

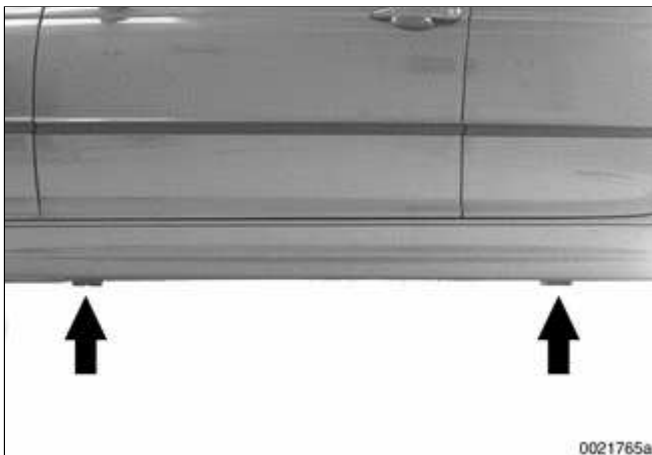
Getting Started

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***

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)

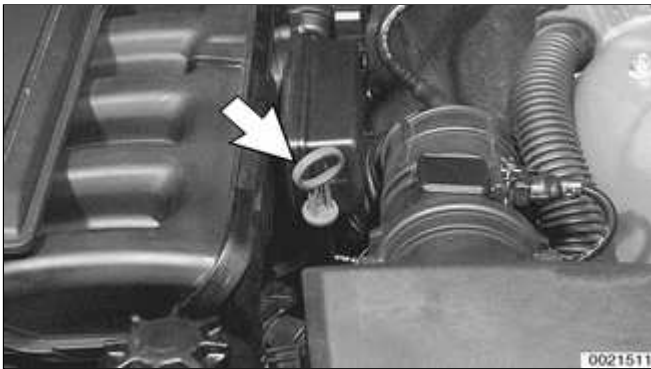
Bolt diameter	Bolt Class (according to DIN 267)					
	5.6	5.8	6.8	8.8	10.9	12.9
M5	2.5	3.5	4.5	6	8	10
M6	4.5	6	7.5	10	14	17
M8	11	15	18	24	34	40
M10	23	30	36	47	66	79
M12	39	52	62	82	115	140
M14	62	82	98	130	180	220
M16	94	126	150	200	280	340
M18	130	174	210	280	390	470

Gaskets and seals

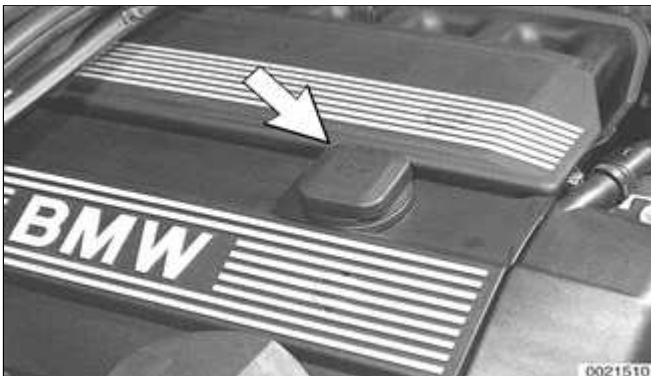
Gaskets are designed to crush and become thinner as the mating parts are bolted together. Once a gasket has been used, it is no longer capable of making as good a seal as when new, and is much more likely to leak. For this reason, gaskets should not be reused.

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



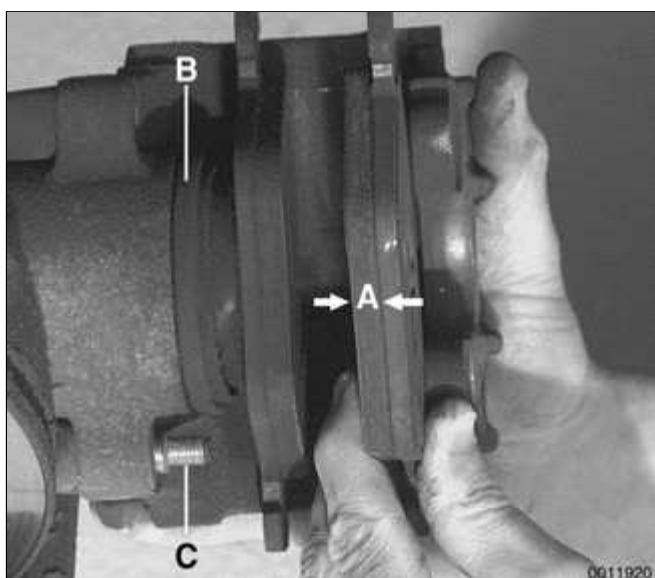
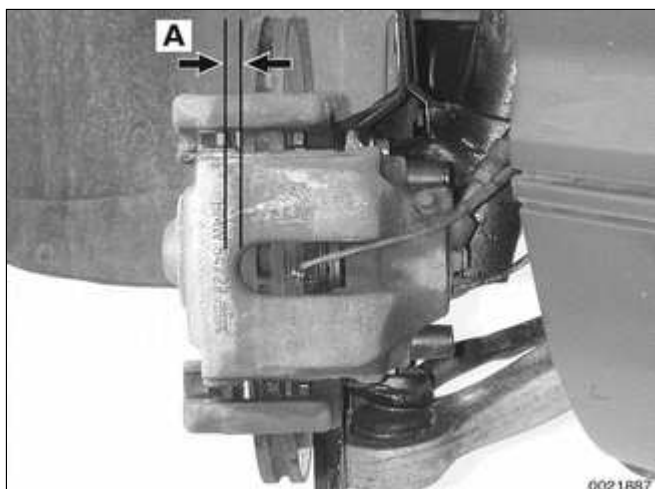
- ⚠ Engine oil level is checked with a dipstick (**arrow**) in engine block.
 - ◆ Check oil level with car on a level surface, after engine has been stopped for at least a few minutes.
 - ◆ Check level by pulling out dipstick and wiping it clean. Reinsert it all way and withdraw it again.
 - ◆ Oil level 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



- ✦ Disc brake pad wear can be checked through opening in caliper:
 - ◆ Measure distance (A) of brake pad "ear" to brake rotor. See ⇒ [340 Brakes](#). Compare to specification below.

- ✦ Unbolt caliper from steering arm to properly inspect:
 - ◆ Brake pad thickness (A)
 - ◆ Brake rotors
 - ◆ Condition of caliper seal (B)
 - ◆ Condition of caliper slider bolts (C)

Note:

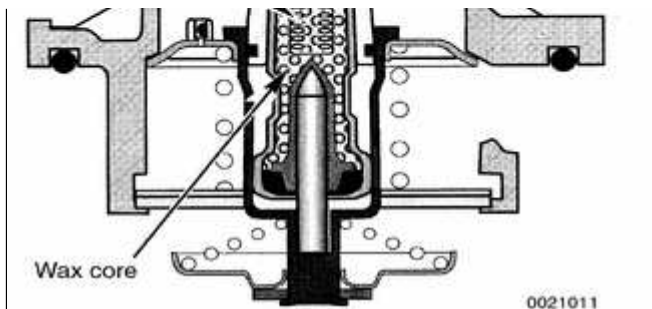
Brake caliper removal and installation procedures are given in ⇒ [340 Brakes](#).

Brake pad lining minimum thickness	
Front or rear pad Dimension A	3.0 mm (0.12 in.)

Brake system, inspecting

Routine maintenance of the brake system includes maintaining the brake fluid in the reservoir, checking brake pads for wear, checking parking brake function, and inspecting the system for fluid leaks or other damage:

BMW code	P-code	Fault type and function	Signal type and range	Explanation
				spring within motor throttle body.
110	P1542	Pedal sensor potentiometer 1	Input analog (0-5V)	Failed signal range check against predefined diagnostic limits.
111	P1542	Pedal Sensor Potentiometer 2	Input analog (0-5V)	Failed signal range check against predefined diagnostic limits.
112	P0120 MS 42	Motor throttle valve potentiometer 1	Input analog (0-5V)	Failed signal range check against predefined diagnostic limits.
	MS 43	Throttle position sensor 1	Input analog (0-5V)	Failed signal range check against predefined diagnostic limits.
113	P0120	Motor throttle valve potentiometer 2	Input analog (0-5V)	Failed signal range check against predefined diagnostic limits.
114	P1580 MS 42	Motor throttle valve final stage	DME internal test	Final stage inside DME (special H-bridge), will set internal flag whenever a short to ground, a short to battery voltage or a disconnection occurs.
	MS 43	A second pedal sensor range check failure is determined	DME internal values logical	If pedal sensor malfunction is determined, followed by a second malfunction, a signal is sent.
115	P1623 MS 42	Output voltage 5V for potentiometer operation 1	DME internal (5V)	Check for proper 5 volts supply to potentiometers is possible within a predefined voltage limit.
	MS 43	Range check for throttle position adaptation	Input analog (0-5V)	Range check for closed position of throttle sensors.
116	P1623	Output voltage for potentiometer operation 2	DME internal (5V)	Check for proper 5 volts supply to potentiometers is possible within a predefined voltage limit.



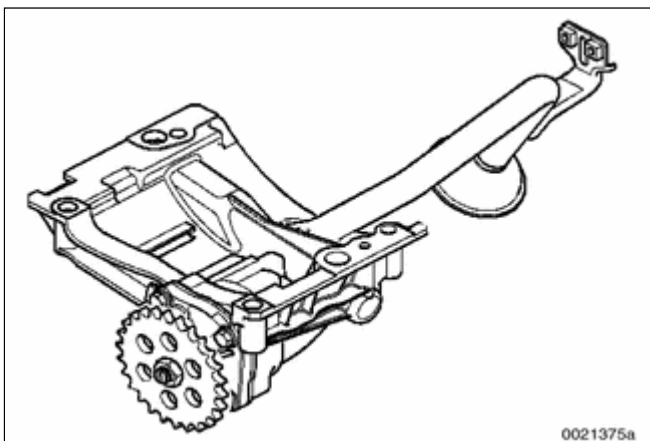
allows the engine to be operated at higher controlled temperatures during low and part throttle. This optimizes operating temperatures in both cylinder head and block, reduces friction and thereby fuel consumption.

The cooling system is designed to:

- ◆ Reduce operating temperatures of cylinder head. The result of lower temperatures is increased torque due to improved volumetric efficiency.
- ◆ Increase operating temperature of cylinder block.

Lubrication system

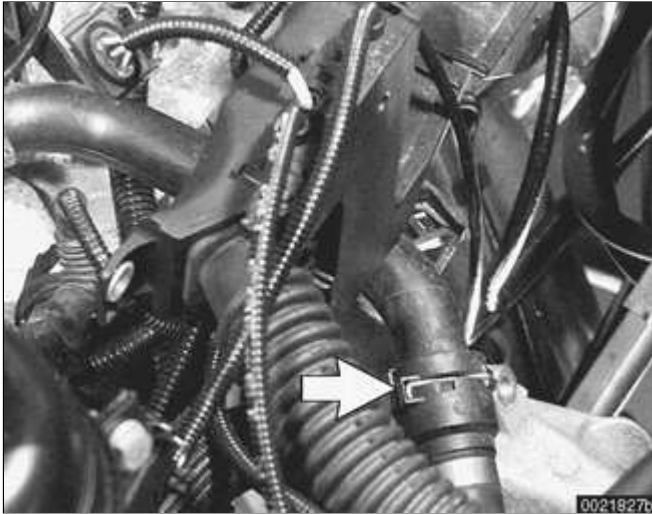
The lubrication system is pressurized whenever the engine is running. The oil pump draws oil through a pickup in the bottom of the oil pan, then forces it through a replaceable oil filter and into the engine oil passages.



- ◀ The chain-driven oil pump is bolted to the bottom of the cylinder block inside the oil pan. A pressure relief valve limits the maximum system pressure. A bypass valve prevents the oil filter from bursting and insures engine lubrication should the filter become plugged. See ⇒ [119 Lubrication System](#) for additional information.

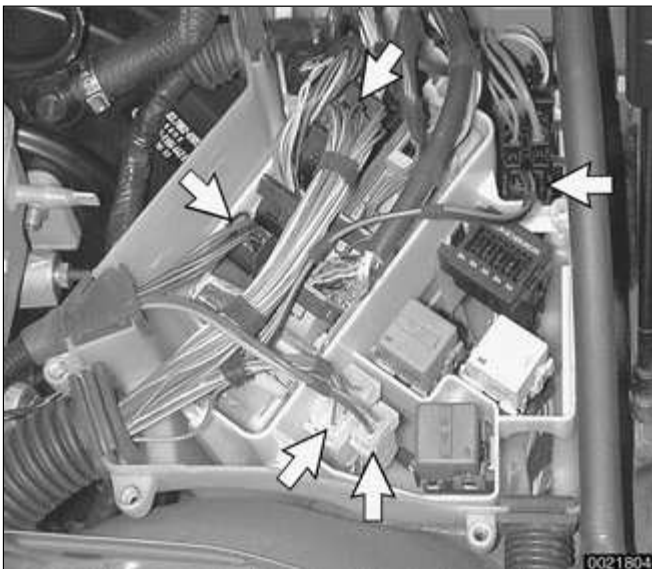
Resonance/turbulence intake system

The intake manifold, made of molded plastic, is configured as two sets of three runners. This design enhances low end



- ✦ Detach coolant hose at front left side of engine by engine mount by releasing lock (**arrow**).

- Unbolt power steering fluid reservoir and pull aside without detaching hoses. Tie to fender with cord or stiff wire.



- ✦ Working at E-box at left rear of engine compartment:

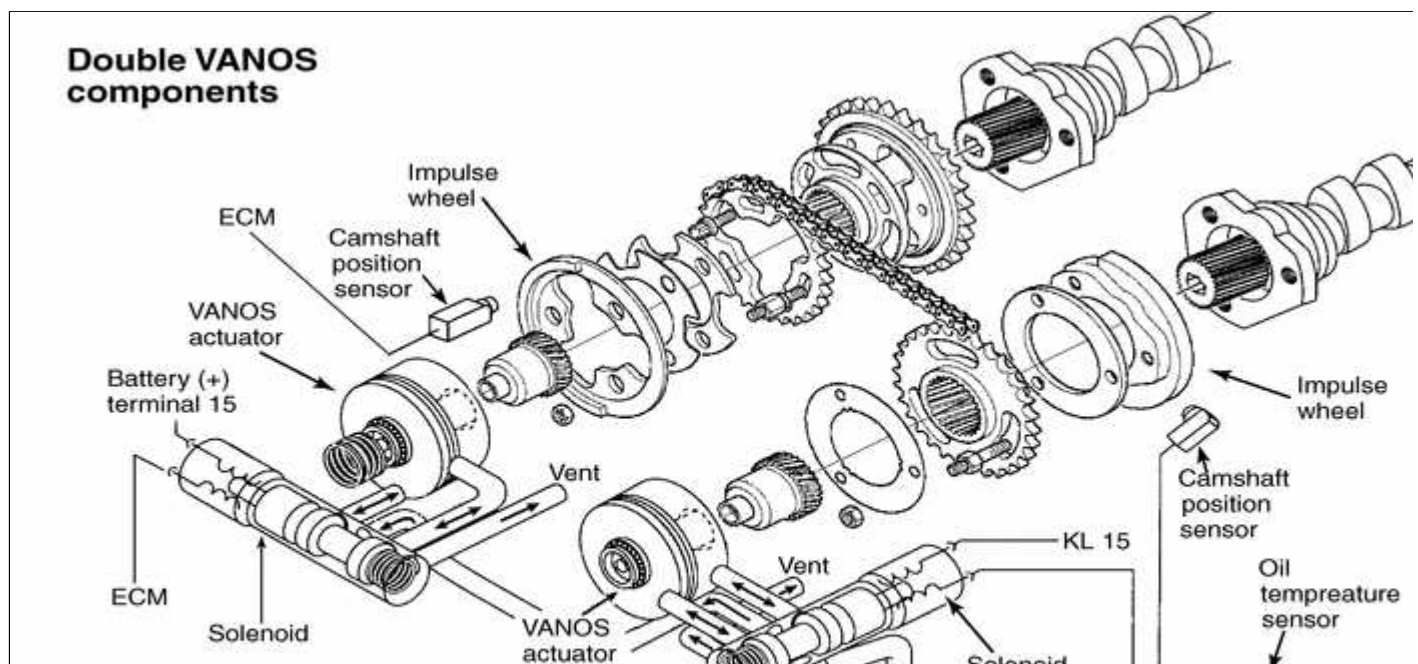
- ◆ Detach engine electrical harness connectors (**arrows**).
- ◆ Lift off harness looms and lay over engine.
- Remove poly-ribbed drive belts. Mark belt direction of rotation if belts will be reused. See ⇒ [020 Maintenance](#).
- All wheel drive models: Remove front axle differential and output shaft bearing pedestal. See ⇒ [311 Front Axle Final Drive](#).
- Remove transmission from car. See ⇒ [230 Manual Transmission](#) or ⇒ [240 Automatic Transmission](#).

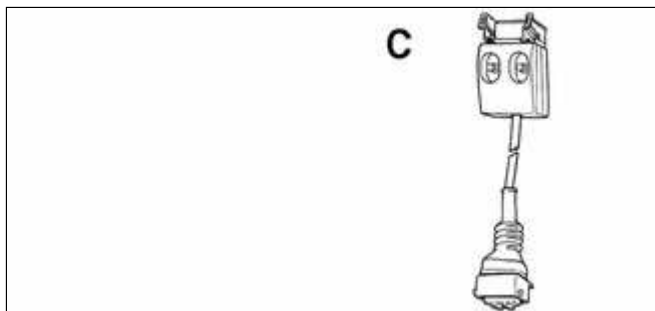
Note:

Detach automatic transmission cooler lines from radiator, remove brackets holding lines to side of engine, and store lines in a clean environment.

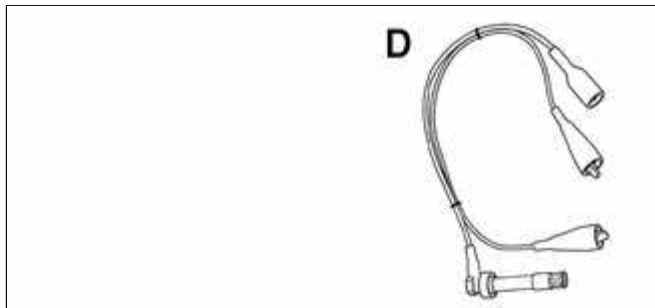
BMW code	P-code	Fault description
19	P1529	VANOS solenoid valve activation, exhaust
21	P1525	VANOS solenoid valve activation, intake
103	P1519	VANOS faulty reference value intake
104	P1520	VANOS faulty reference value exhaust
105	P1522	VANOS stuck (Bank 1) intake
106	P1523	VANOS stuck (Bank 2) exhaust

Double VANOS components

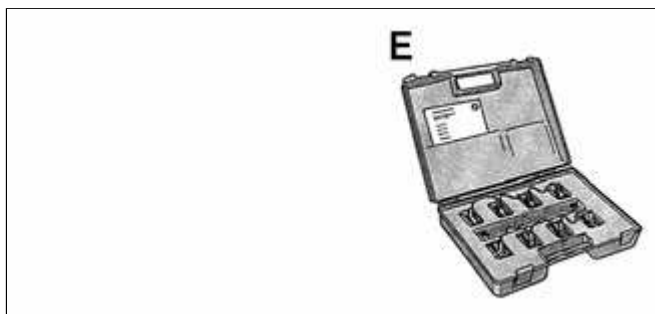




- ▶ Primary voltage test harness BMW 12 7 020



- ▶ Secondary voltage test harness BMW 12 7 030

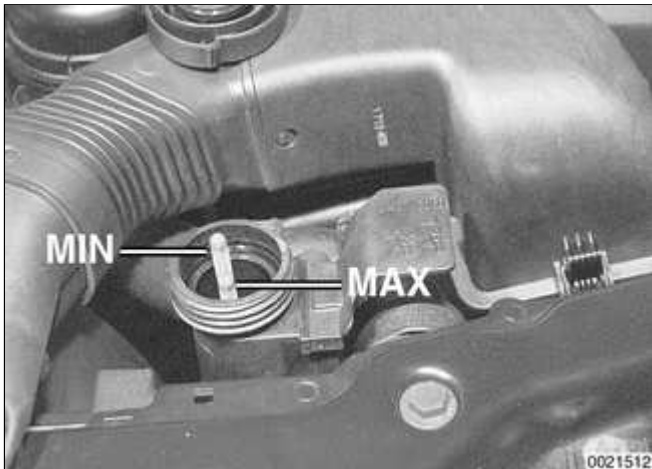


- ▶ Ignition coil test adapters BMW 12 7 040

Engine management

BMW E46 engines use an advanced engine management system known as Digital Motor Electronics (DME). DME incorporates on-board diagnostics, fuel injection, ignition and other engine control functions. DME variants are listed in ⇒ [Table a](#).

Second generation On-Board Diagnostics (OBD II) is incorporated into the engine management systems used on the cars covered by this manual. Using a BMW-specific electronic scan tool, it is possible to access Diagnostic Trouble Codes (DTCs) that pinpoint ignition and other engine management problems.



- Slowly add coolant until it spills from bleed screw. When coolant spilling from bleed screws is free of air bubbles, tighten screw.

- Run engine until it reaches operating temperature.
 - ◆ After engine has cooled, recheck coolant level.
 - ◆ Top up so that coolant level indicator is at MAX.

CAUTION!

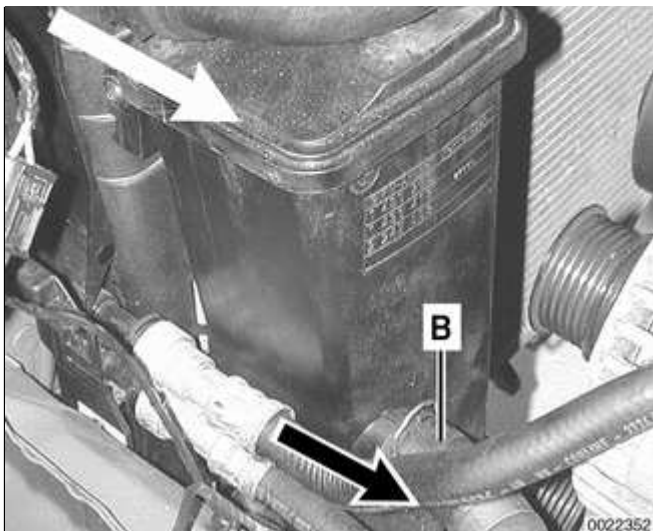
Always use genuine BMW coolant or its equivalent to avoid the formation of harmful, clogging deposits in the cooling system. Use of other antifreeze solutions may be harmful to the cooling system.

Tightening torque	
Radiator bleed screw	2.5 Nm (22 in-lb)

Viscous clutch cooling fan, replacing (models with automatic transmission)

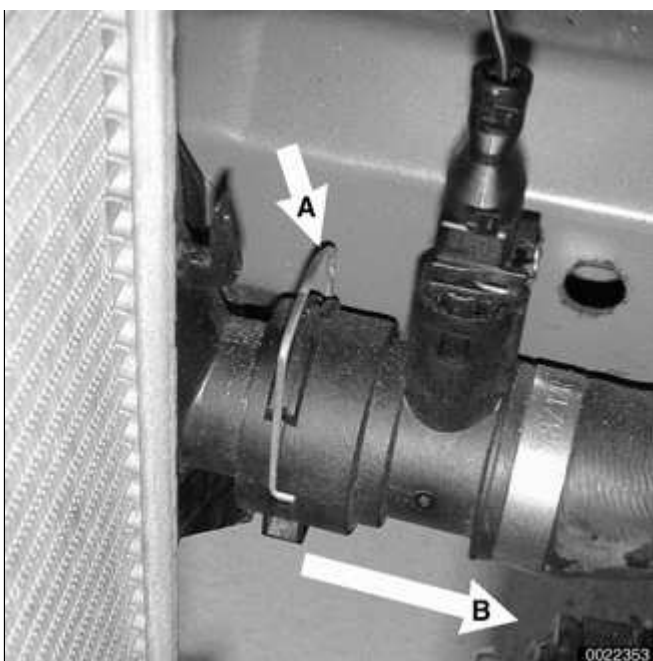


- To gain access to viscous clutch fan or electric fan at front of the engine:
 - ◆ Remove expansion rivets (**arrows**) and remove intake duct.



- Working on ride side of radiator, release hose retaining clips (**A**) and disconnect lower coolant hose fitting from radiator (**B**).

- Working underneath radiator, disconnect harness connector from coolant level sensor.

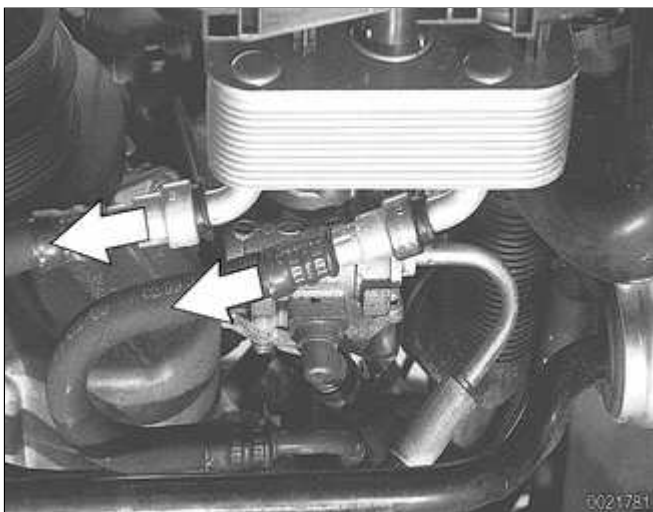


- Where applicable, disconnect automatic transmission fluid (ATF) cooler lines from ATF cooler at quick disconnect unions (**arrows**) as follows:

- ◆ Push hose toward oil cooler.
- ◆ Press black locking ring into hose fitting while pulling hose off cooler.

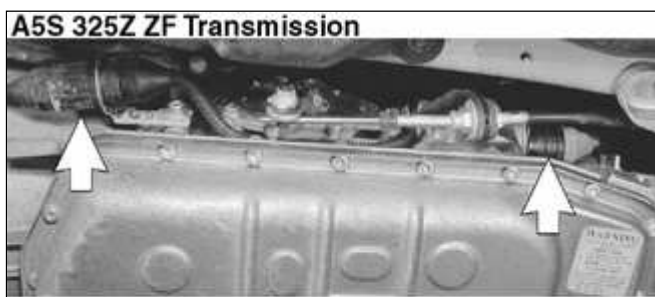
CAUTION!

Be sure to have a drain pan ready to catch spilled ATF.



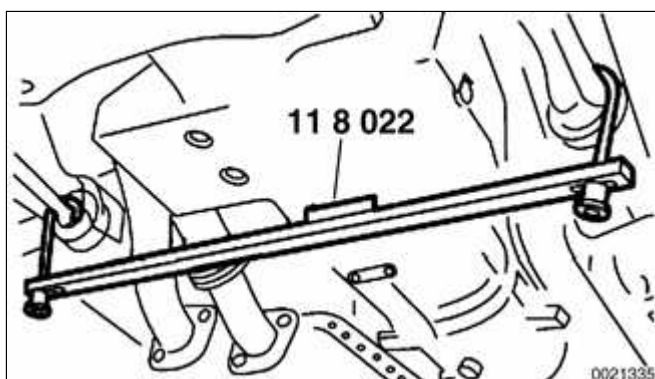


remove cable from bracket. (A5S 325Z transmission shown.)



- ▲ Disconnect electrical harness connector(s) from transmission by turning bayonet lock ring(s) (**arrows**) counterclockwise.
 - ◆ On A5S 325Z disconnect two connectors on the left side of the transmission.
 - ◆ On A5S 360R / A5S 390R disconnect the harness connector at the right rear of the transmission.
 - ◆ Remove wiring harness(s) from transmission housing.

- Disconnect transmission cooler line clamps from engine. Disconnect cooler lines from transmission.



- ▲ Attach BMW special tool 11 8 022 to lower control arms.
 - Support transmission with transmission jack. Remove transmission support crossmember.
 - Lower transmission until engine cylinder head touches firewall. Tighten knurled screws of BMW special tool 11 8 022 until tool supports engine oil pan securely.

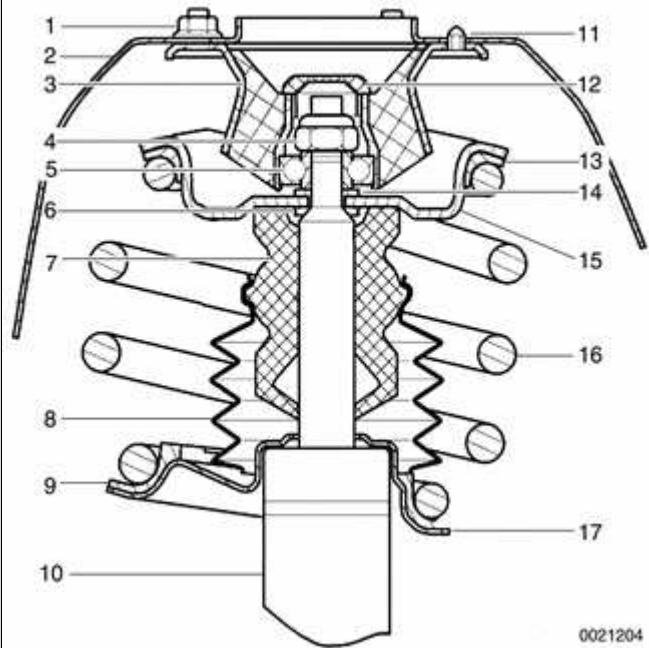


- ▲ Remove access plug in cover plate on right side of engine block and remove torque converter bolts. Turn crankshaft to access bolts.



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Front strut top mount assembly (rear wheel drive models)



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Assembly is reverse of disassembly, noting the following:

- ◆ Line up slot in spring pad with corresponding slot in lower spring seat.
- ◆ Use a new upper strut self locking nut. Tighten nut fully before releasing spring compressor.
- ◆ Be sure upper spring pad is correctly installed to upper spring seat and spring end is correctly seated in upper and lower spring seats.
- ◆ Release spring compressor carefully and evenly, allowing spring to expand slowly.
- ◆ Have car professionally aligned when job is complete.

1 - Self locking nut M8 -tighten to: 24 Nm (18 ft-lb) (18 mm flange) 34 Nm (25 ft-lb) (21 mm flange)

2 - Strut tower

3 - Upper strut mount

4 - Upper strut self locking nut M14 -tighten to 64 Nm (47 ft-lb)

5 - Upper strut bearing

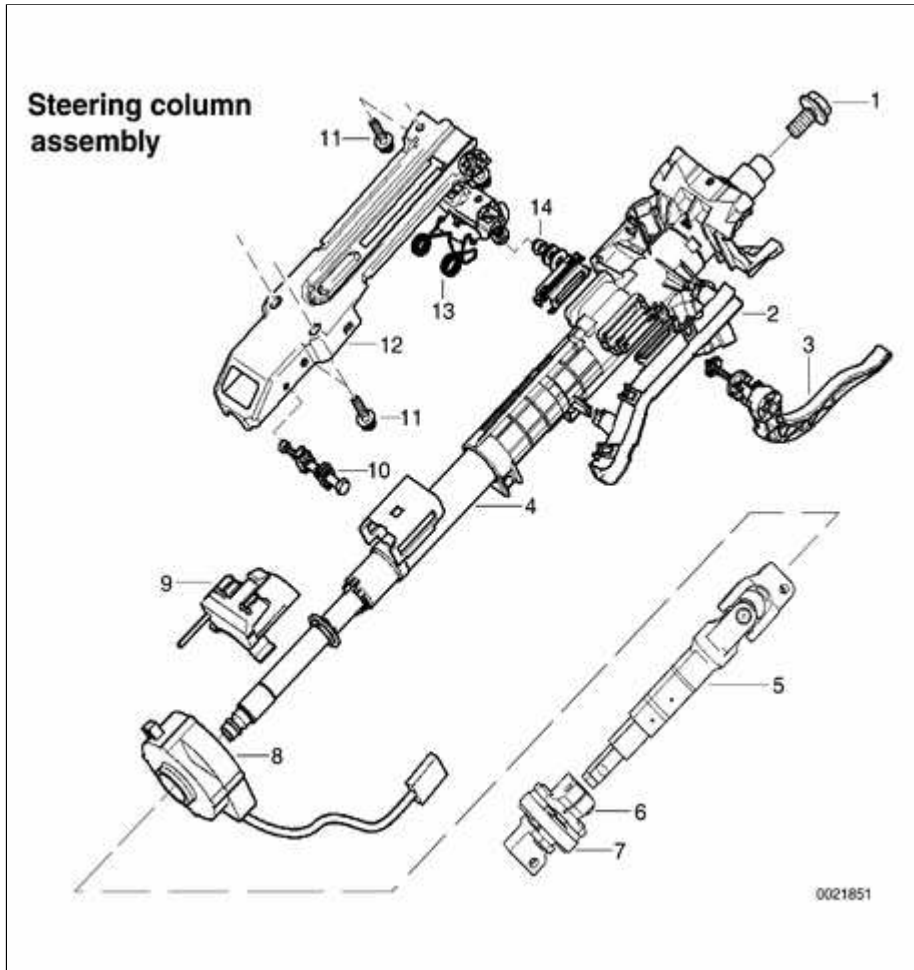
6 - Sealing ring

7 - Rubber bump-stop

8 - Dust shield

9 - Lower spring pad

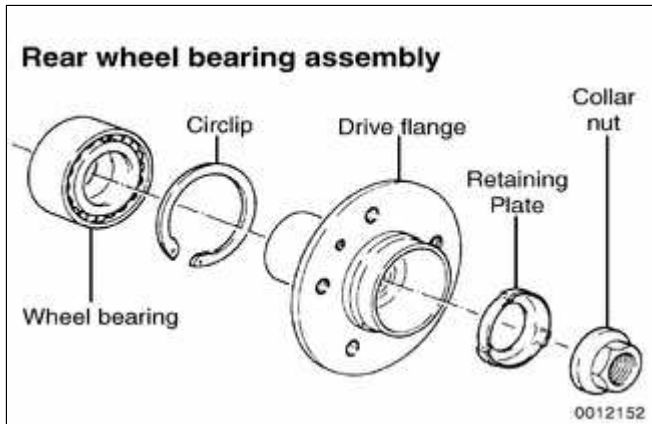
Steering Column



Steering column assembly

- 1 - Hex bolt (M14 x 1.5)
- ◆ tighten to 63 Nm (46 ft-lb)
- 2 - Cable duct
- 3 - Steering column adjustment lever
- 4 - Upper steering column
- 5 - Lower steering column with universal joint
- 6 - Torx bolt (M8 x 33)
- ◆ tighten to 22 Nm (16 ft-lb)
- 7 - Flexible joint (guibo)
- 8 - Steering angle sensor
- 9 - Steering angle sensor bracket
- 10 - Column pivot bushing
- 11 - Bolt (M8 x 36)

Rear Wheel Bearings



- ✦ The rear wheel bearing is a unitized assembly and is not repairable separately.

Special press tools, to be used with the trailing arm attached to the car, are required to replace a wheel bearing. Read the procedure through before beginning the job.

Rear wheel bearing, replacing

- Remove drive axle as described in ⇒ [331 Rear Axle Final Drive](#).

WARNING!

Make sure that the car is firmly supported on jack stands designed for the purpose. Place the jack stands beneath a structural chassis point. Do not place jack stands under suspension parts.

- Right side: Detach brake pad sensor connector at brake caliper.
- Remove brake caliper assembly and rotor as described in ⇒ [340 Brakes](#). Leave brake hose connected to caliper. Suspend caliper assembly from chassis using stiff wire.

- ✦ Remove ABS pulse sensor at trailing arm.

