pressure for a short time, or may



5.4a If a slow puncture is suspected, check the valve core first to make sure it's tight

1.10 Weekly Checks

leak down very slowly. If a slow puncture persists, check the valve stem core to make sure it is tight (see illustration). Examine the tread for an object that may have embedded itself in the tyre, or for a previous repair that may have begun to leak. If a puncture is suspected, it can be easily verified by spraying a solution of soapy water onto the puncture (see illustration). The soapy solution will bubble if there is a leak. Unless the puncture is unusually large, a tyre specialist can usually repair the tyre.

5 Carefully inspect the inner sidewall of each tyre for evidence of brake fluid leakage. If you see any, inspect the brakes immediately.

6 Correct air pressure adds miles to the life span of the tyres, improves fuel economy, and enhances overall ride quality. A tyre pressure gauge is essential.



Keep an accurate gauge in the glove compartment. The pressure gauges attached to the nozzles of air hoses at service stations are often inaccurate.

7 Always check the tyre pressures when the tyres are cold (ie before driving the vehicle).



5.4b If the valve core is tight, raise the vehicle, and spray a soapy water solution onto the tread as the tyre is turned slowly - leaks will cause small bubbles to appear



5.8 To extend the life of the tyres, check the air pressure at least once a week with an accurate gauge (don't forget the spare!)

Checking the pressures when the tyres are warm, or hot, will result in higher readings, due to heat expansion. On no account should air be let out of the tyres in this case, or the tyres will effectively be under-inflated when cold.

8 Unscrew the valve cap protruding from the wheel or hubcap, and push the gauge firmly onto the valve stem (see illustration). Note the reading on the gauge, and compare the

figure to the recommended tyre pressures shown in the Specifications listed at the beginning of this Chapter. Be sure to refit the valve cap to keep dirt and moisture out of the valve stem mechanism. Check all four tyres and, if necessary, add enough air to bring them to the recommended pressure.

9 Don't forget to keep the spare tyre inflated to the specified pressure.

Tyre tread wear patterns



Shoulder Wear

Underinflation (wear on both sides)

Under-inflation will cause overheating of the tyre, because the tyre will flex too much, and the tread will not sit correctly on the road surface. This will cause a loss of grip and excessive wear, not to mention the danger of sudden tyre failure due to heat build-up.

Check and adjust pressures

Incorrect wheel camber (wear on one side)

Repair or renew suspension parts

Hard cornering

Reduce speed!



Centre Wear

Overinflation

Over-inflation will cause rapid wear of the centre part of the tyre tread, coupled with reduced grip, harsher ride, and the danger of shock damage occurring in the tyre casing.

Check and adjust pressures

If you sometimes have to inflate your car's tyres to the higher pressures specified for maximum load or sustained high speed, don't forget to reduce the pressures to normal afterwards.



Uneven Wear

Front tyres may wear unevenly as a result of wheel misalignment. Most tyre dealers and garages can check and adjust the wheel alignment (or "tracking") for a modest charge.

Incorrect camber or castor

Repair or renew suspension parts

Malfunctioning suspension

Repair or renew suspension parts

Unbalanced wheel

Balance tyres

Incorrect toe setting

Adjust front wheel alignment

Note: The feathered edge of the tread which typifies toe wear is best checked by feel.