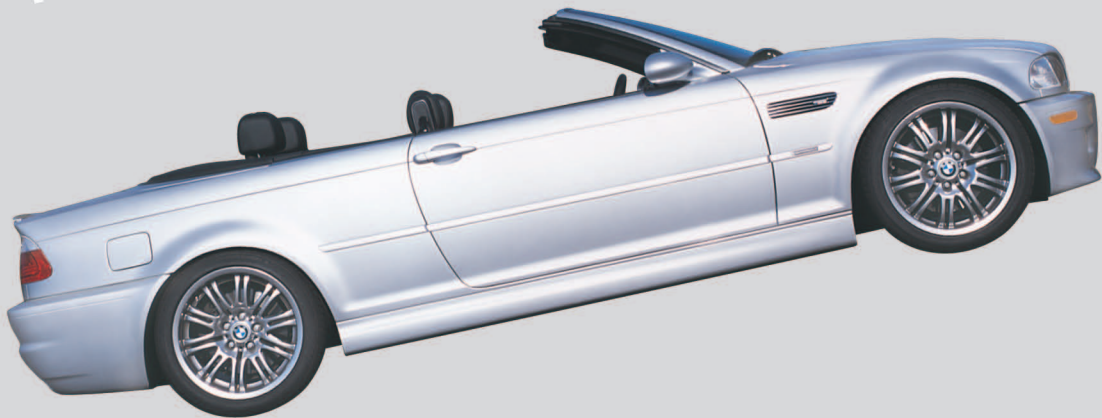


# BMW 3 Series

## 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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**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.

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

Assenmacher 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".

***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**



- ◆ Park car on level ground with engine off.
- ◆ Level is correct if it is between **MIN** and **MAX** marks on dipstick.
- ◆ If level is below **MIN** mark, start engine and add fluid to reservoir to bring level up.
- ◆ Stop engine and recheck level.
- ◆ Hand-tighten reservoir cap.

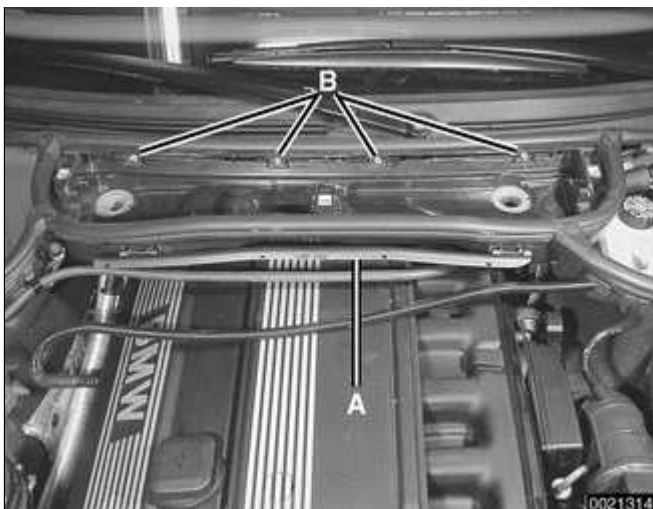
#### Power steering fluid

Recommended fluid	Dexron III® ATF
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### Spark plugs, replacing

E46 engines use a "coil-over" configuration, with one ignition coil above each spark plug.

- ✦ Remove microfilter housing:
  - ◆ Remove microfilter for interior ventilation. See ⇒ [Ventilation microfilter, replacing](#)
  - ◆ Open wiring harness loom (**A**), remove harness and lay aside.
  - ◆ Unfasten screws (**B**) and take off lower microfilter housing.
- ✦ Remove engine cover over ignition coils:
  - ◆ Remove oil filler cap.



the driver's seat. A protective cover must be removed to access the filter.



- ✦ Fuel filter for M52 TU engine is shown in illustration.



- ✦ E46 cars with M54 engine are equipped with a fuel filter that has a built in fuel pressure regulator.
  - Disconnect battery negative (-) cable.
  - Drain fuel filter from inlet side into a container and inspect drained fuel. Check for rust, moisture and contamination.
  - When replacing fuel filter:
    - ◆ Clamp filter inlet and outlet hoses to lessen fuel spillage.
    - ◆ Loosen center clamping bracket and hose clamps on either end of filter.
    - ◆ Note arrow or markings indicating direction of flow on new filter.
    - ◆ Install new filter using new hose clamps.

***WARNING!***

***Fuel will be expelled when the filter***

*reset using the special scan tool.  
Removing the connector from the  
ECM or disconnecting the battery  
will not erase the fault memory.*

The extra hardware needed to operate the OBD II system consists mainly of the following:

- ◆ Additional oxygen sensors downstream of the catalytic converters
- ◆ Fuel tank pressure sensor and device to pressurize fuel storage system
- ◆ Several engine and performance monitoring devices
- ◆ Standardized 16-pin OBD II connector under the dash
- ◆ Upgraded components for the federally required 100,000 mile or 10 year reliability mandate

## Malfunction Indicator Light (MIL)

- ✦ The OBD II system is designed to illuminate the Malfunction Indicator Light (MIL) when emission levels exceed 1.5 times the Federal standards.

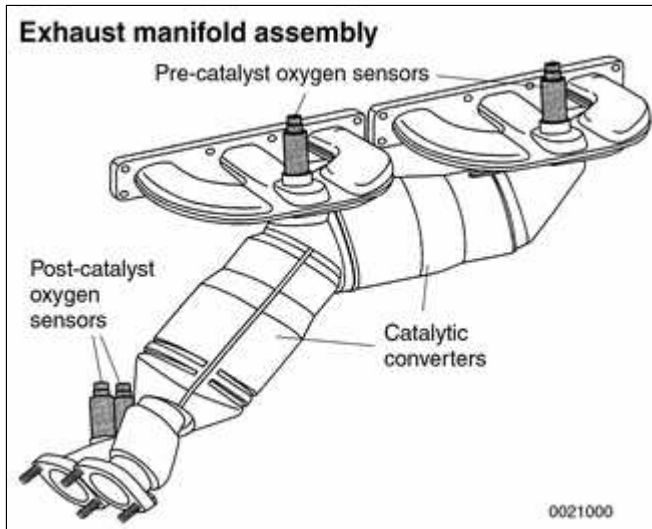
### **Note:**

*On model year 1999 and 2000 cars, the MIL is labeled Check Engine. On model year 2001 cars, the MIL is labeled Service Engine Soon.*



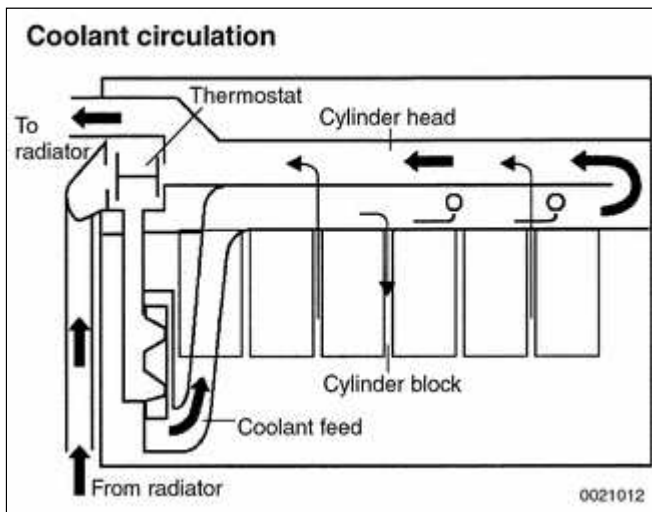
<b>BMW code</b>	<b>P-code</b>	<b>Fault type and function</b>	<b>Signal type and range</b>	<b>Explanation</b>
23	P0206	Injector circuit cyl. 6	Output digital pulse width (active low)	DME final stage will set flag whenever a short to ground, a short to battery voltage or a disconnection between output transistor and component exists.
24	P0204	Injector circuit cyl. 4	Output digital pulse width (active low)	DME final stage will set flag whenever a short to ground, a short to battery voltage or a disconnection between output transistor and component exists.
25	P0135	Oxygen sensor heater pre-cat (Bank1)	Output digital pulse width (active low)	DME final stage will set flag whenever a short to ground, a short to battery voltage or a disconnection between output transistor and component exists.
27	P1550	Idle control valve closing coil	Output digital pulse width (active low)	DME final stage will set flag whenever a short to ground, a short to battery voltage or a disconnection between output transistor and component exists.
29		Ignition coil cyl.1	Input analog timing (100 mV)	DME initiates secondary ignition for each cylinder then looks for feedback through shunt resistor in harness to determine if ignition actually occurred.
30		Ignition coil cyl.3	Input analog timing (100 mV)	DME initiates secondary ignition for each cylinder then looks for feedback through shunt resistor in harness to determine if ignition actually occurred.
31		Ignition coil cyl.5	Input analog timing (100 mV)	DME initiates secondary ignition for each cylinder then looks for feedback through shunt resistor in harness to determine if ignition actually occurred.

<b>BMW code</b>	<b>P-code</b>	<b>Fault type and function</b>	<b>Signal type and range</b>	<b>Explanation</b>
188	P1132	Oxygen sensor heater, pre-cat (Bank 1), insufficient	Output digital pulse width (active low)	DME internally calculated heater power is checked against predefined diagnostic limits.
189	P1133	Oxygen sensor heater, pre-cat (Bank 2), insufficient	Output digital pulse width (active low)	DME internally calculated heater power is checked against predefined diagnostic limits.
190	P1186	Oxygen sensor-heater, post-cat (Bank 1), insufficient	Output digital pulse width (active low)	DME internally calculated heater power is checked against predefined diagnostic limits.
191	P1187	Oxygen sensor heater, post-cat (Bank 2), insufficient	Output digital pulse width (active low)	DME internally calculated heater power is checked against predefined diagnostic limits.
197	MS 43	Signal range check	DME internal analog input	
202	P0170	Fuel trim (Bank 1), O2 control limit	DME internal values logical	Controller for lambda is too long beyond a min. or a max.
203	P0173	Fuel Trim (Bank 2), O2 control limit	DME internal values logical	Controller for lambda is too long beyond a min. or a max.
204	P0505	Idle control system, idle speed not plausible	DME internal values logical	Functional check between actual engine speed (RPM) and predetermined RPM exceeds maximum deviation of +200/-100 RPM.
208		EWS, engine speed check not ok	DME internal test	Engine speed signal is transferred by EWS to DME. Fault is set if transferred signal is not reflecting engine speed due to input problem in EWS.
209		EWS, content of message	Input binary stream bit data (0-12V)	Content of binary message received from EWS invalid.
210		Ignition feedback, faulty (>2 cylinders)	Input analog timing (100 mV)	Check for correct signal timing after each ignition has been initiated by feedback



- Each exhaust manifold assembly incorporates a catalytic converter. The converters are mounted close to the engine for faster heat up. Pre- and post-catalyst oxygen sensors are mounted in each exhaust manifold.

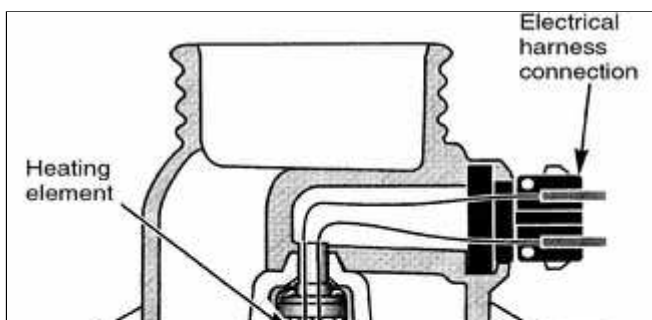
## Cooling system



- The cooling system circulation is designed so that coolant flows directly from the coolant pump to the cylinder head. The coolant is fed from the coolant pump through a cast coolant feed passage to the rear of the cylinder head. From there it flows forward to the thermostat housing, radiator and heater valve.

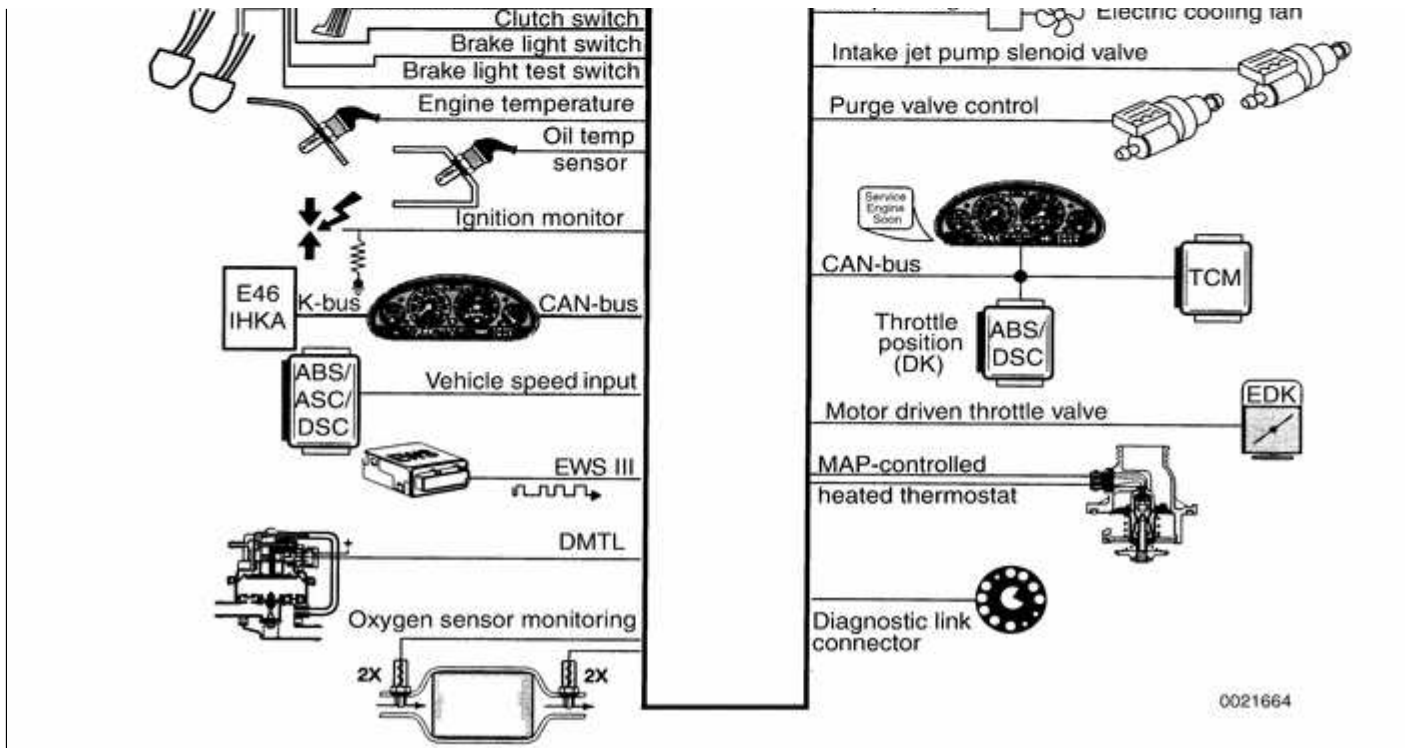
The coolant passages in the cylinder block are only connected to the coolant supply through the holes in the head gasket. A reduced volume of the coolant flows through the cylinder block.

All models are equipped with a DME-controlled electric cooling fan. On some models, a supplemental cooling fan is used. See ⇒ [170 Radiator and Cooling System](#) for specific configuration and application information.



- An electrically heated thermostat controls the flow of coolant through the radiator based on coolant and outside temperature, engine load, and driving speed, rather than just coolant temperature.

The DME-controlled heated thermostat



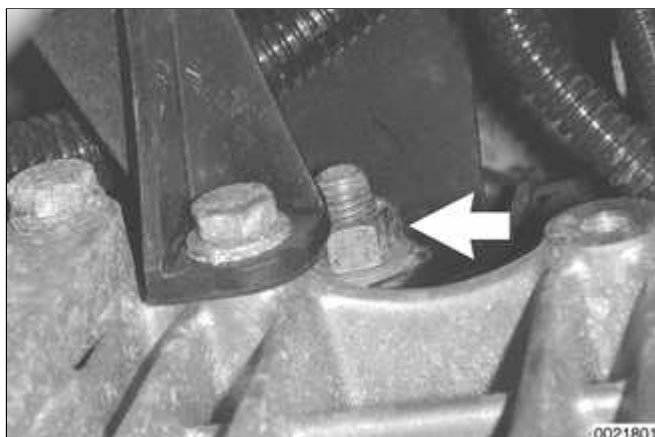
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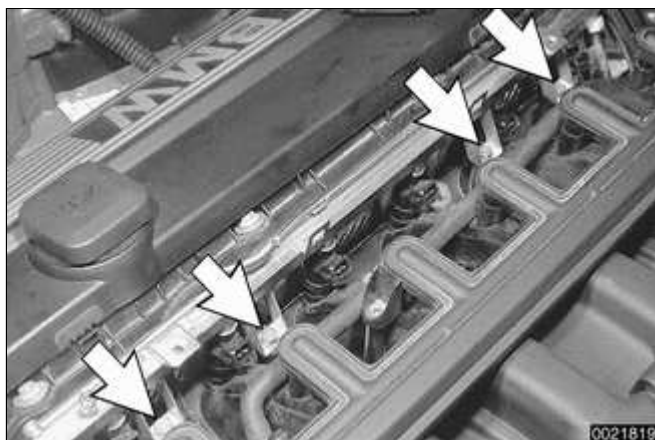
tools 13 5 281/13 5 282.

**CAUTION!**

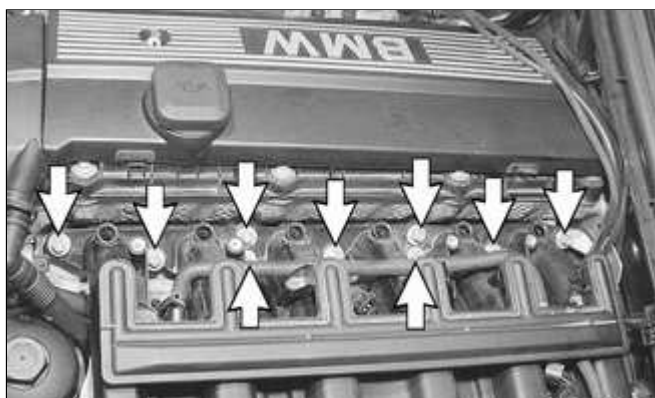
**Fuel may be expelled under pressure. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Before disconnecting fuel hoses, wrap a cloth around fuel hoses to absorb any leaking fuel. Plug all open fuel lines.**



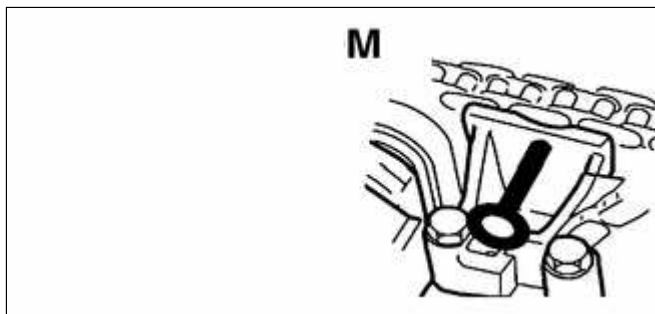
- ✦ Working underneath car, remove lower intake manifold support mounting bolt (**arrow**), located adjacent to left engine mount.



- ✦ Remove fuel rail mounting bolts (**arrows**).
  - ◆ Carefully pry fuel rail off manifold.
  - ◆ Separate fuel line support bracket at rear of intake manifold.
  - ◆ Thread fuel line(s) out of rear of engine compartment while lifting fuel rail out.

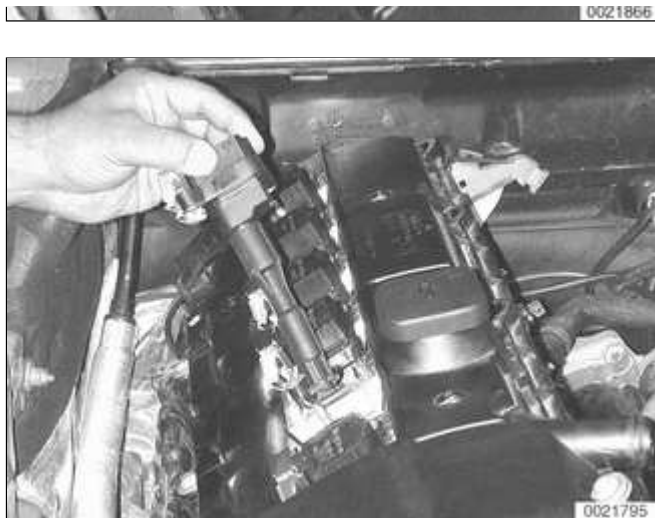


- ✦ Remove manifold mounting nuts (**arrows**).



- ▲ Secondary chain tensioner lock pin  
BMW special tool 11 3 292

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- ◀ Remove ignition coils.
  - ◆ Disconnect ignition coil harness connectors.
  - ◆ Remove coil mounting fasteners.
  - ◆ Remove coils.
  - ◆ Remove ground straps.
  - ◆ Set coil harness to left side of engine compartment.
- Remove cylinder head cover mounting fasteners and remove cylinder head cover.

**Note:**

*The cylinder head cover mounting bolt insulators and gaskets should be reinstalled in their original locations. The three grounds mount to the first, second and fourth central studs. Make note of their arrangement during removal.*

- Remove spark plugs.

**CAUTION!**

***Stuff clean lint free rags into open intake ports to prevent any foreign matter from falling into the ports.***



- ◀ Remove oil baffle cover from above intake camshaft.

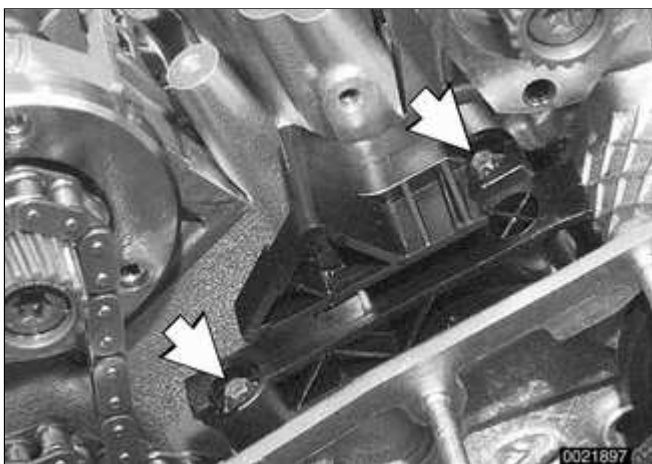
- ♦ **Hydraulic lifters should be stored in an upright position.**
- ♦ **Used hydraulic lifters must be replaced into original lifter bores.**

## Cylinder head assembly, removing

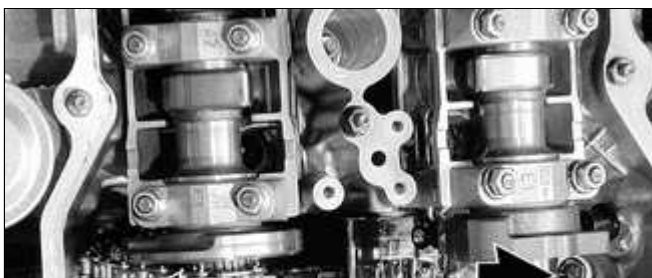
- Remove exhaust manifolds. See 180 Exhaust System.



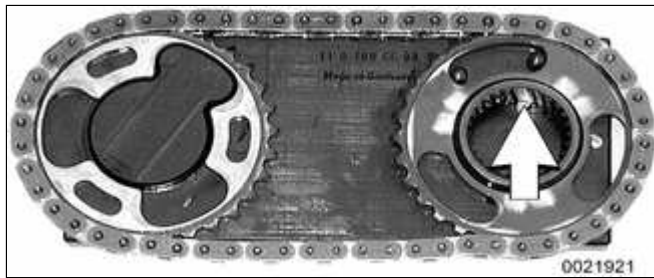
- ◀ Remove intake camshaft position sensor (**arrow**) from side of cylinder head.



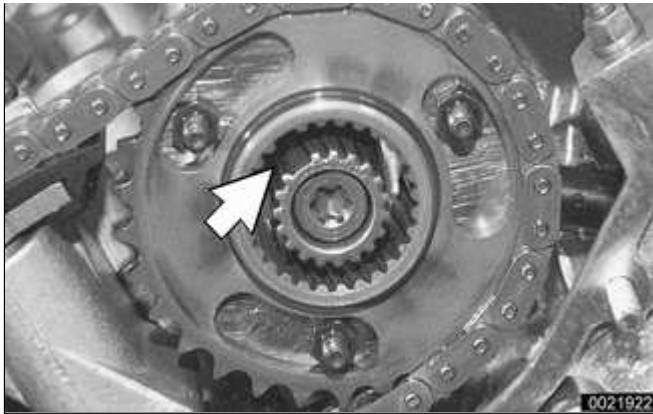
- ◀ Remove secondary chain lower guide bolts (**arrows**). Remove chain guide. The bolt on the intake camshaft side is a long bolt that extends into the lower timing chain cover.



- ◀ Remove screws (**arrows**) holding lower timing chain cover to cylinder head. (Photo shows camshafts in place).



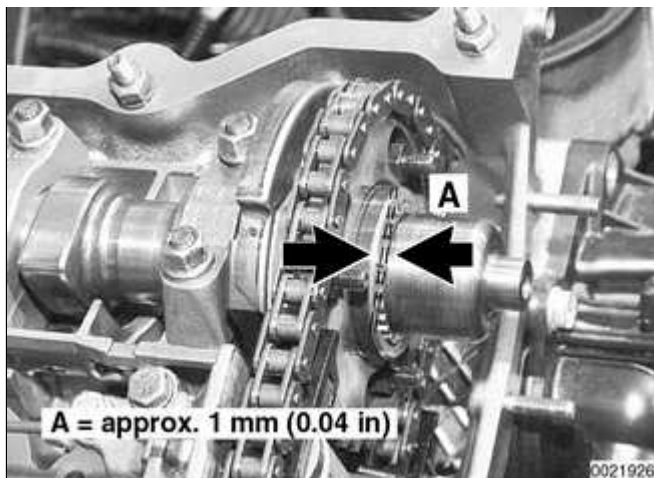
- Place intake and exhaust sprockets in BMW special tool 11 6 180. Position spline gap on intake sprocket (**arrow**) as shown and place secondary chain on sprockets.



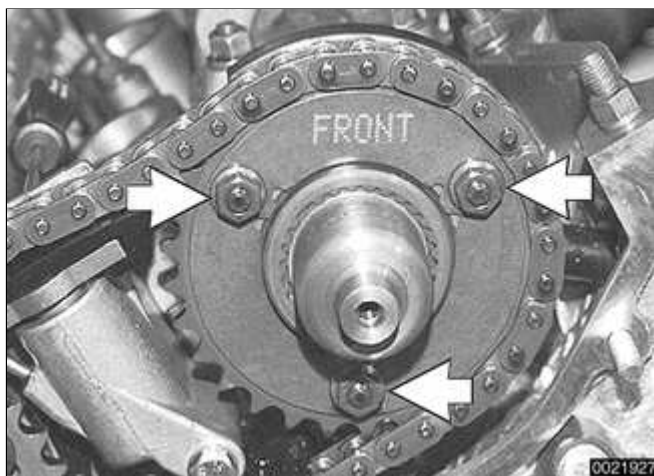
- Remove chain and sprockets from tool and slide sprockets on camshafts. Confirm that gap in intake sprocket splines lines up with corresponding gap in camshaft splines (**arrow**).

**CAUTION!**

**Do not alter position of sprockets with respect to chain when removing from special tool 11 6 180.**



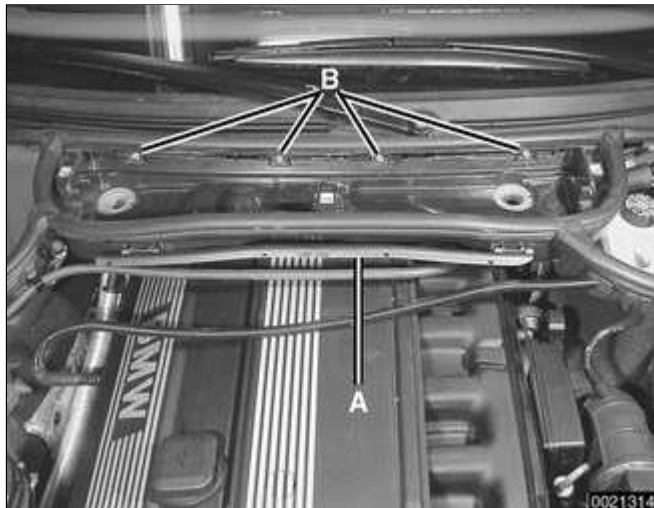
- Slide splined shaft onto intake camshaft until approx. 1 mm (0.04 in.) of splines (**arrows**) are visible. Confirm that locating tooth of shaft fits into spline gaps on camshaft and sprocket.



- Install intake camshaft spring plate so that **FRONT** mark is visible. Install mounting nuts (**arrows**) finger tight.



- Insert sprocket mounting bolts (**arrows**) on exhaust side camshaft



**Failure to remove the DME main relay or attempting to disable the ignition system by other methods may result in damage to the engine control module (ECM).**

- ✦ Remove housing for interior ventilation microfilter.
  - ◆ Remove upper cover and microfilter.
  - ◆ Open wiring harness loom cover (A) and remove wires.
  - ◆ Unfasten screws (B) and remove lower microfilter housing.
- Remove oil filler cap.
- Remove engine cover over ignition coils. Replace oil filler cap.



- ✦ Remove ignition coils.
  - ◆ Pull up on spring clips to disconnect ignition coil harness connectors.
  - ◆ Remove coil grounding straps.
  - ◆ Remove coils.
  - ◆ Remove spark plugs.

**Note:**

*Check the spark plugs for oil deposits that may indicate poor cylinder sealing, then set them aside in order. Used spark plugs should be reinstalled in the same cylinder from which they were*

## Valves

### Valves, removing and installing

- Remove cylinder head as described in ⇒ [113 Cylinder Head Removal and Installation](#).

#### **CAUTION!**

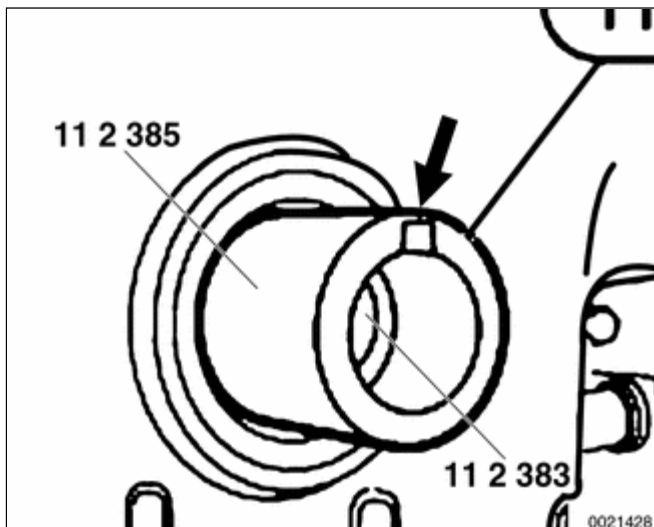
- ♦ ***Do not let the hydraulic lifters fall out as the camshaft carrier is removed. Special suction cups are available from BMW to hold the hydraulic lifters in place during carrier removal.***
- ♦ ***Hydraulic cam lifters should be stored in an upright position. If necessary, use a magnetic tool to aid in removal of the lifters.***
- Remove valves using a valve spring compressor.

#### **CAUTION!**

***Label each valve assembly as it is removed so it can be installed in its original position.***

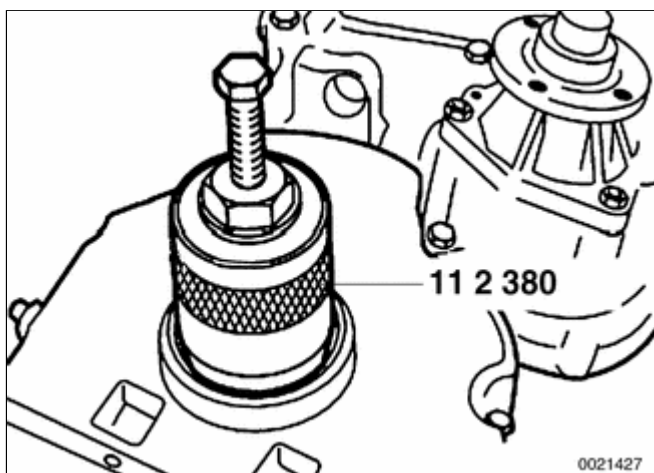
- Remove and discard valve stem oil seals from valve guides. See ⇒ [Valve stem oil seals](#) later in this section.
- Valve installation is reverse of removal.

Valve specifications are listed in ⇒ [Table c](#). Remove carbon deposits from

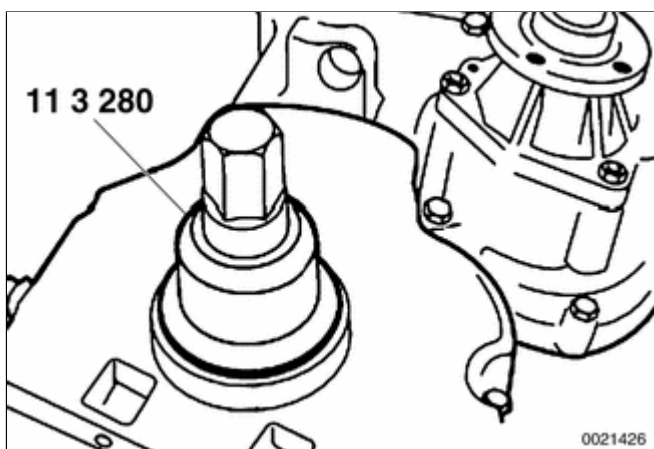


*hub from crankshaft.*

- ▲ Place special tool 11 2 383 on end of crankshaft to cover threaded hole, and fit special tool 11 2 385, aligning groove in 11 2 385 with keyway on crankshaft (**arrow**).



- ▲ Put special tool 11 2 380 over tools installed on crankshaft, and screw in until it makes firm contact with the seal. Tighten screw in end of 11 2 380 to draw out seal.

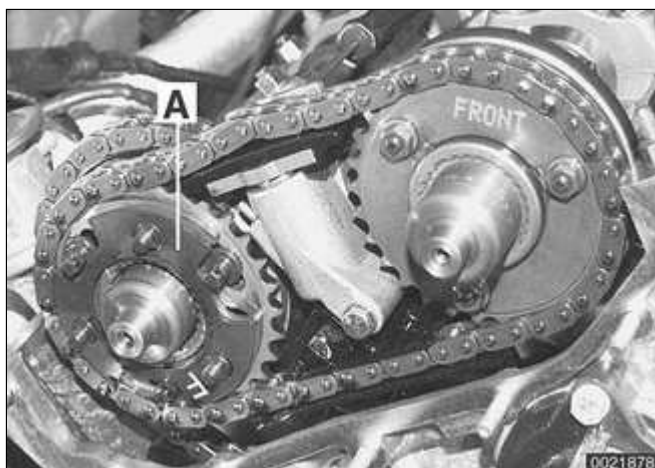


- ▲ To install new seal, coat with oil, and use special tool 11 3 280 and crankshaft center bolt to draw seal in flush with timing case cover.

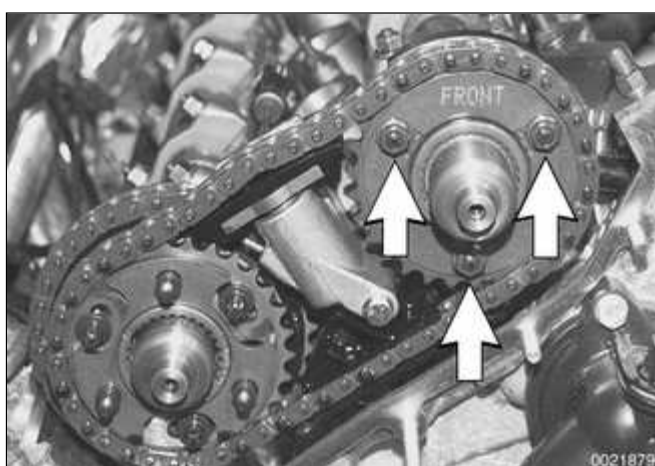
- Install crankshaft hub (up to 1/2000) or vibration damper (from 1/2000) to crankshaft. Install new crankshaft center bolt finger tight.
- Torque crankshaft hub center bolt, using special tools 11 2 150/11 2 410 (up to 1/2000) or 11 8 190/11 8 200 (from 1/2000). nothing

#### Tightening torque

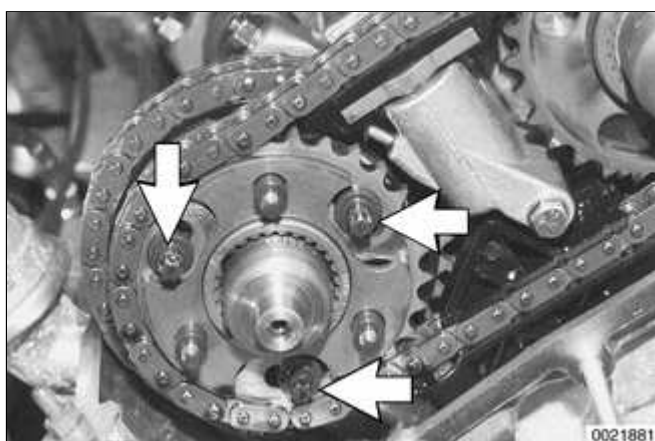
Vibration damper	410 Nm (302
------------------	-------------



- Remove spring plate (A).



- Remove intake camshaft sprocket mounting nuts (arrows) and remove spring plate (labelled **FRONT**).



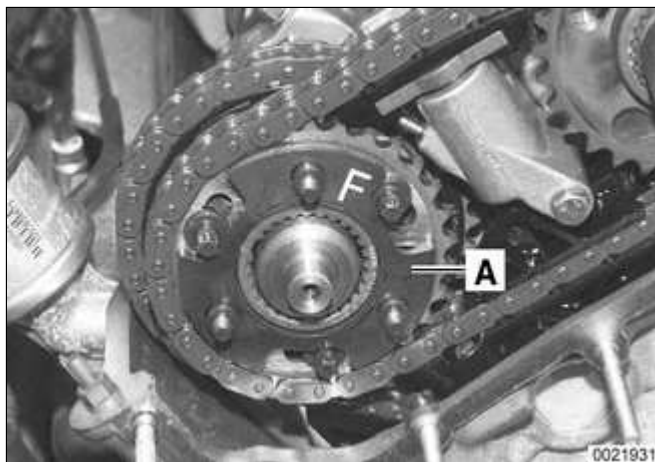
- Remove torx screws from exhaust camshaft sprocket (arrows).



- Lift off exhaust and intake sprockets together with secondary chain, thrust spacer (A) and splined shaft (B).

**CAUTION!**

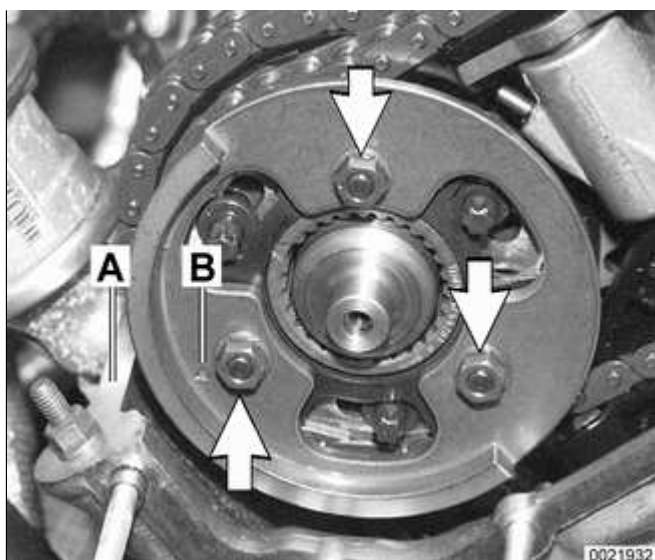
**Splined shafts for both intake and exhaust camshafts share the same part number. Remove and mark used**



- ▲ Install spring plate (A) to exhaust camshaft. Make sure that F marking is visible.

**Note:**

*If F marking is no longer visible, install spring plate so that convex side points forward (toward front of car).*



- ▲ Install exhaust camshaft impulse wheel, aligning mark (B) with top edge of cylinder head (A). Install mounting nuts (arrows) finger tight.



- ▲ Pull out exhaust splined shaft until it stops.
  - Press down on secondary chain tensioner and remove tensioner lock-down tool.



- ▲ Preload primary chain:
  - ◆ Tighten adjusting screw on BMW special tool 11 4 220 to specified torque.

0021769



0021824

- ✦ Remove sealing caps from inside VANOS unit with BMW special tool 11 6 170, or with short flat nose pliers.

**Note:**

*Additional oil may drain from VANOS unit.*

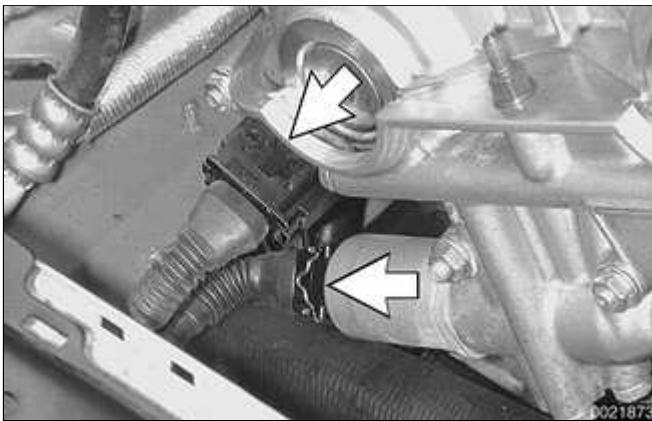


0021825

- ✦ Remove set screws (left hand thread) on ends of intake and exhaust camshaft hydraulic pistons.

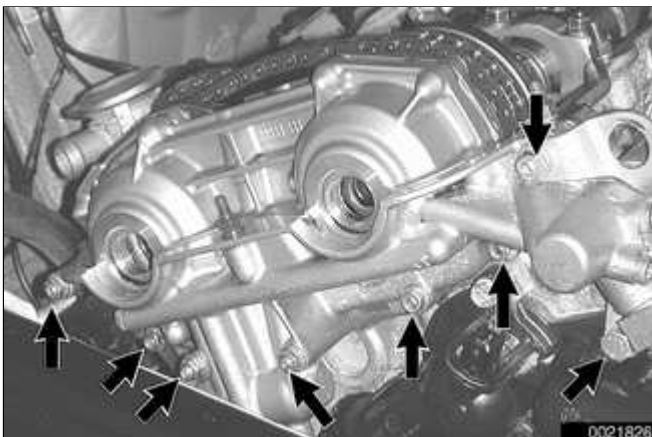
**CAUTION!**

**Set screws have left-hand threads. Remove with a clockwise motion.**



0021873

- ✦ Disconnect electrical harness connectors from camshaft position sensors and solenoid valves on both exhaust and intake sides of VANOS unit.



0021826

- ✦ Remove VANOS unit:
  - ◆ Remove fasteners from engine support eye.
  - ◆ Remove VANOS mounting nuts (**arrows**) from cylinder head. Slide VANOS unit and metal gasket off.

**CAUTION!**

## General

This repair group covers lubrication system troubleshooting as well as oil pan removal and oil pump replacement.

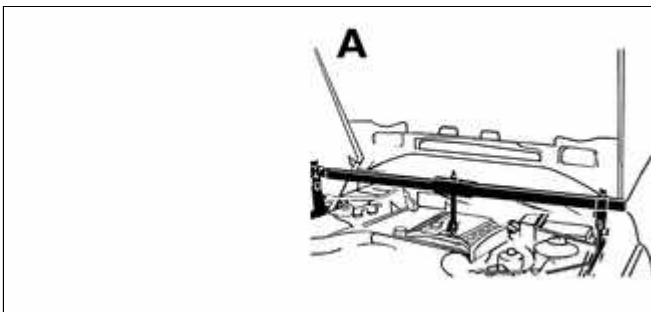
## Special tools

The engine needs to be properly supported while the front suspension subframe is removed to access the lubrication system. If BMW special tools 00 0 200 / 00 0 208 are not available, a device to support the weight of the engine from above would be suitable.

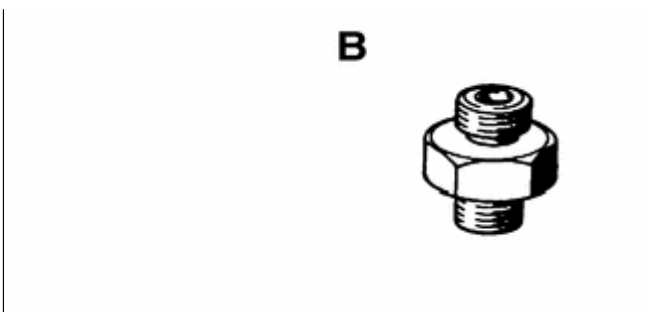
A standard oil pressure gauge may be used for measuring oil pressure. If the BMW DIS tester system is to be used, a special adapter is needed.

### **Note:**

*Oil change procedure and oil filter replacement are covered in ⇒ [020 Maintenance](#)*



- ◀ Engine support bracket BMW 00 0 200/00 0 208



- ◀ Adapter for BMW oil pressure gauge BMW 11 4 050

- ◆ Use new oil dipstick tube sealing O-ring.
- ◆ Fill engine with oil as described in ⇒ [020 Maintenance](#).
- ◆ After adding engine oil, start and run engine. Raise engine speed to 2,500 rpm until oil pressure warning lamp goes out (about 5 seconds).

**Note:**

*BMW does not recommend a front end alignment following this procedure.*

<b>Tightening torques</b>	
Control arm ball joint to suspension subframe	90 Nm (66 ft-lb)
Front subframe to frame rails (M12, use new bolts)	
8.8 grade	77 Nm (57 ft-lb)
10.9 grade	110 Nm (81 ft-lb)
12.9 grade	105 Nm (77 ft-lb)
Front end reinforcement to frame rails or suspension subframe (M10, use new bolts)	
Initial torque	59 Nm (44 ft-lb)
Torque angle	90° + 30°
Stabilizer bar to frame rail (M8 nut)	22 Nm (16 ft-lb)
Steering column universal joint clamping screw (M8 bolt, use new bolt)	22 Nm (16 ft-lb)

11 - Oil pick-up pipe

12 - Bolt M6 -tighten to 10 Nm (89 in-lb)

- On engines with integrated oil pump and oil scraper: Remove oil pump with scraper.
- On engines with separate oil pump and scraper:
- ◆ First remove mounting bolts and withdraw oil pump intake pipe.
- ◆ Remove oil pump mounting bolts. Remove oil pump assembly.

**Note:**

- ◆ *Note any spacers between pump and engine block.*
- ◆ *Note positions of locating dowels.*
- Remove cover from oil pump and check for wear or scoring. Spin oil pump shaft and check that gears turn smoothly. Replace pump if gears spin with difficulty or any wear is present.
- Installation is reverse of removal, noting the following:
- ◆ Align sprocket splines to oil pump shaft splines before tightening sprocket nut.

<b>Tightening torques</b>	
Oil drain plug to oil	25 Nm (18 ft-lb)

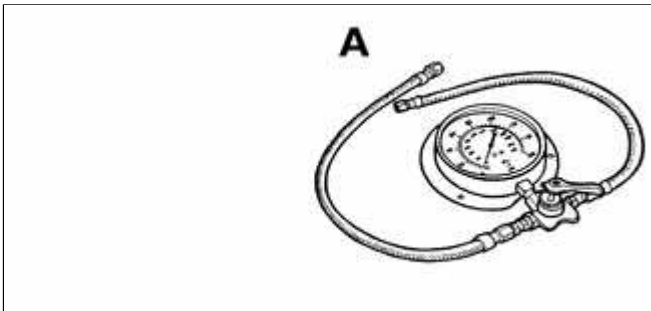
***only as specified by BMW, as  
described in this manual, or as  
described by the instrument  
manufacturer.***

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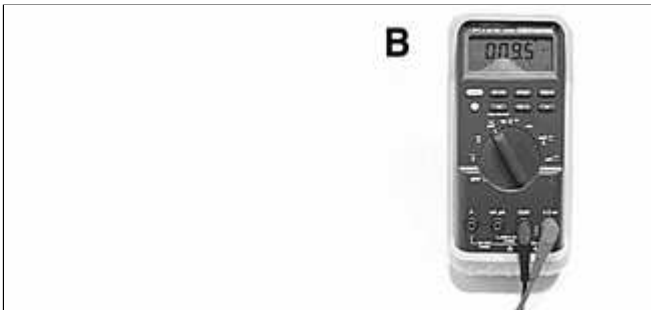
(malfunction indicator lamp) in the instrument cluster is illuminated, begin troubleshooting by hooking up a BMW-compatible scan tool. The rich diagnostic capabilities of these systems have the potential to save hours of diagnostic time, incorrect component replacement and possible damage to system components. See ⇒ [OBD On Board Diagnostics](#) at the back of this manual.

## Tools and test equipment

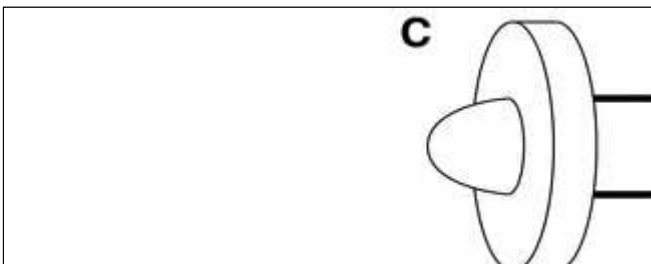
If the equipment required to do the job is unavailable, it is recommended that these repairs be left to an authorized BMW dealer or other qualified BMW repair facility.



- ⚡ Fuel pressure gauge Baum 1318  
(Source: Baum Tools Unlimited)



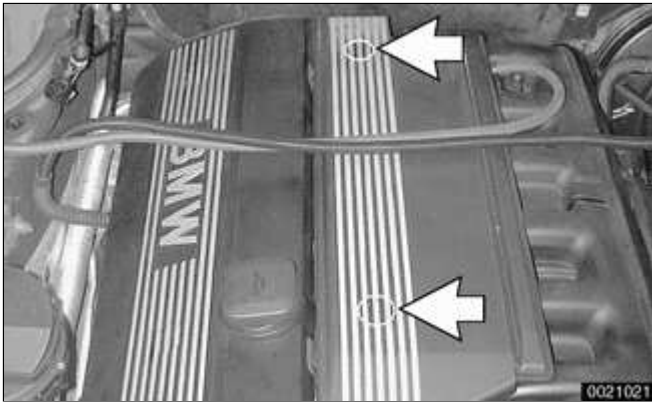
- ⚡ Automotive digital multimeter Fluke 87



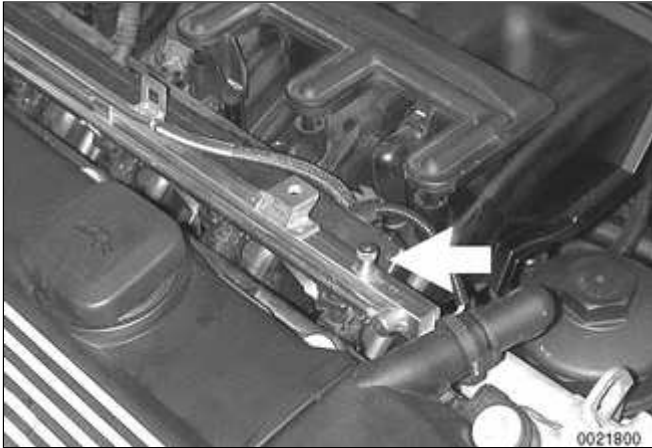
- ⚡ Low current test light ("noid") Baum 1115a (Source: Baum Tools Unlimited)



- ⚡ Factory DTC scan tool BMW DIS/MoDiC



- ✦ Remove fuel rail cover by prying off nut covers (**arrows**) and removing nuts.

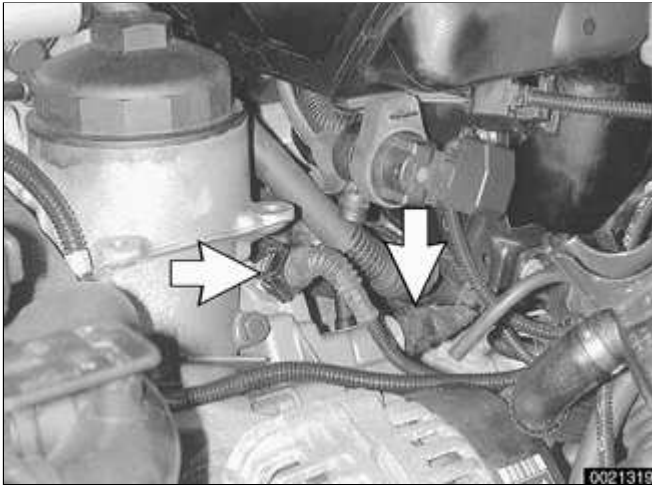


- ✦ Unscrew Schrader valve cap (**arrow**) from fuel rail. Unscrew fuel tank cap to release pressure to vent tank.
  - Using a brief burst of compressed air (maximum of 3 bar or 43.5 psi) blow fuel back through return line into fuel tank.

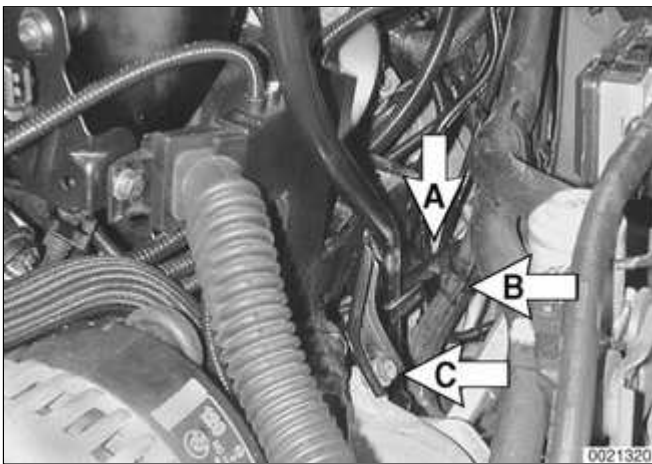
### **WARNING!**

- ♦ **Fuel in fuel line is under pressure (approx. 3 - 5 bar or 45 -75 psi) and may be expelled under pressure. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Before disconnecting fuel hoses, wrap a cloth around fuel hoses to absorb any leaking fuel. Catch and dispose of escaped fuel. Plug all open fuel lines.**
- ♦ **Always unscrew fuel tank cap to release pressure in the tank before working on the tank or lines.**

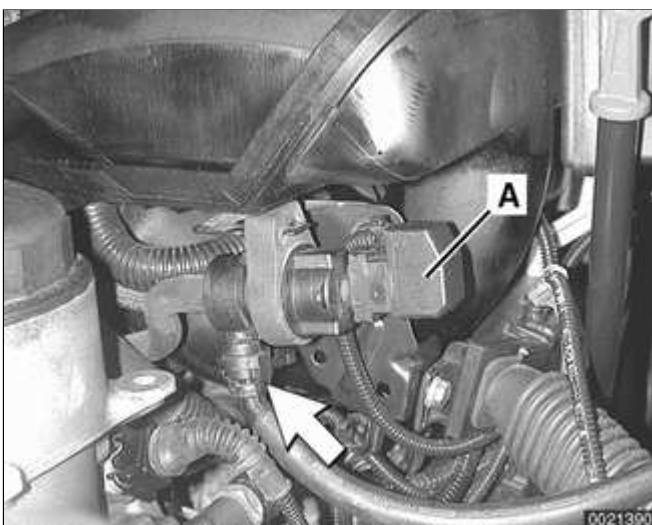
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- ✦ Disconnect electrical harness connectors (**arrows**) at oil pressure sender and oil temperature sender at base of oil filter housing.

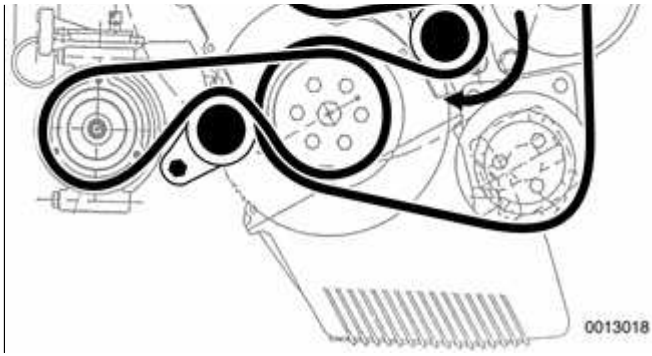


- ✦ Remove dipstick guide tube:
  - ◆ Disconnect wiring harness brackets from tube (**A**).
  - ◆ Unclip fuel lines from tube (**B**).
  - ◆ Remove lower guide tube mounting bolt (**C**). Pull out dipstick guide tube.



- ✦ If necessary, disconnect electrical harness connector at fuel tank venting valve (**A**). Disconnect hose at quick disconnect fitting (**arrow**).
  - Remove throttle assembly mounting screws at all corners and pull assembly off manifold.
  - Installation is reverse of removal.
  - ◆ Replace sealing ring between throttle assembly and intake manifold.

<b>Connector X60003 52-pin black</b>			
<b>Pin</b>	<b>Signal</b>	<b>Component/function</b>	<b>Notes</b>
19	Input	Signal, throttle potentiometer 1	Throttle valve
20	Ground	Ground, throttle position sensor	Throttle valve
21	Ground	Ground, crankshaft position sensor	Crankshaft position sensor
22	Output	Signal, intake air temperature	Intake air temperature sensor
23	Ground	Ground, intake air temperature sensor	Intake air temperature sensor
24	Output	Signal, coolant temperature sensor	Coolant temperature sensor
25	Ground	Ground, coolant temperature sensor	Coolant temperature sensor
26	Input	Signal, oil pressure	Oil pressure switch
27	Output	Signal, engine oil temperature	Oil temperature sensor
28	Ground	Ground, engine oil temperature sensor	Oil temperature sensor
29	Output	Signal, knock sensor	Knock sensor
30	Output	Signal, knock sensor	Knock sensor
31	Output	Signal, knock sensor	Knock sensor
32	Output	Signal, knock sensor	Knock sensor
33	Input	Signal, cylinder 1 fuel injector	Cylinder 1 fuel injector
34	Input	Signal, cylinder 2 fuel injector	Cylinder 2 fuel injector
35	Input	Signal, cylinder 3 fuel injector	Cylinder 3 fuel injector
36	Input	Signal, cylinder 4 fuel injector	Cylinder 4 fuel injector
37	Input	Signal, cylinder 5 fuel injector	Cylinder 5 fuel injector



pulley and check for play in all directions.

- ◆ Spin pulley and check that shaft runs smoothly without play.

**Note:**

*The coolant provides lubrication for the pump shaft, so an occasional drop of coolant leaking from the pump is acceptable. If coolant drips steadily from the vent hole, the pump should be replaced.*

The cooling system becomes pressurized at normal operating temperature, which raises the boiling point of the coolant. Leaks may prevent the system from becoming pressurized, allowing the coolant to boil at a lower temperature. If visual evidence is inconclusive, a cooling system pressure test can help to pinpoint hard-to-find leaks.

If the cooling system is full of coolant and holds pressure, the next most probable causes of overheating are:

- ◆ Faulty radiator fan or DME control circuit. Use an appropriate scan tool to interrogate the DME control module for faults.
- ◆ Loose or worn drive belt.
- ◆ Failed thermostat or coolant pump impeller. Some pumps may be fitted with plastic impellers.
- ◆ Clogged/plugged radiator or coolant passages.

## Cooling system pressure test

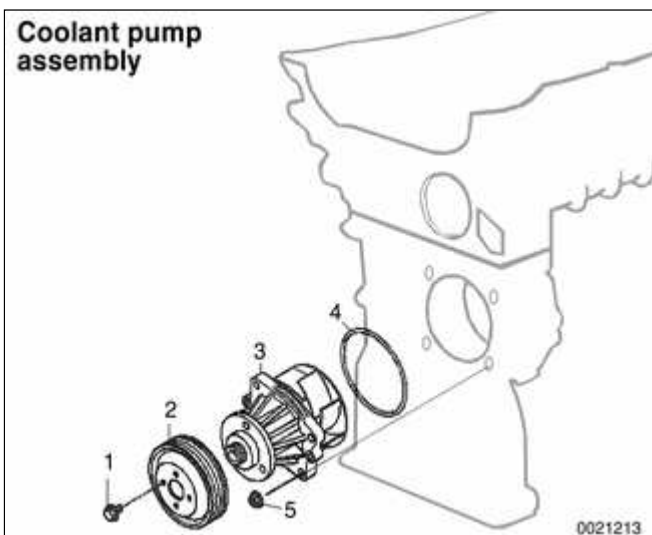


- ◆ Use new sealing gasket.
- ◆ Fill system with coolant as described under ⇒ [Coolant, draining and filling](#)

#### Tightening torques

Engine block drain plug to block	25 Nm (18 ft-lb)
Radiator drain plug to radiator	2 - 3 Nm (18 - 27 in-lb)

### Coolant pump, replacing



- ✦ The engine coolant pump is mounted in the front of the engine in the timing chain cover.

- 1 - Bolt M6 -tighten to 10 Nm (89 in-lb)
- 2 - Drive pulley
- 3 - Coolant pump
- 4 - O-ring seal
- 5 - Nut M6 -tighten to 10 Nm (89 in-lb)

- Drain cooling system as described earlier.

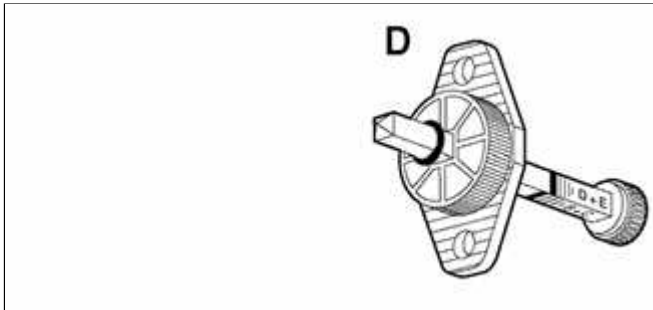
#### **WARNING!**

**Allow cooling system to cool before opening or draining system.**

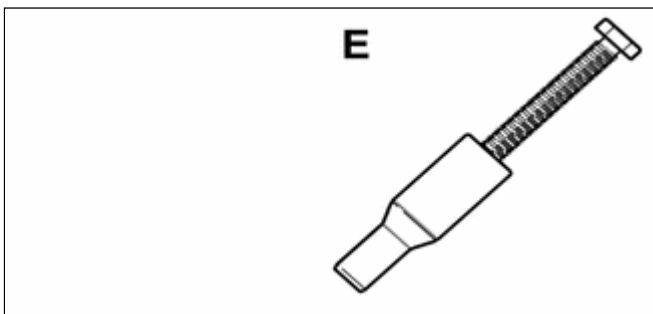
- Remove air intake duct, cooling fan and fan shroud as described earlier.



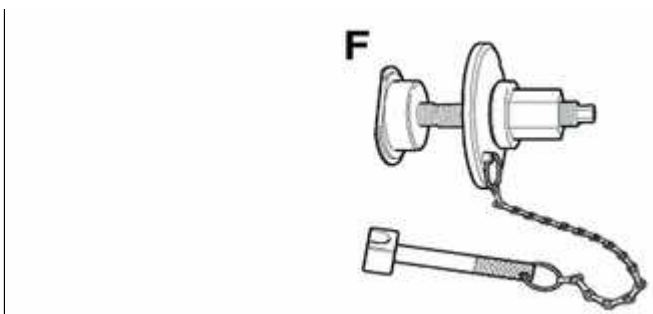
◀ Clutch lining gauge BMW 21 2 080



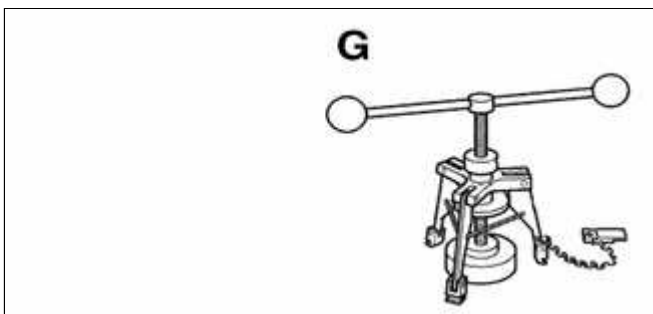
◀ Clutch centering mandrel BMW 21 2 142



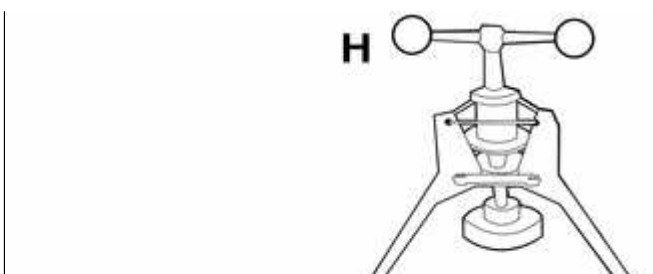
◀ SAC clutch lock tool BMW 21 2 150



◀ Clutch diaphragm tensioning tool BMW 21 2 160



◀ SAC tensioning tool BMW 21 2 170



excessive runout (warping).  
Replace if necessary.

**Note:**

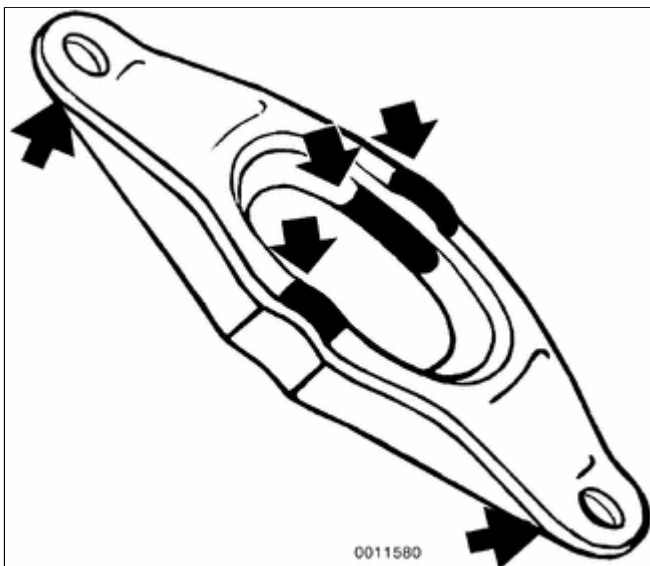
*Measure the depth of clutch lining at lining rivets. If shallowest rivet depth is less than 1 mm (0.04 in.), replace clutch disk.*

- Inspect flywheel for scoring, hot spots, cracks or loose or worn guide pins. Replace flywheel if any faults are found.

**WARNING!**

***If flywheel is removed from vehicle, use new bolts during installation. The old stretch-type bolts should not be reused.***

- Inspect transmission pilot bearing in end of crankshaft. The bearing should rotate smoothly without play. If necessary, replace as described later.



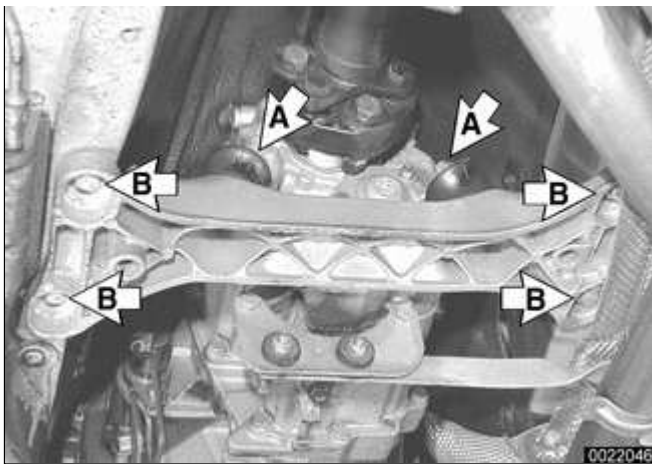
- ◀ Inspect and clean release bearing lever. Apply a thin coat of grease to release bearing lever lubrication points (**arrows**). Also, lightly lubricate clutch disc splines and transmission input shaft splines.

## Clutch, installing new pressure plate

Tightening torques	
M10 (10.9 grade)	60 Nm (44 ft-lb)
M12 (10.9 grade)	100 Nm (74 ft-lb)
Transmission / transfer case crossmember to chassis (M8)	21 Nm (15 ft-lb)
Transfer case to transmission (M10)	41 Nm (30 ft-lb)

### Output shaft seal, replacing (transmission installed)

- Raise and safely support vehicle.
- Support transmission with transmission jack.

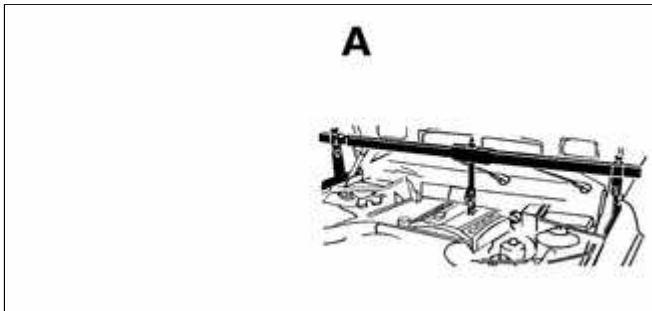


- ⚡ On rear wheel drive cars:
  - ◆ Remove driveshaft. See ⇒ [260 Driveshaft](#).
  - ◆ Remove transmission mount bolts (A).
  - ◆ Remove transmission crossmember bolts (B) and tilt down rear of transmission.

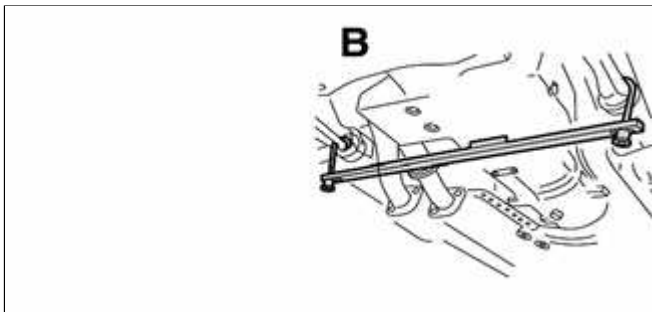


- ⚡ On all wheel drive cars:
  - ◆ Remove front and rear driveshafts. See ⇒ [260 Driveshaft](#)
  - ◆ Remove transfer case crossmember bolts (arrows) and remove transfer case. See ⇒ [270 Transfer Case](#).

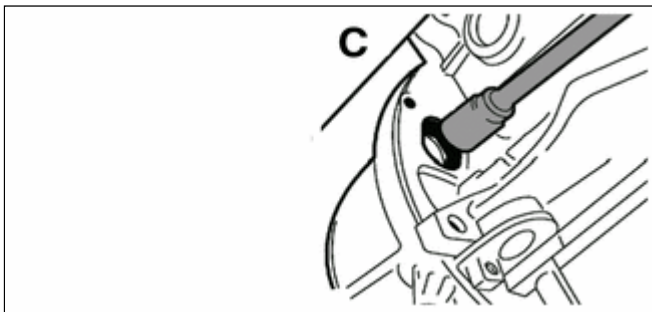
absolutely necessary, they are especially helpful when dealing with the removal and replacement of the torque converter.



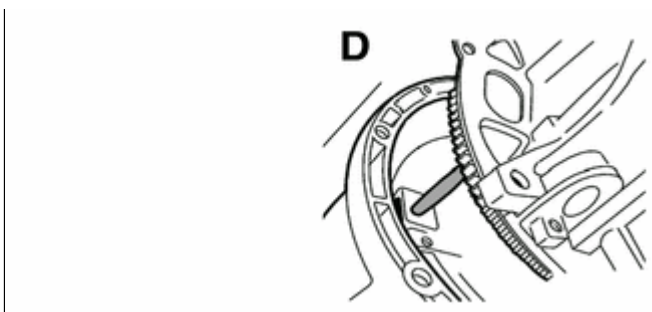
- ◀ Engine support bracket BMW 00 0 200 / 208



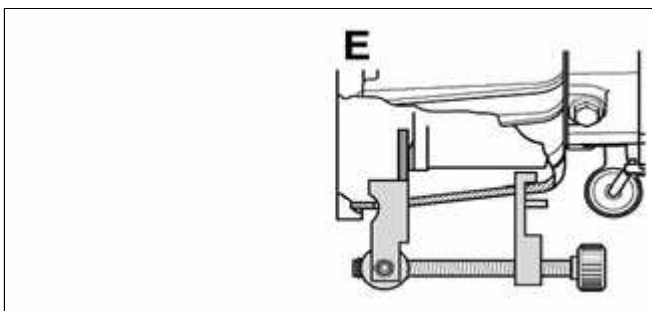
- ◀ Oil pan support bracket BMW 11 8 022



- ◀ Torque converter socket BMW 24 1 100



- ◀ Spline bore alignment tool BMW 24 2 300



- ◀ Torque converter clamp BMW 24 4 131 / 135

Internal repairs to the automatic transmission require special service equipment and knowledge. If it is determined that internal service is required, consult an authorized BMW

- ◆ Install new O-rings on transmission cooler lines, where applicable.
- ◆ Inspect engine drive plate for cracks or elongated holes. Replace if necessary.
- ◆ Check to be sure torque converter is seated correctly in transmission during final installation.
- ◆ When mounting transmission to engine, the three mounting tabs on torque converter must be aligned with indentations on drive plate. Use an alignment dowel to line up bolt holes, if necessary.
- ◆ Fill transmission with clean ATF until oil level is even with fill hole. Then check fluid level as described earlier.
- ◆ Adjust gearshift mechanism. See ⇒ [270 Transfer Case](#).

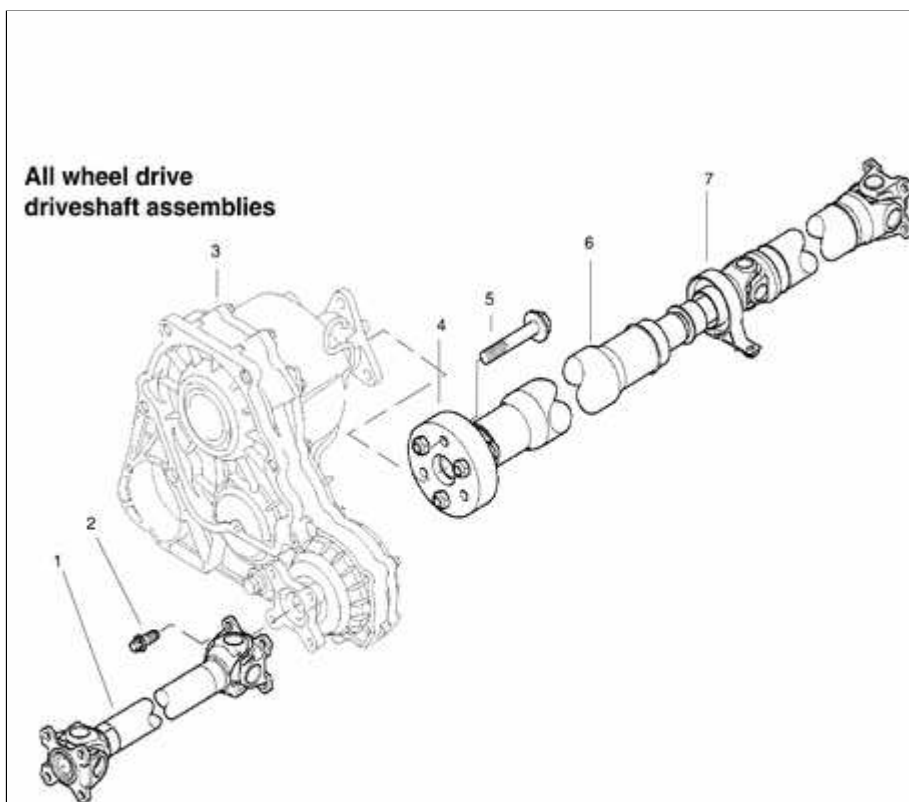
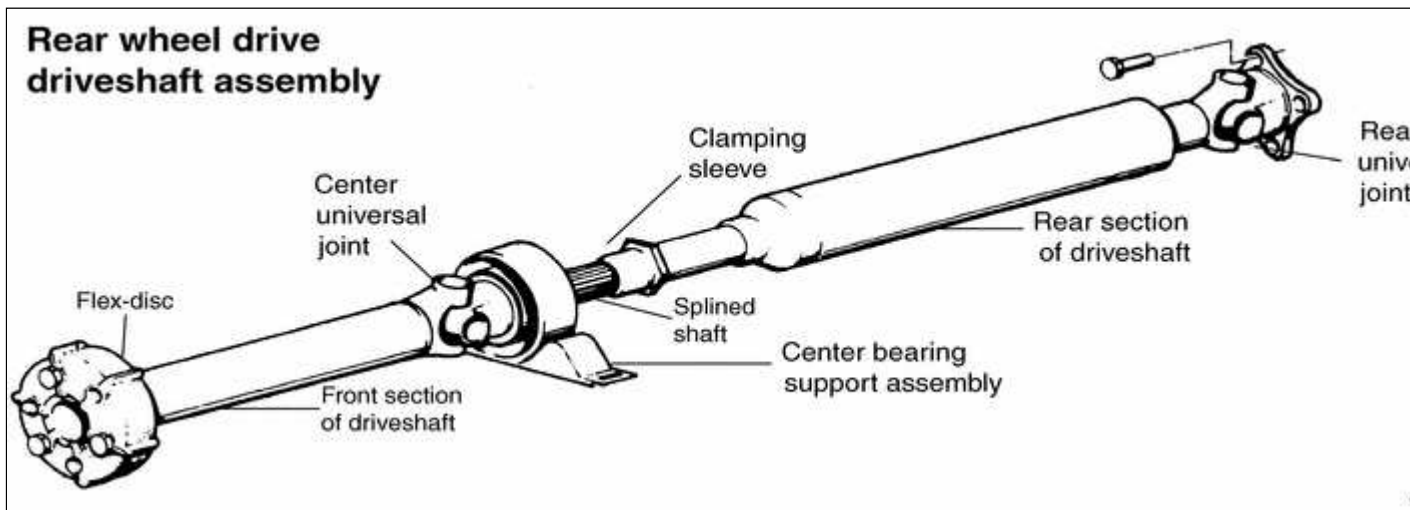
**Note:**

*Torx-head mounting bolts should always be used with washers to prevent difficult removal in the future.*

<b>Tightening torques</b>	
ATF drain plug to ATF sump	
A5S 325Z	35 Nm (26 ft-lb)
A5S 360R	20 Nm (15 ft-lb)
ATF fill plug to ATF sump	
A5S 325Z	30 Nm (22 ft-lb)
A5S 360R	20 Nm (15 ft-lb)

driveshaft runs from the transfer case to the front differential. The front driveshaft bolts to the transfer case and differential directly, using no flexible rubber disk.

## Rear wheel drive driveshaft assembly



## All wheel drive driveshaft assemblies

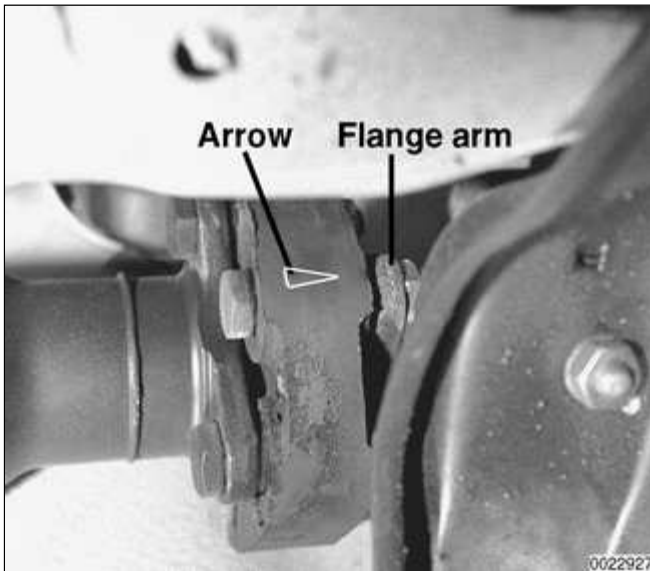
- 1 - Front driveshaft assembly
- 2 - Torx screw M10
- ◆ tighten to 70 Nm (52 ft-lb)
- 3 - Transfer case
- 4 - Flex disc
- 5 - Bolt M12

*unsupported, the rear universal joint may be damaged.*

- Unbolt flex-disc from driveshaft.

**Note:**

*Removal and installation of the bolts may be made easier by placing a large hose clamp around the flex-disc, and tightening the clamp slightly to compress the coupling.*



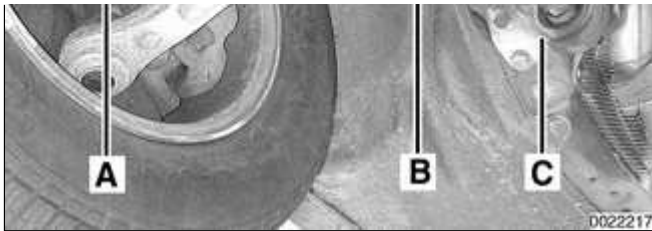
- ✦ Install new flex-disc using new self-locking nuts. Molded arrows on coupling should face flange arms.

- Install driveshaft as described earlier.

**Note:**

*Torque only the nuts while holding the bolt heads. This will prevent damaging or fatiguing the rubber.*

Tightening torques	
Center bearing to body	21 Nm (15 ft-lb)
Clamping sleeve	10 Nm (89 in-lb)
Drive axle to differential flange	
M10 Torx bolt	83 Nm (61 ft-lb)
M10 with locking teeth (replace bolts)	96 Nm (71 ft-lb)
M10 with ribbed teeth (black)	100 Nm (74 ft-lb)
M10 with ribbed teeth (silver) ZNS (replace bolts)	80 Nm (59 ft-lb)
Flex-disc to driveshaft or transmission flange	
M10 (8.8 grade)	48 Nm (35 ft-lb)



- Each front strut assembly includes a tubular strut housing with an integrated shock absorber and a large coil spring. The upper strut mount includes a coil spring seat and strut bearing. A rubber bump stop limits suspension travel. The steering arm clamps the lower end of the strut assembly. The strut assembly pivots between the upper strut mount bearing and a ball joint on the control arm.

The front suspension is designed with minimum positive steering offset. This geometry contributes to stability when traction is unequal from side to side.

### Front suspension, rear wheel drive cars

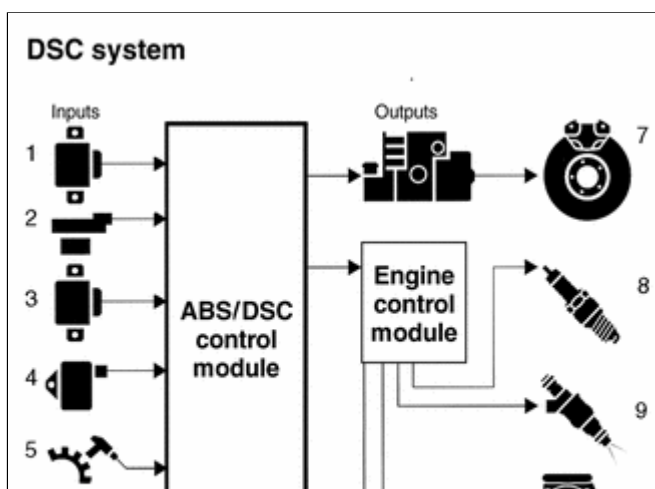
The control arms are constructed of forged aluminum. This design lowers the overall weight of the car and reduces the amount of unsprung mass. By reducing unsprung mass, softer, more comfortable springs can be used and accurate handling is maintained.

The three point mounting of each L-shaped control arm precisely controls the front-to-rear and side-to-side position of the strut, while the flexibility of the joints and mounts also allows the movement necessary for suspension travel. The control arm mounting points

Indicator lamp	Condition	Action / Use
Light off	ASC monitoring mode	Automatic ASC operation
Press ASC button, light comes on	ASC off (disabled)	Rocking the car to get out of snow or other loose surface Driving with snow chains
Press ASC button, light goes out	ASC monitoring mode	Automatic ASC operation
Light flashes	ASC active mode	Normal ASC operation as it controls wheel speed
Light stays on after start up or comes on while driving	Defect in ASC	Consult BMW dealer for diagnosis/repair (vehicle operation remains normal)

## Dynamic Stability Control (DSC)

Dynamic Stability Control (DSC), standard in 2000 and later E46 models, utilizes many principles and components of the ASC traction control system. DSC is active throughout the driving experience, unlike ASC which is only active during acceleration and braking. DSC helps stabilize the vehicle in cornering and avoidance maneuvers by adjusting engine controls such as throttle, ignition, fuel injection and the application of brake pressure to the wheels individually.



⚡ The DSC control module uses various inputs to determine vehicle instability during braking, cornering, or reduced traction situations. Based upon these inputs the ABS/DSC control module sends outputs to the engine control module and the ABS/DSC hydraulic unit to activate torque reduction protocols and braking intervention.

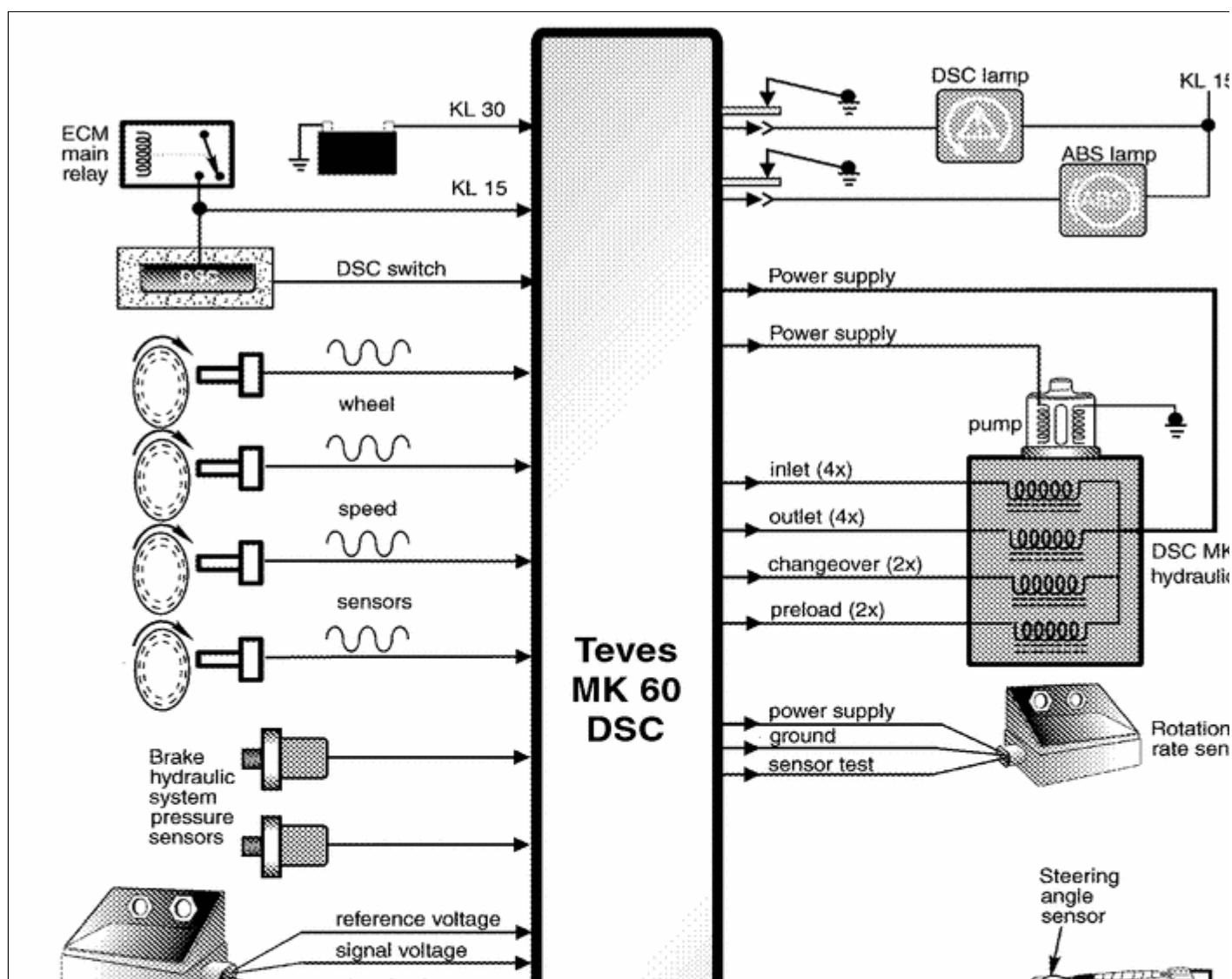
### Inputs

- 1 - Lateral acceleration sensor

## DSC lateral acceleration sensor

The lateral acceleration sensor provides the DSC control module with an input signal based on the degree of lateral acceleration (g forces) that the vehicle experiences. Based on a 5 volt reference voltage, the sensor will return an output voltage that ranges between 0.5 and 4.5 volts to the DSC control module, with 1.8 volts as a standing voltage. This input, along with other DSC inputs, determines the amount of DSC regulation needed to maintain vehicle stability.

Teves MK 60 DSC diagram



## General

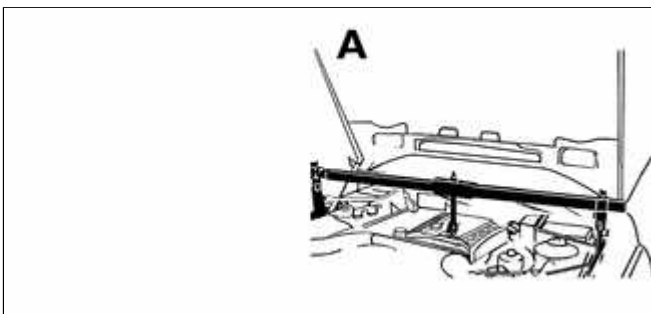
This repair group covers the repair and replacement of components that make up the front suspension of E46 cars.

See ⇒ [300 Suspension, Steering and Brakes-General](#) for a description of the front suspension and components, as well as specification for setting ride height.

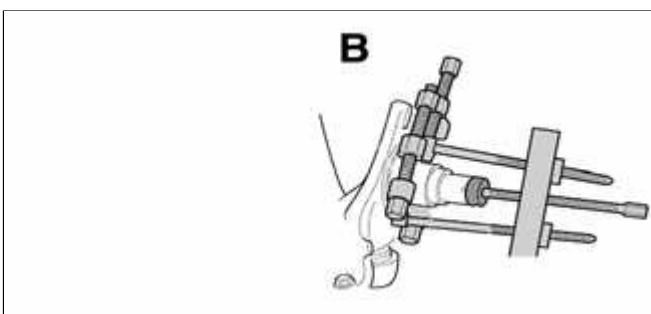
## Special tools

Special service tools are required for most of the work described in this repair group. In addition to the tools depicted in the illustrations, a variety of press tools are necessary for control arm bushing replacement.

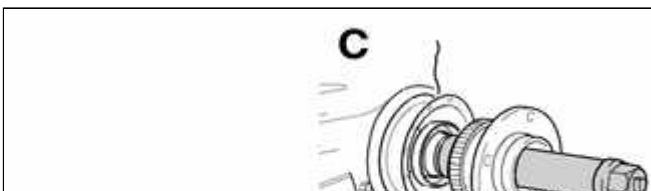
Read the procedures through before beginning any job.



- ◀ Engine support bracket BMW 00 0 200/00 0 205



- ◀ Bearing puller BMW 00 7 500/31 2 106



- ◀ Wheel bearing installation tool BMW 31 2 110

related components.

- Replace strut, upper strut mount or spring, as needed.

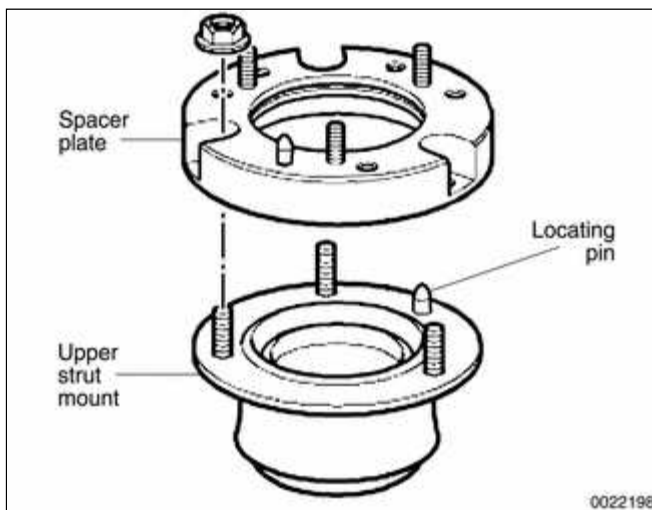
**Note:**

*Springs and/or struts should always be replaced in pairs.*

- ⚡ Be sure that replacement struts are marked with the same code as the ones being removed.

**Note:**

*Aftermarket struts are not marked.*



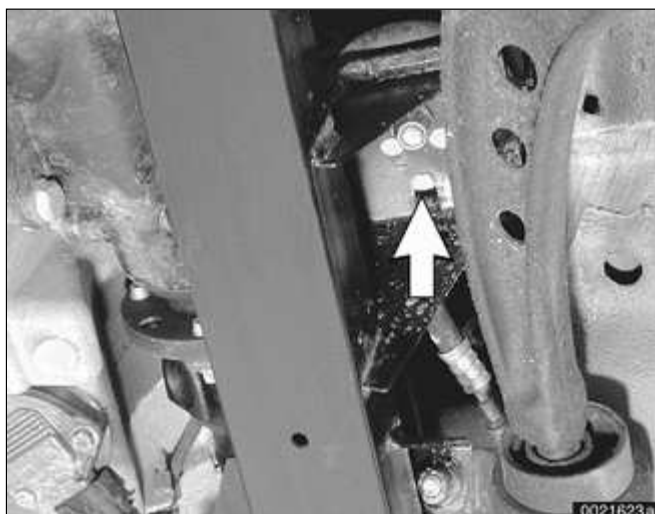
- ⚡ Vehicles with "rough road" package are equipped with a spacer plate above the upper strut mount. Make sure the strut mount locating pin fits in the corresponding bore of the spacer plate.

**Note:**

*If there is no locating bore in the strut tower for the pin in the replacement upper strut mount to fit, drive out the pin before installing the new mount.*



- ⚡ Replace springs in pairs only. The part number (**A**) is stamped near the large end of the spring.

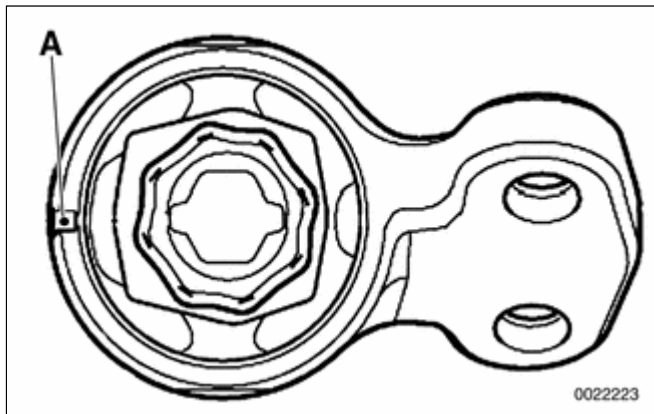


- Installation is reverse of removal, noting the following:
- ◆ Make sure all bolts, bolt holes, and mating surfaces are clean to ensure proper tightening and alignment. Use new self-locking nuts or bolts, where applicable.
  - ◆ Lower engine onto engine mounts, making sure locating pin on left mount (**arrow**) seats correctly in slot of subframe boss.
  - ◆ Allowing engine to settle fully on mounts before tightening engine mount fasteners.
  - ◆ When the job is completed have front end professionally aligned.

Tightening torques	
Control arm rear bracket to subframe M10 bolt (always replace)	59 Nm (44 ft-lb)
Engine mount to subframe M10 self locking nut	45 Nm (33 ft-lb)
Inner ball joint to control arm M14 self-locking nut (always replace)	80 Nm (59 ft-lb)
Inner ball joint mount to subframe M12 bolt	77 Nm (57 ft-lb)
Stabilizer anchor to subframe (M8)	22 Nm (16 ft-lb)



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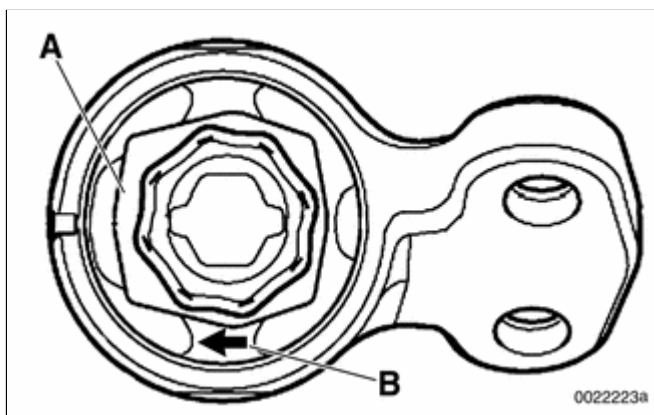


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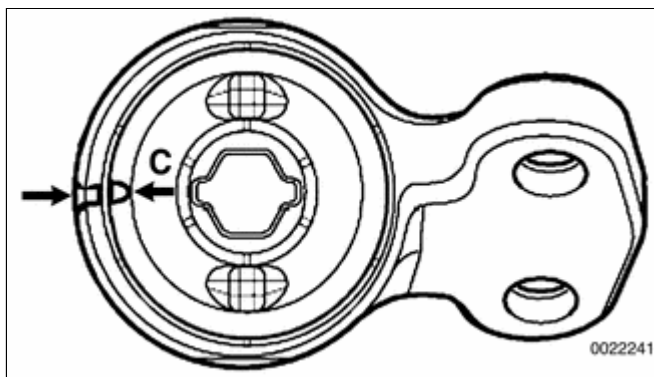
- Inspect bushing bracket. Replace bracket if there is a center punch mark at boss **A**.

**WARNING!**

**If a bushing bracket with the center punch mark is reused with a new bushing, the bushing may fall out.**



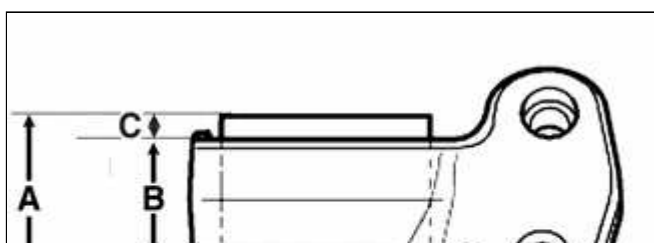
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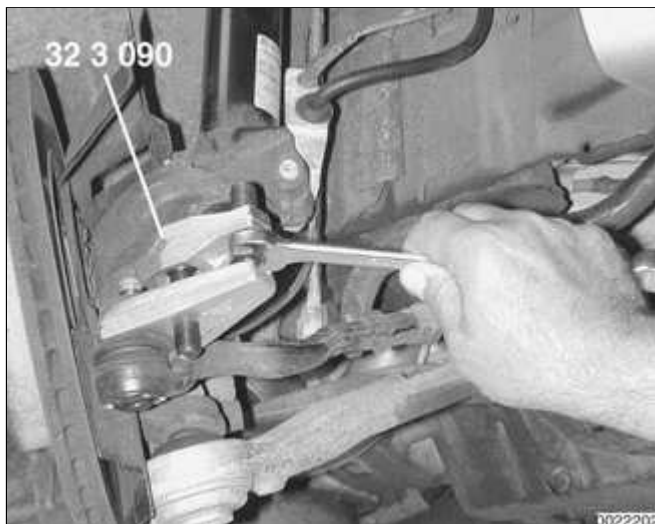
- Use press tools to remove old bushing and press in new. Be sure to line up marks on new bushing with boss on bracket. Depending on manufacturer, mark on bushing may consist of:

- ◆ Extra buffer on inner part of bushing (**A**)
- ◆ Arrow on rubber webbing of bushing (**B**)
- ◆ Indent on outer casing of bushing (**C**)



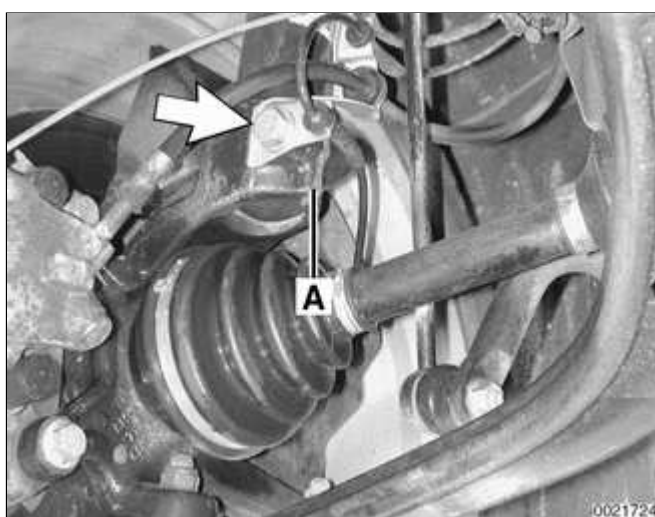
- New bushing must be pressed in so that it protrudes the correct distance from edges of bracket. See ⇒ [Table a](#).

**Table a. Control arm bushing**



▲ Remove tie rod outer end nut. Use BMW special tool 32 3 090 or equivalent to press tie rod end off steering arm.

- Detach control arm from front axle subframe as described earlier.
- Remove outer ball joint nut. Use BMW special tool 32 3 090 or equivalent to separate steering arm and strut assembly from control arm.
- Attach BMW special tool 33 2 111 /116 /117, or equivalent puller, to steering arm using five lug bolts and press out CV joint stub axle inward, out of steering arm.

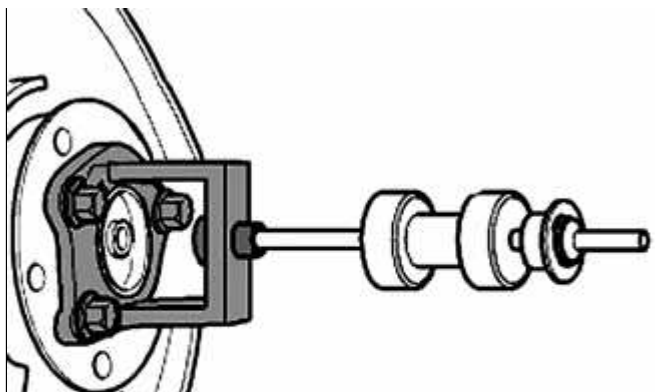


▲ Support steering arm from below. Loosen pinch bolt (**arrow**) at top of steering arm. Spread clamping collar at slot **A**, if necessary, to slide steering arm off strut assembly.

- Working at bench, clamp steering arm in a vise.

**CAUTION!**

**Use a vise with aluminum jaws, or protect steering arm from damage when clamping in vise.**



▲ Remove wheel hub with integral wheel bearing from steering arm using a slide hammer puller (BMW special tools 33 4 201, 33 4 202, 33 4 203 and 33 2 116).

- If bearing inner race stays on wheel hub, use BMW special tool set 33 4 400 or two-jaw puller to remove race.

- ◆ Be sure to restake new collar nut at outboard end of drive axle after tightening to correct torque specifications. Caulk axle threads.
- ◆ Top up differential fluid. See ⇒ [Front differential oil, checking and filling](#)

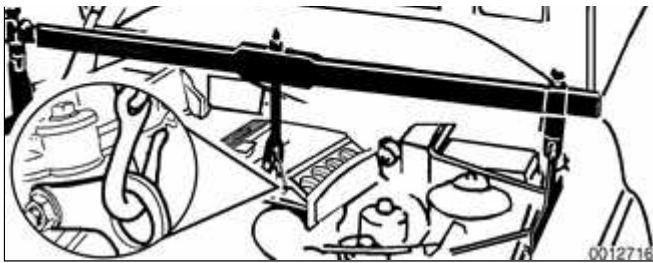
<b>Tightening torques</b>	
Brake caliper to steering arm	110 Nm (81 ft-lb)
Control arm bushing bracket to front axle subframe (replace bolts)	59 Nm (44 ft-lb)
Drive flange collar nut to front hub	420 Nm (310 ft-lb)
Inner ball joint bracket to front axle subframe	77 Nm (57 ft-lb)
Road wheel to hub	100 ± 10 Nm (74 ± 7 ft-lb)
Stabilizer link to stabilizer bar	65 Nm (48 ft-lb)

## Drive axle radial seal, replacing

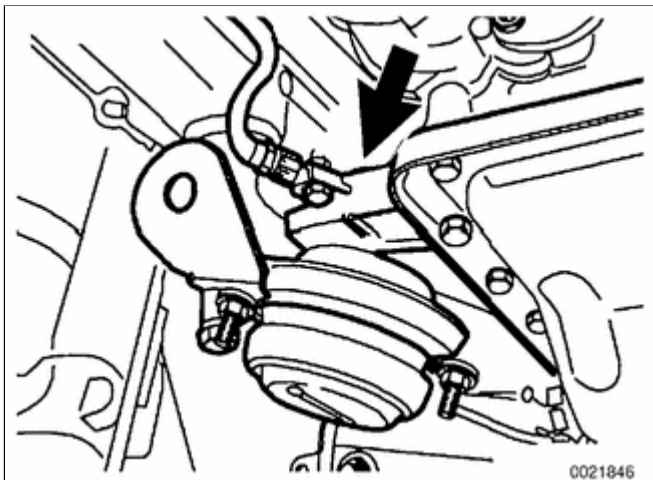
### **Note:**

*If only replacing drive axle radial seal, the axle does not need to be completely removed from the vehicle. Only the inboard CV joint needs to be removed from either the front axle differential or the right axle bearing pedestal. The front suspension may be partially disassembled for radial seal replacement.*

- Lift vehicle and support safely.

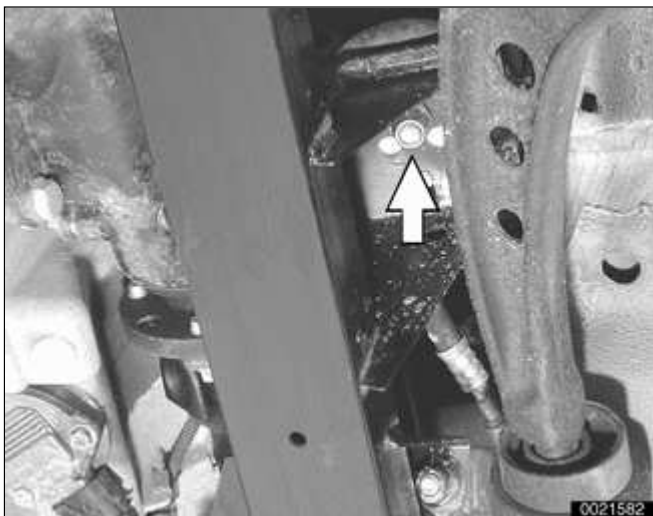


- Release nut at top on right engine mount (**arrow**).



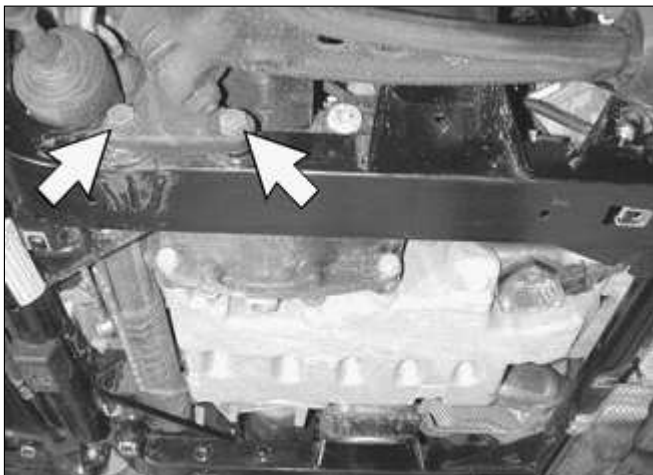
- Remove nut (**arrow**) at bottom on left engine mount.

- Raise engine approximately 10 mm (0.4 in.).
- Remove front wheels. Unbolt brake calipers and suspend from body using stiff wire. See ⇒ [340 Brakes](#).
- Remove front driveshaft. See ⇒ [260 Driveshaft](#).



- Remove left inner ball joint mounting bracket bolts (**arrows**) from subframe.

- Repeat for right side.



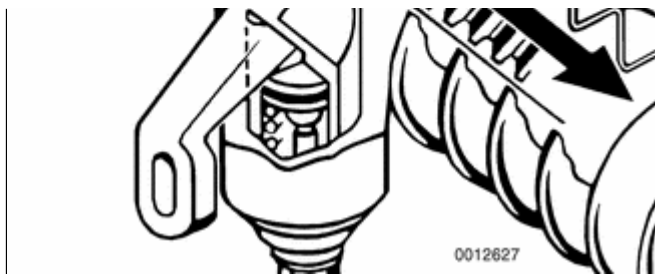
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line from the steering rack to the reservoir loops into the airstream in front of the vehicle and is used as a steering fluid cooler.

The steering rack and linkage require no maintenance other than alignment and periodic inspection for worn components. The rubber rack boots and tie-rod end boots should be inspected periodically for tears or damage and replaced if necessary.

**WARNING!**

- ♦ ***The BMW airbag system (MRS II) is complex. Special precautions must be observed when servicing the system. Serious injury may result if system service is attempted by persons unfamiliar with the BMW airbag system and its approved service procedures. BMW specifies that all inspection and service should be performed by an authorized BMW dealer.***
  
- ♦ ***The BMW E46 is equipped with an airbag mounted in the steering wheel. The airbag is an explosive device and should be treated with extreme caution. Always follow the airbag removal procedure as outlined in ⇒ [721 Airbag System \(SRS\)](#).***
  
- ♦ ***BMW airbags are equipped with a back-up power supply inside the MRS II control module. A 5 second waiting period should be observed after the battery cable has been disconnected. This will allow the reserve power supply to discharge.***

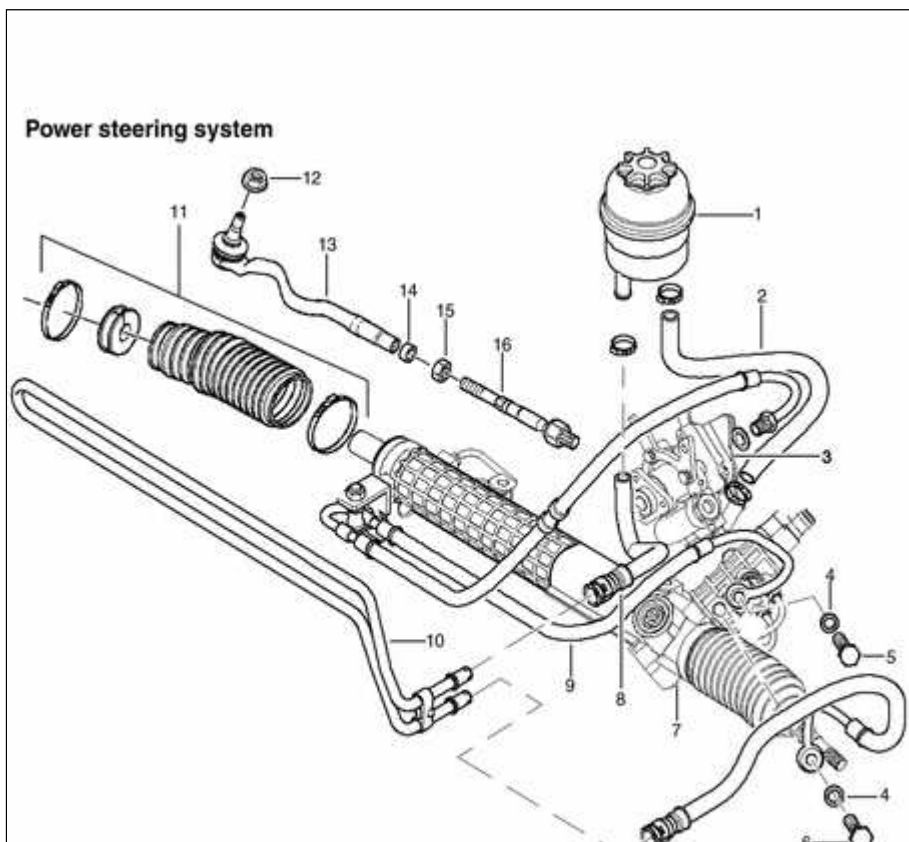
## Power Steering System

The power steering fluid reservoir is located on the lower left front of the engine.

### CAUTION!

- ◆ **Maintain clean conditions when working with open power steering fluid lines.**
- ◆ **Plug off power steering lines and connections to keep out contamination.**

Power steering fluid	
Recommended fluid	ATF (automatic transmission fluid)



### Power steering system

- 1 - Power steering fluid reservoir
  - 2 - Fluid supply line
  - 3 - Power steering pump
  - 4 - Copper sealing ring
  - 5 - Banjo bolt M14
- ◆ tighten to 35 Nm (26 ft-lb)

**WARNING!**

**While performing alignment procedures, make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.**

Normal loaded position	
Each front seat	68 Kg (150 lb)
Rear seat (center)	68 Kg (150 lb)
Trunk	21 Kg (46 lb)
Fuel tank	full

**Table a. Front wheel alignment specifications**

Parameter	Standard suspension	All wheel drive suspension	Sport suspension	Rough road suspension
Toe angle (total)	0° 14' ± 8'			
Camber (difference between left/right max. 30') track differential angle with 20° lock on inside wheel	-20' ± 20' -1° 34' ± 30'	20' ± 20' -53' ± 30'	43' ± 20' -1° 34' ± 30'	+8' ± 20' -1° 34' ± 30'
Caster (difference between left/right max. 30') with 10 wheel lock with 20 wheel lock	5° 26' ± 30' 5° 37' ± 30'	5° 27' ± 30' 5° 37' ± 30'	5° 36' ± 30' 5° 47' ± 30'	5° 17' ± 30' 5° 27' ± 30'
Front wheel displacement	0° ± 15'			

**Table b. Rear wheel alignment specifications**

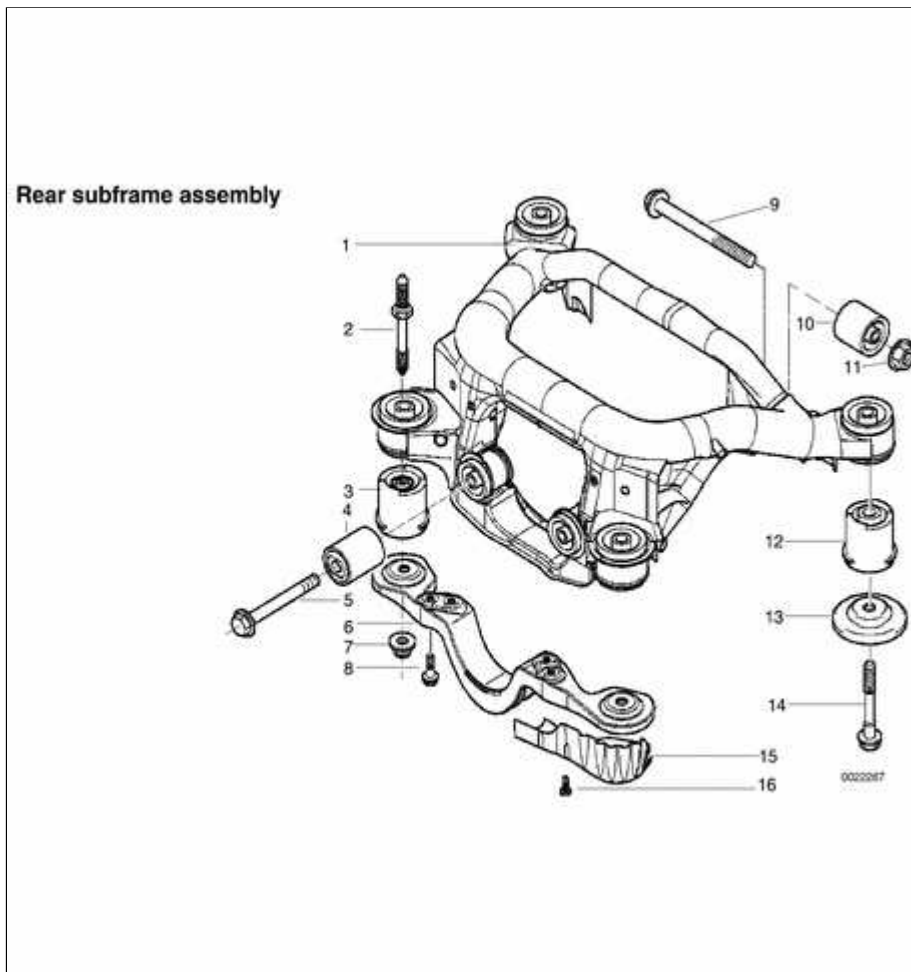
Parameter	Standard suspension	All wheel drive suspension	Sport suspension	Rough road suspension
Toe angle (total)	0° 16' ± 6'			

<b>Tightening torques</b>
---------------------------

position)
-----------

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<b>Tightening torques</b>	
M10 compression nut	64 Nm (47 ft-lb)
M10 Torx bolt	85 Nm (63 ft-lb)
Lower control arm to subframe (M12)	110 Nm (81 ft-lb)
Subframe to body (M12)	77 Nm (57 ft-lb)
Upper control arm to subframe (M12)	77 Nm (57 ft-lb)



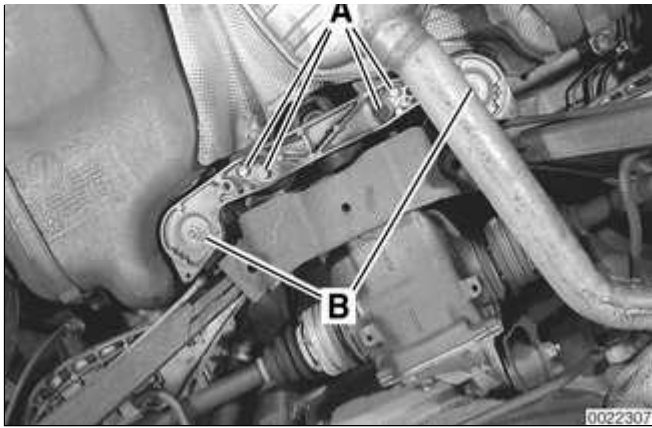
### Rear subframe assembly

- 1 - Rear subframe (final drive carrier)**
- 2 - M12 mounting stud**
- ◆ tighten to 90 Nm (66 ft-lb)
- 3 - Bushing**
- 4 - Bushing**
- 5 - M12 bolt with washer**
- ◆ tighten to 110 Nm (81 ft-lb)
- 6 - Rear suspension reinforcement**
- 7 - M12 self-locking collar nut**

- Reinstall drive axle.

<b>Tightening torques</b>	
Brake rotor to drive flange (M8)	16 Nm (12 ft-lb)
Brake caliper to trailing arm (M12)	67 Nm (50 ft-lb)
Drive axle collar nut to drive flange	
M24	250 Nm (184 ft-lb)
M27	300 Nm (221 ft-lb)
Drive axle to final drive flange	
M10x20 mm Torx bolt	83 Nm (61 ft-lb)
M10x46 mm bolt (black)	100 Nm (74 ft-lb)
M10x46 mm bolt (silver) (always replace)	80 Nm (59 ft-lb)
Road wheel to hub	100 ± 10 Nm (74 ± 7 ft-lb)

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- ◆ Remove heat shield between reinforcement brace and exhaust pipe.
- ◆ Remove bolts (A) mounting brace to undercarriage.
- ◆ Remove nuts (B) mounting brace and front of rear subframe to undercarriage.
- ◆ Lower and remove reinforcement.

**Note:**

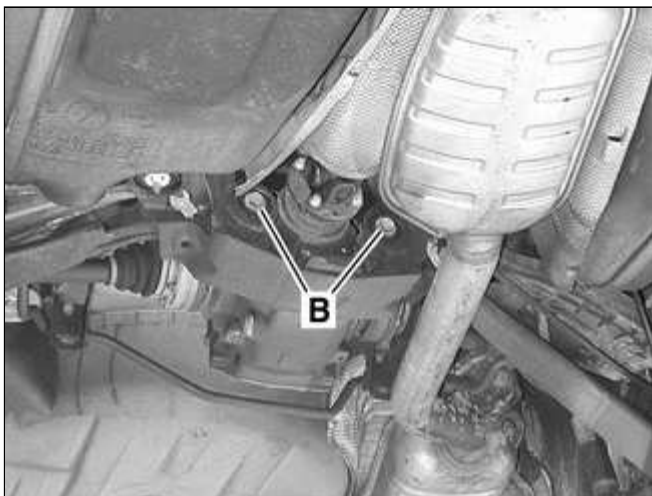
*If necessary, tilt rear half of exhaust system down. Support exhaust system securely.*

- Detach driveshaft from differential input shaft flange and suspend. See ⇒ [260 Driveshaft](#).

**CAUTION!**

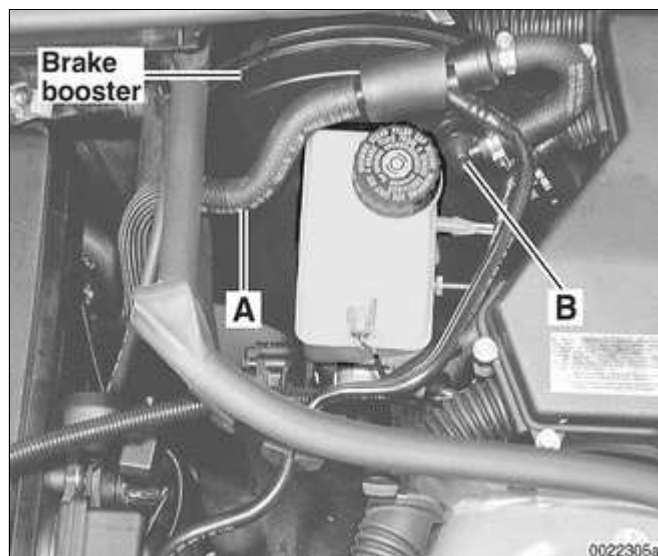
***Suspend the detached drive axle from the car body with a stiff wire hook to prevent damage to the outer CV joint.***

- Remove rear stabilizer bar.



- ▲ Support differential with transmission jack. Remove rear (A) and front (B) mounting bolts at subframe.
  - Slowly lower differential unit and remove toward rear.
  - Installation is reverse of removal. In order to prevent excess vibration and noise, follow sequence for tightening

cylinder is leaking internally, or fluid is leaking externally. Check all brake fluid lines and couplings for leaks, kinks, chafing and corrosion. If no leaks can be found, the master cylinder is faulty and should be replaced.



#### ◀ Check brake booster:

- ◆ Remove vacuum hose (A) from brake booster and install BMW special tool 34 3 100 between connection and hose on non-return valve (B).
- ◆ Start engine and check build-up of partial vacuum. Switch engine off.
- ◆ Press brake pedal to set partial vacuum of no more than 0.8 bar (11.6 psi). Wait for vacuum value to stabilize.
- ◆ When pedal is released, partial vacuum should not drop by more than 0.06 bar (0.8 psi) over 1 hour.
- If vacuum values are not reached:
  - ◆ Check connections of vacuum hoses.
  - ◆ Replace vacuum non-return valve (B).
  - ◆ Check seal between brake booster and master cylinder.
  - ◆ If values still cannot be reached, brake booster must be replaced.

Worn or contaminated brake pads will cause poor braking performance.

caliper piston will have to be pressed back into caliper before caliper can be removed.

**CAUTION!**

***Pressing caliper piston in may cause brake fluid reservoir to overflow. To prevent this, use a clean syringe to first remove some fluid from reservoir.***

- ◆ Open caliper bleeder screw only when applying force to the piston. Do not allow air to be drawn in through bleeder screw. Catch expelled fluid in appropriate container.
- ◆ Do not let brake caliper hang from brake hose. Suspend it from chassis using stiff wire.
- ◆ Inspect brake caliper for signs of leakage. Check that caliper piston slides smoothly into caliper. Replace caliper if any faults are found.
- ◆ Thoroughly clean all contact points on caliper and brake pad carrier. Clean guide bolts and make sure they slide freely.
- ◆ Do not lubricate guide bolts.
- ◆ Bleed brake system if hydraulic line to caliper has been removed or replaced. See ⇒ [Bleeding brakes](#).

Tightening torque	
Caliper to brake pad carrier mounting bolts	30 Nm (22 ft-lb)

mounting nuts.

- ◆ Replace sealing O-ring between master cylinder and brake booster.
  
- ◆ Bleed brake system as described earlier.

**CAUTION!**

***Do not over-torque the master cylinder mounting bolts. This could damage the brake booster and prevent proper vacuum build-up.***

Tightening torques	
Brake master cylinder to brake booster	26 Nm (19 ft-lb)
Brake booster to bulkhead	22 Nm (16 ft-lb)
Brake fluid line to master cylinder or hydraulic unit	18 Nm (13 ft-lb)

**Note:**

*When replacing the brake booster one-way valve or vacuum hose, install the valve so that the molded arrow is pointing toward the intake manifold. Use new hose clamps.*

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Tightening torques	
Sensor bracket to body	8 Nm (6 ft-lb)

## DSC steering angle sensor



- A Vehicles equipped with DSC have a steering angle sensor (**arrow**) mounted to the steering column right above the pedal cluster. Replacement of this component requires special tools to properly align the steering column and sensor.

After removal or replacement the steering angle sensor requires calibration using BMW scan tools DIS or MoDiC. Once calibrated, the sensor sends a confirmation ID code to the DSC control module to indicate proper calibration.

For steering column removal see ⇒ [320 Steering and Wheel Alignment](#).

## DSC pressure sensor

Rear wheel drive cars: Two DSC pressure sensors are used, mounted in the brake master cylinder.

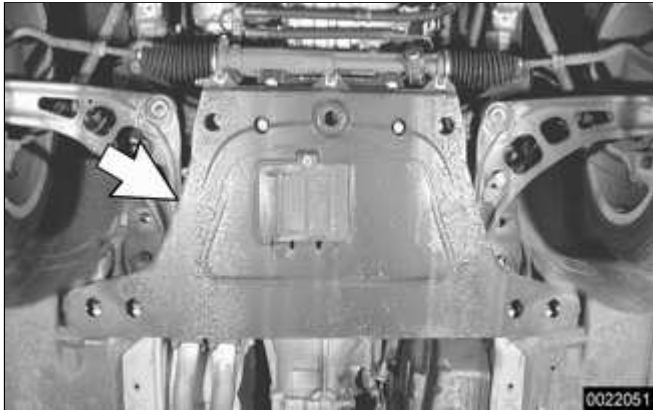
All wheel drive cars: One DSC pressure sensor is used, mounted on the hydraulic unit.

Tightening torques	
Pressure sensor to hydraulic unit	19 Nm (14 ft-lb)
Pressure sensor to master cylinder	15 + 4 Nm (11 + 3 ft-lb)

## Hydraulic unit/control module,

refinement. Interior materials and colors, the soft top and the light-alloy wheels have been carefully matched.

Although the automatic Convertible roof is standard, a hard-top in body color with heated rear window is available as an option for the cold season.



◀ The Convertible body structure includes many passive safety refinements over its fixed-top counterparts.

- ◆ To achieve a more rigid underbody, an aluminum reinforcement plate (**arrow**) is bolted to the front undercarriage and reinforcing struts are bolted to the rear undercarriage.

**Note:**

*The aluminum reinforcement plate is used in all rear wheel drive E46 models produced from December 2000.*

- ◆ Transverse seat support reinforcements in the floor pan accommodates the new seat-integrated seat belts (SGS).
- ◆ The windshield frame is reinforced with stepped reinforcing tubes which allow it to act as roll-over protection.
- ◆ The windshield is bonded into its frame.
- ◆ There are tubular door reinforcements.
- ◆ The rollover protection system is tripped into position in a fraction of second. With this feature, two bars fully independent of each other come up behind each rear-seat

## Washers.

- ◆ Central locking with power trunk release. See ⇒ [515 Central Locking and Anti-theft.](#)
- ◆ Keyless entry (FZV)
- ◆ Power window control. See ⇒ [512 Door Windows.](#)
- ◆ Car/key memory
- ◆ Interior lighting
- ◆ Alarm system (DWA)
- ◆ Electronic consumer sleep mode. See ⇒ [600 Electrical System–General.](#)

Other functions not directly controlled by ZKE V but interconnected:

- ◆ Rain sensor (AIC)
- ◆ Sunroof operation. See ⇒ [540 Sunroof.](#)
- ◆ Seat memory. See ⇒ [520 Seats.](#)
- ◆ Outside rear-view mirror control and heating
- ◆ Windshield washer jet heating



- ◆ ZKE V Diagnostic Trouble Codes (DTCs) are accessible electronically through the data-link connector (DLC). See ⇒ [610 Electrical Component Locations.](#)



- 8 - Stop buffer**
- 9 - Spring pin**
- 10 - Lower hood lock**
- 11 - Saucer head screw**
- 12 - Eccentric wheel**
- 13 - Hex nut with plate**
- 14 - Hood catch**
- 15 - Bowden cable, center**

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## Rear side trim panel, removing and installing (Coupe model)

- Remove rear seat cushion.  
Remove rear backrest side section. See ⇒ [520 Seats](#).

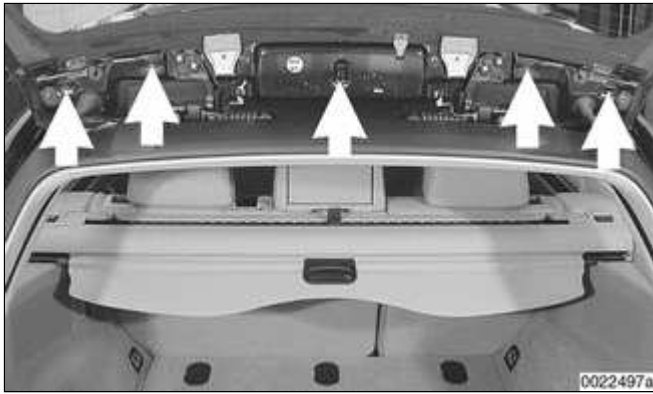


- ✦ Using a trim tool, gently pry up door threshold trim. Starting at A-pillar, press radius of trim downwards while sliding trim forward off trim clips. Remove clips from body using pliers. Save for installation.

- Remove trim plugs on armrest.  
Remove panel mounting screws.
- Gently pry off panel using trim tool.
- Disconnect electrical harness connectors as necessary. Remove side panel by lifting up and toward interior.
- Installation is reverse of removal.  
Replace any damaged plastic parts or clips.

## Rear side trim panels, removing and installing (Convertible model)

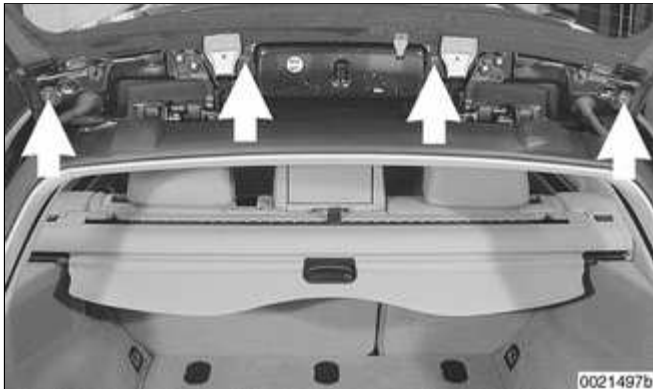
- Remove rear seat cushion.  
Remove rear backrest side section. See ⇒ [520 Seats](#).
- Lower side windows; open convertible roof.
- Remove side panel insert:



- ✦ Raise rear window. Remove inner trim from glass panel by releasing clips on trim from retainers (**arrows**). For clarity, trim is removed in photo.

**Note:**

*Use two plastic prying wedge tools to release each pin retaining trim.*

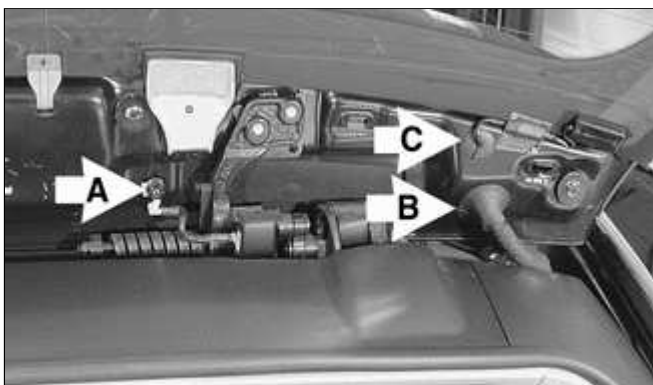


- ✦ Release spoiler mounting bolts (**arrows**). Disconnect wiring to brake light and AM radio antenna and release washer hose. Remove spoiler. (Window shown in place).

- Installation is the reverse of removal. Replace any waterproofing sheeting disturbed during removal. Adjust spoiler as shown later in this section.

## Rear window, removing and installing

- Remove rear spoiler as detailed above.
- Working at top outside of window, remove waterproofing sheeting over antenna amplifier and disconnect wiring connections. Release tape retaining wiring harnesses.



- ✦ Release grounds (**A**) and rubber grommets (**B, C**) at both hinges.

## Front bumper, removing and installing

- Raise and properly support vehicle.

### **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.**

- Working underneath car, remove screws from left and right side corner trim, then remove trim.



- ◀ Remove bumper cover retaining screws (**arrows**).

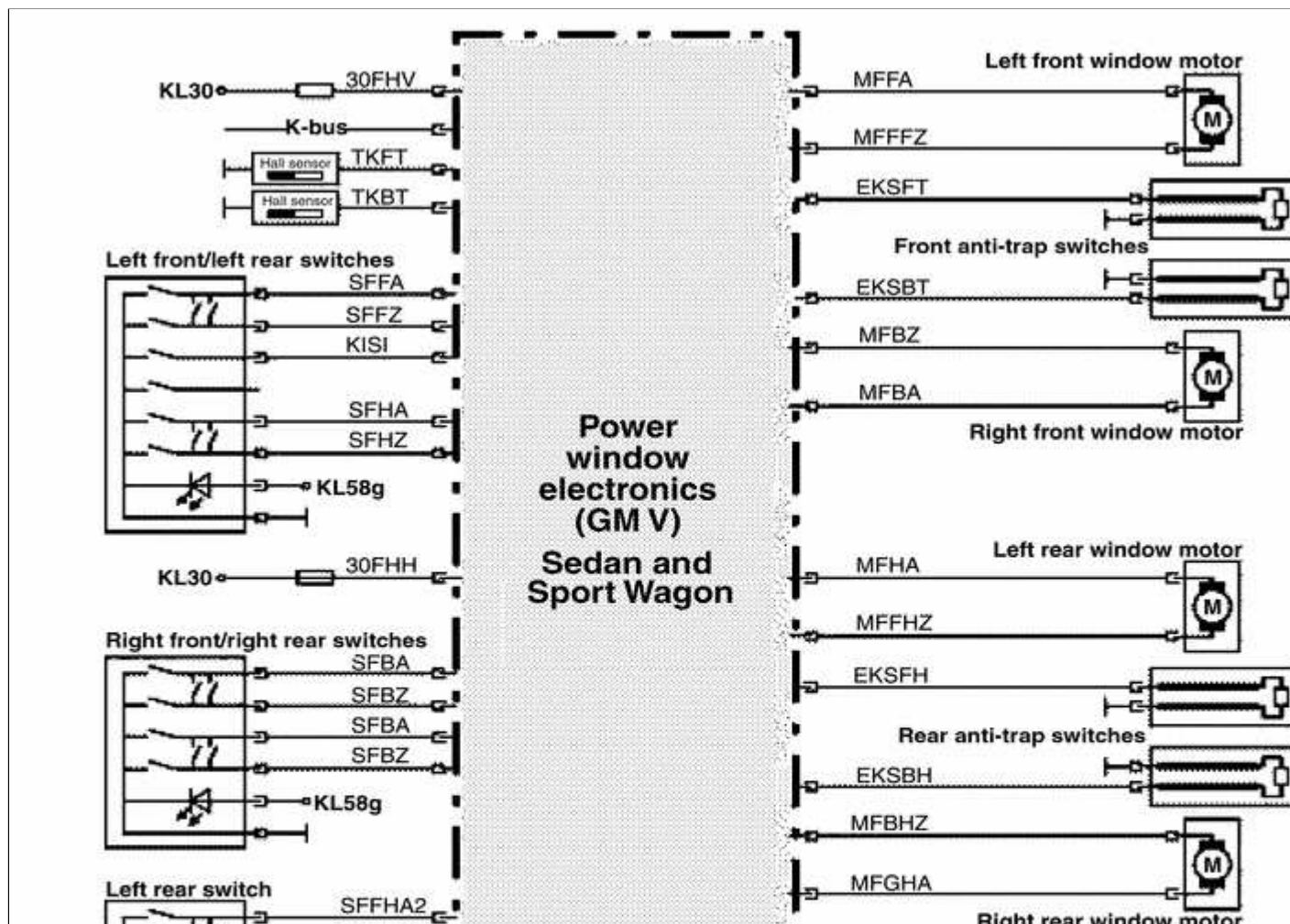


- ◀ Remove screws (**arrows**) retaining bumper bar to impact absorbers on left and right sides.
  - Slide bumper assembly out a few inches and disconnect the following connections, if applicable:
    - ◆ Electrical harness connectors at fog light assemblies.
    - ◆ Electrical harness connector at signal horn.
    - ◆ Electrical harness connectors at

customized with the Car Memory function. See => [515 Central Locking and Anti-theft](#).

- ◆ After the ignition is switched off, electric windows can be operated until a door is opened or until 16 minutes has elapsed.
- ◆ The GM V bases window motor end position on current draw (load). There is a maximum window motor run time of 8 seconds. The motor is then switched off even if the end position load sensor fails.

**Power window electronics (GM V) Sedan and Sport Wagon**



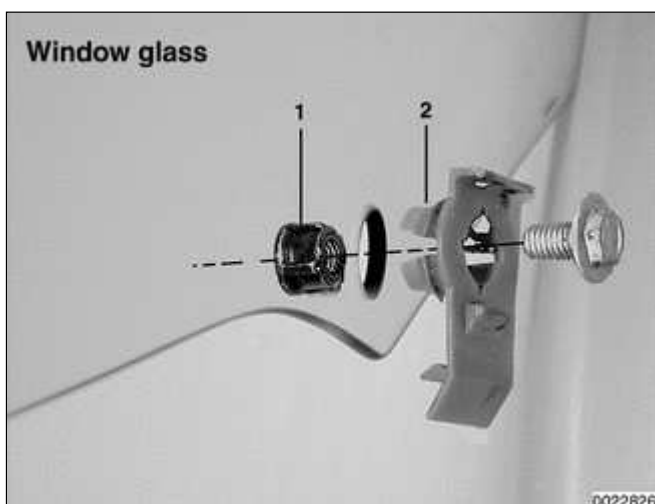


(4.5 in.) from bottom.

- ◆ Remove window retaining screw (inset) at window regulator rail.

**WARNING!**

**Once the window is positioned correctly, disconnect harness connector from power window motor to prevent accidental operation of the window.**



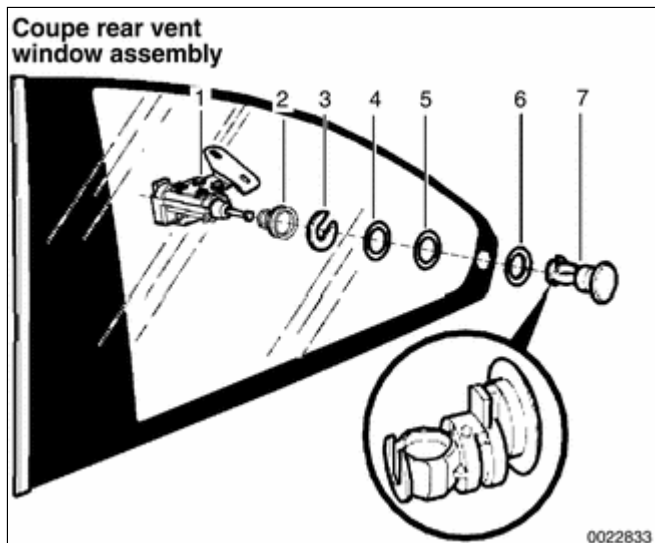
- ✦ Detach plastic window retainer from glass:

- ◆ Push expander nut (1) out of plastic retainer.
- ◆ Squeeze retainer tabs (2) and remove from glass.

**Note:**

*BMW recommends replacing the plastic window retainer every time the glass is removed from the door.*

- Pull window glass straight up to lift out of door.
- Installation is reverse of removal.
- ◆ Replace plastic window retainer once glass is inside door.
- ◆ If applicable, use new mounting bolts when reinstalling side-impact airbag to door.
- ◆ Rear window does not need adjustment.



Refer to accompanying illustration when removing Coupe rear vent window or vent latch mechanism.

- 1 - Vent window drive
- 2 - Inner cap
- 3 - Retainer
- 4 - Washer
- 5 - Washer
- 6 - Shim
- 7 - Glass support

- ◆ When installing, make sure U-shaped opening in glass support points to rear of car.
- ◆ To access rear vent hinges, remove B pillar (door pillar) trim.
- ◆ When reinstalling make sure window seals completely. Note gap clearances below.

<b>Vent window clearances</b>	
Front trim strip to rear edge of front window	up to 6 mm (0.24 in.)
Rear of window to water drain	up to 1.8 mm (0.07 in.)
Top of window to water drain	1 mm (0.04 in.)

<b>Tightening torques</b>	
Vent window to body (M6 nut)	6.2 Nm (55 in-lb)

## Rear side window (Convertible

## Center Console

The console between the two front seats starts behind the shifter housing. It houses the parking brake handle, optional telephone and oddments storage tray. The rear portion of the console houses the ashtray and covers the emergency brake cable ends.

The optional front seat armrest is part of this console.

### Center console, removing and installing



- ✦ Press rolling cover of rear ashtray down. Depress cover fully to pop ashtray out of console. Remove ashtray.

- Remove retaining screws and bracket.
- Remove ashtray cover and housing. Disconnect electrical harness connector for ashtray courtesy light.
- Remove screws at base of ashtray compartment in console.



- ✦ Unclip trim boot for parking brake lever and pull boot and handle forward off brake lever.
- Gently pry up boot or trim at transmission selector. On automatic transmission vehicles, unplug connector for gear indicator light.

## General

This section covers repair information for door, trunk and cargo compartment locks and central locking. Also covered are Electronic Immobilization System (EWS) and anti-theft alarm (DWA).

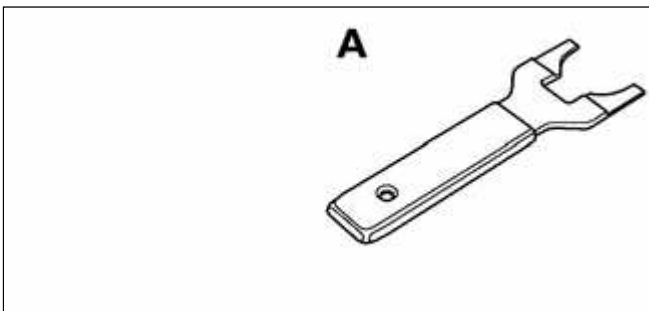
Keep in mind that E46 cars are equipped with sophisticated and self-diagnostic electrical systems. When experiencing malfunctions relating to central locking or anti-theft systems, it is recommended that the system be diagnosed using the BMW service tester DIS or MoDiC or equivalent. An advanced diagnostic scan tool can usually pinpoint electrical faults quickly and safely. Consult an authorized BMW dealer.

### Note:

*Additional general electrical information can be found in ⇒ [610 Electrical Component Locations](#) and [Electrical Wiring Diagrams](#).*

## Special tools

A few special tools may be necessary for repairs in this section.



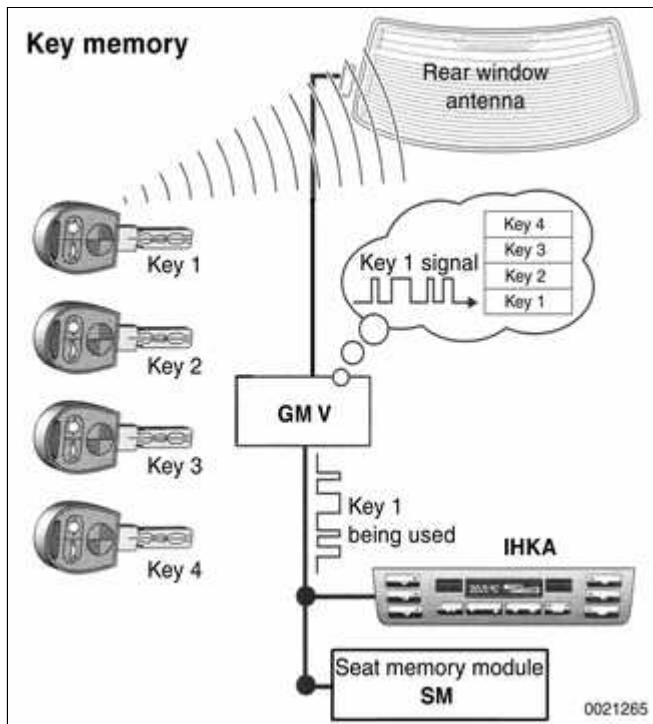
- ◀ Ring antenna removal tool BMW 61 3 300



- ◀ Front door lock adjustment tool 4 mm Allen wrench

received at the GM V. Therefore Car Memory/Key Memory features will not be activated.

## Remote key initialization



Initialization of FZV keys is required to establish lock/unlock signal synchronization with the GM V. The initialization procedure provides the GM V with a key identification number and a "rolling code" for each key. If initialization is not performed, the GM V will not respond to the key signals.

Up to 4 remote keys can be initialized. They must be initialized at the same time. Key initialization is only possible with the vehicle unlocked.

- Close all doors and have all keys available.
- Using key number 1, turn the ignition switch to KL R (accessory position), then switch off within 5 seconds and remove the first key.
- Within 30 seconds of turning the ignition switch to OFF Press and hold button #2
- While holding button #2, press and release ("tap") button #1 three times within 10 seconds.
- Release both buttons.

### Note:

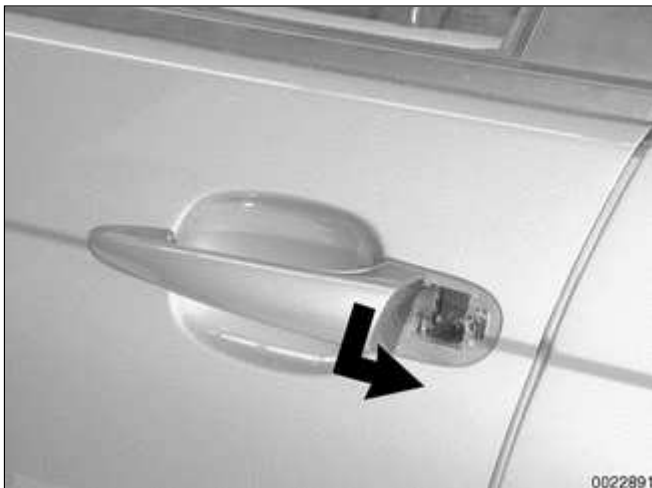
The Key Memory function of the GM responds to the key identification number of each key. If the keys are not initialized in the same order prior to initialization,



- ◆ On Sedan or Sport Wagon:  
Replace cylinder mounting bolt  
access hole trim cover if necessary.

### Door handle, removing and installing (to production date 9/2000)

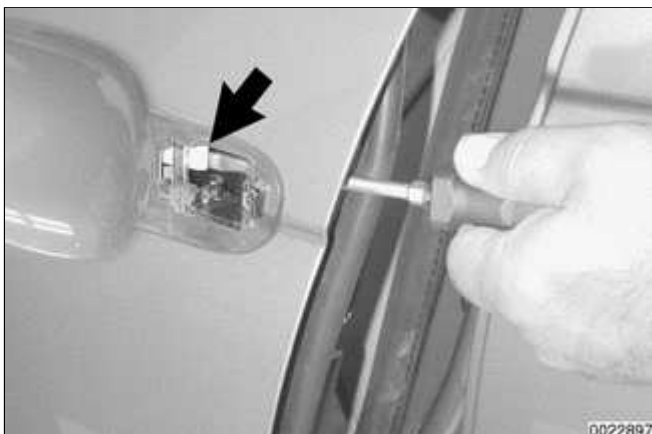
- On driver's door: Remove door lock cylinder as described earlier.
- Other doors: Remove door handle rear anchor. Procedure is similar to removing driver's door lock cylinder described earlier.



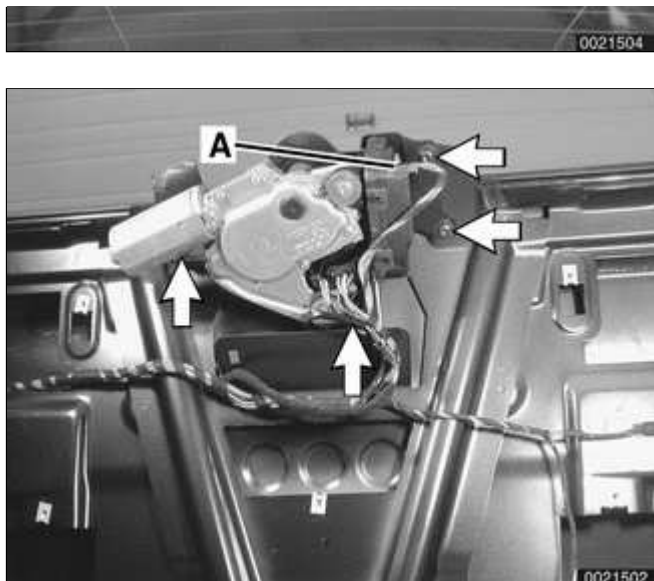
- ◀ Pull handle out as far as it will go, then backward approx. 2 mm (0.08 in.).
- Push handle in slightly (approx. 4 mm/0.16 in.).
- Remove door handle from door by angling out of door cavity.

#### Note:

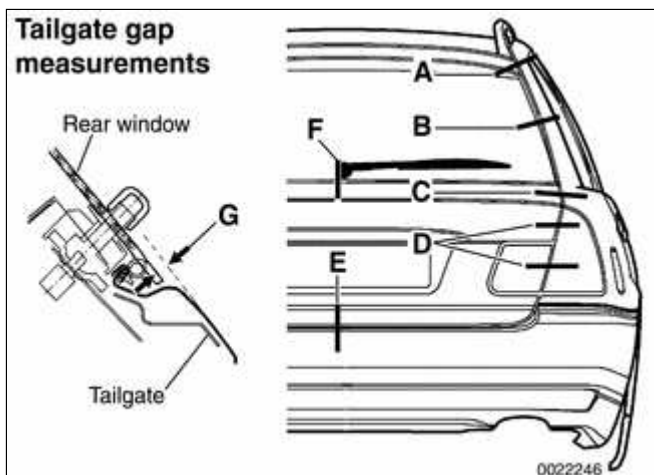
*Make sure the lock release pawl at the rear of the handle and the mounting guide at the front of the handle are intact.*



- ◀ Before reinstalling, insert screwdriver through access hole in edge of door to push lock release lever (**arrow**) outward.
- Insert outside handle and snap forward until a click is heard.
- Be sure to check unlocking of rotary latch and outside door handle overtravel as described above under ⇒ [Rotary latch adjustments](#).



- ◀ To remove rear window lock:
  - ◆ Open tailgate. Remove tailgate trim panel.
  - ◆ Detach window lock electrical harness connector (A).
  - ◆ Remove lock mounting screws (arrows).
  - ◆ Slide lock out from under rear window wiper motor.
  - ◆ Reinstall lock mounting bolts finger tight. Adjust lock position before tightening bolts.
- To adjust lock position:
  - ◆ Close window slowly, allowing lock to center itself on striker.
  - ◆ Tighten striker mounting bolts, then check rear window to body gaps as shown below.
  - ◆ Tighten lock mounting bolts.

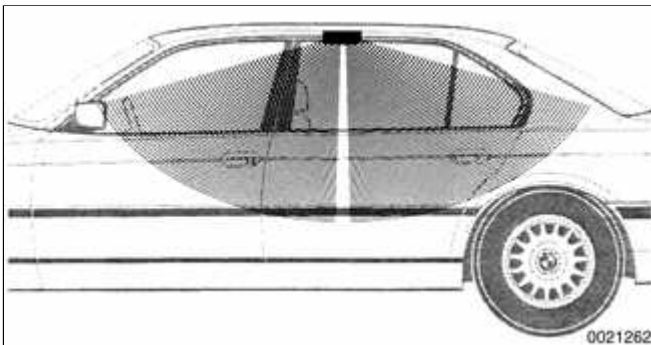


- ◀ When reinstalling, or to adjust tailgate or rear window alignment, adjust position of tailgate striker or window lock with mounting bolts finger tight.
  - ◆ Set gap measurements as listed below.
  - ◆ Also see ⇒ [412 Trunk Lid, Tailgate](#).

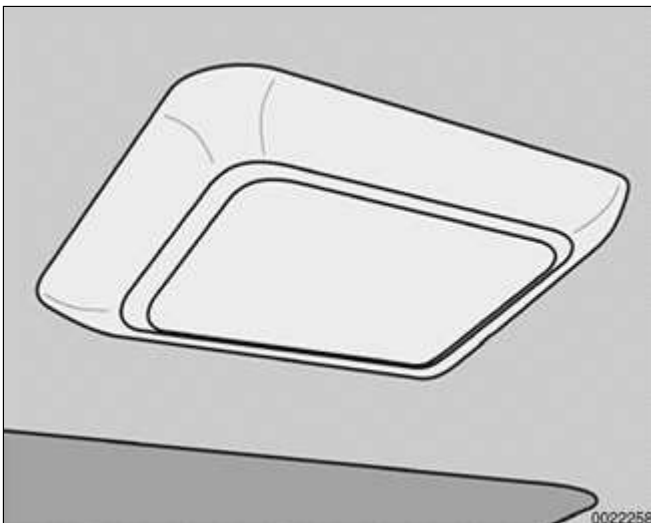
and is currently monitoring the vehicle angle. b. If the tilt sensor detects a change in the vehicle angle when DWA is armed, the NG signal is switched to inform the GM V to activate the siren.

When the tilt sensor receives the STDWA signal from the GM V, the angle of the vehicle is memorized and monitored by the solid state electronics. Once armed, if the angle changes, the tilt sensor provides a switched ground signal to the GM V to activate DWA.

### Interior protection (UIS)



- ◀ The combined ultrasonic transmitter and receiver in UIS monitors the vehicle interior for motion.



- ◀ The UIS is mounted in the center of the headliner panel even with the door (B) pillar. Due to the design of the vehicles interior, the sensor is unidirectional and must be installed in the proper direction to ensure proper operation of the system (trim cover ensures directional installation).

Every time the DWA system is armed (STDWA signal), the sensor adapts to whatever objects are stationary in the interior. The sensor emits ultrasonic waves in a programmed timed cycle. It receives echoes of the emitted signals. The UIS amplifies the received sound wave signals and compares them with the transmitted waves. The UIS also checks the incoming echoes for background hiss (wind noise through a



- ▲ Remove plastic caps over front seat mounting nuts, then remove mounting nuts (**arrows**).
- Disconnect negative (-) cable from battery.

**CAUTION!**

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

- ▲ Tilt seat back to access electrical harness connectors. Slide lock to release and disconnect. Cut or untwist wire ties as necessary.
- Remove seat from car. The headrests may be removed to provide additional clearance.

**Note:**

*Use a blanket to protect door sill from scuffing by seat rail during seat removal.*

- Installation is reverse of removal. Use wire ties or equivalent means to keep seat harness wiring from fraying.

Tightening torque	
Front seat to floor	45 Nm (33 ft-lb)
Seat belt end to seat	48 Nm (35 ft-lb)



rearmost edge with a plastic tool.



Remove sunroof motor mounting screws (**arrows**).

- Installation is the reverse of removal. Perform initialization procedure as described earlier.

Tightening torque	
Sunroof motor to sunroof carrier	2.8 Nm (25 in-lb)

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## Convertible Top Components

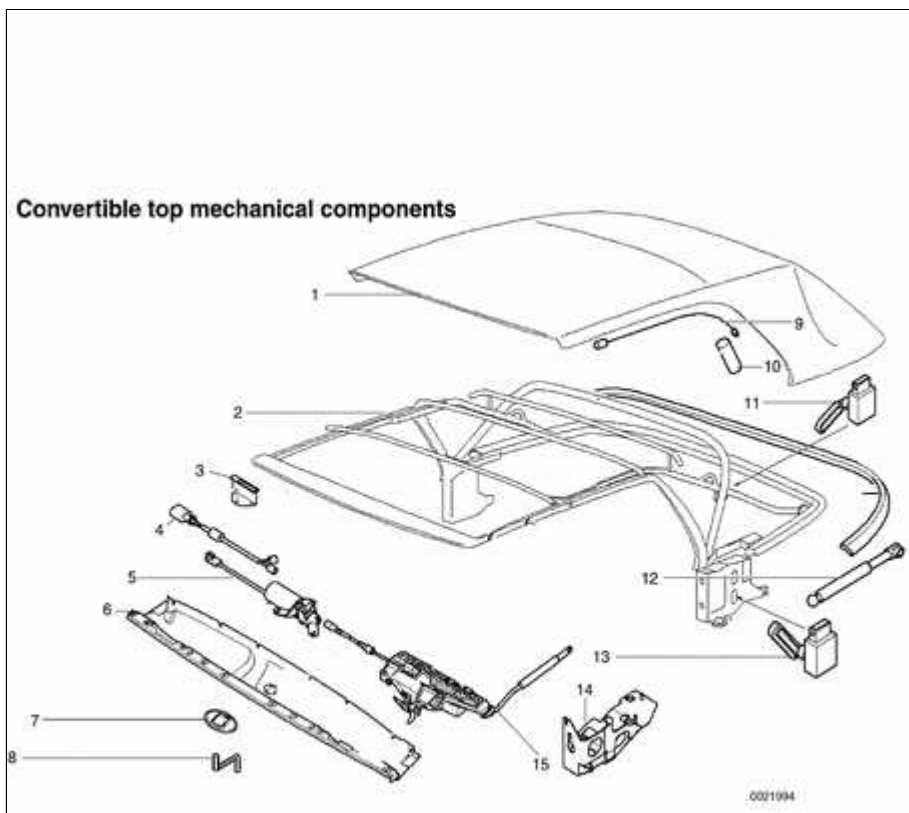
### Mechanical top components

The metal folding frame of the top is bolted to the sides of the car behind the door pillars (B-pillars).

The three layer soft top consists of:

- ◆ Fabric outer layer
- ◆ Middle fleece liner
- ◆ Inner liner

Refer to the accompanying illustration for mechanical component locations.



### Convertible top mechanical components

- 1 - Folding top
- 2 - Folding top frame
- 3 - Base plate
- 4 - Windshield frame lock microswitch
- 5 - Windshield frame lock drive motor
- 6 - Windshield

## E46 Electrical System

E46 cars are electrically complex. Many vehicle systems and subsystems are interconnected or integrated. In addition, the requirements of second generation On-Board Diagnostics (OBD II) are such that there are now many more circuits and wires in the vehicle than ever before. The components must exchange large volumes of data with one another in order to perform their various functions.

The use of dedicated data lines for each link in the system has reached the limits of its capabilities. On the one hand, wiring harnesses now must be so complex that they become unmanageable. In addition, the finite number of pins on conventional connectors becomes a limiting factor in electronic control module development.

The solution has been found in the use of specialized, vehicle compatible serial bus systems. The E46 bus system is summarized in ⇒ [Table a.](#)

<b>Table a. E46 busses</b>	
<b>Bus</b>	<b>Circuits covered</b>
K-bus	Driver information systems (instrument cluster, Check Control, on-board computer) Central Body Electronics (ZKE V) General Module (GM V) Seat memory (SM) Sunroof (SHD) Rain sensor (AIC) Telephone and sound system Headlight module (LSZ)

<b>Number</b>	<b>Circuit description</b>
30	Battery positive (+) voltage. Supplies power whenever battery is connected. (Not dependent on ignition switch position, unfused)
31	Ground, battery negative (-) terminal
50	Supplies power from battery to starter solenoid when ignition switch is in START position only
+54	Originates at ignition switch. Supplies power when ignition switch is in the RUN position only
85	Ground side (-) of relay coil
86	Power-in side (+) of relay coil
87	Relay actuated contact
D	Alternator warning light and field energizing circuit

Additional abbreviations shown in the wiring diagrams are given below.

**Table d. Common E46 abbreviation**

<b>Abbreviation</b>	<b>Component or system</b>	<b>Abbreviation</b>	<b>Component or system</b>
ABS	antilock brakes	KL 50	ignition switch start position
A/C	air conditioning	LDP	fuel tank leak diagnosis pump (DME MS 42.0)

cautions before doing any work on your electrical system.

**WARNING!**

**The battery safety terminal, pyrotechnic seat belt tensioners, and airbags utilize explosive devices and must be handled with extreme care. Refer to the warnings and cautions in ⇒ [121 Battery, Alternator, Starter](#); ⇒ [720 Seat Belts](#); and ⇒ [721 Airbag System \(SRS\)](#).**

**CAUTION!**

- ◆ **Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.**
- ◆ **Relay and fuse positions are subject to change and may vary from car to car. If questions arise, an authorized BMW dealer is the best source for the most accurate and up-to-date information.**
- ◆ **A good way to verify a relay position is to compare the wiring colors at the relay socket to the colors indicated on the wiring diagrams located at the rear of this manual.**
- ◆ **Always switch the ignition off and remove the negative (-) battery cable before removing any electrical components. Connect and disconnect ignition system wires, multiple connectors, and ignition test equipment leads only while the ignition is switched off.**

Fuse	Rating	Protected circuit
		46) Seat heating (see also fuse 42) Roller sun blind (see also fuse 42) Tire pressure control (see also fuses 31, 42, 69)
13	7.5A	Roll-over protection system (Convertible)
14	5A	Electronic immobilizer (EWS) (see also fuse 67) Starter interlock
15	5A	Rain sensor Rear wiper (Sport Wagon, see also fuse 45)
16	not used	
17		
18		
19		
20		
21		
22	5A	Engine control (M3, see also fuses 29, 30) Sequential transmission (M3, see also fuse 22)
23	5A	Heater (see also fuses 28, 62)
24	5A	Electrochromic rear view mirror (see also fuse 67) Park distance control
25	5A	Heated outside mirror, passenger Heated spray nozzles
26	5A	Cigarette lighter (Australia, see also fuse 47) Garage door opener
27	10A	Engine control (see also fuses 29, 30) Back-up light
28	5A	Air conditioner (see also fuses 62, 63) Blower (see also fuse 50) Heater (see also fuses 23, 62)
29	5A	Engine control (see also fuses 27, 30) Engine control (M3, see also fuses 22, 30)
30	7.5A	Engine control (see also fuses 27, 29) Engine control (M3, see also fuses 22, 29) OBD II system (see also fuse 43)

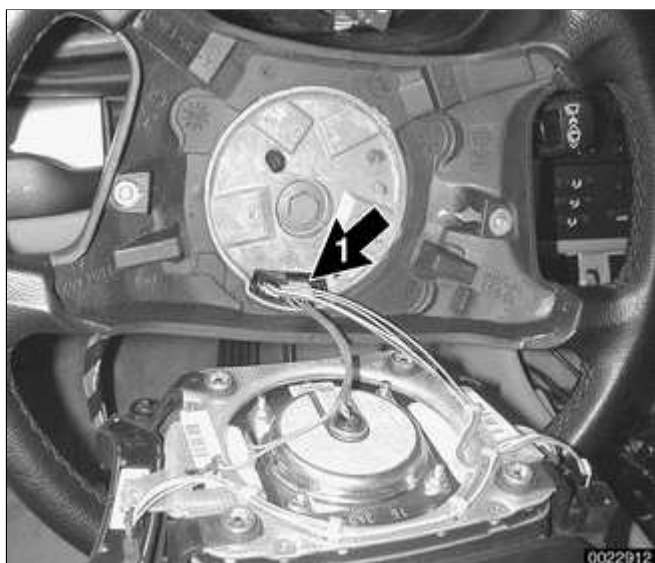
Component	Year, model	Location	Refer to
recirculation system)			
Airbag connector, passenger side	1999 - 2001	Right side dashboard support	⇒ <a href="#">Fig. 41</a>
Airbag connector, steering wheel	1999 - 2001	Under steering wheel airbag	⇒ <a href="#">Fig. 34</a>
Airbag control module (MRS module)	1999 - 2001	Under parking brake lever console, under carpet	⇒ <a href="#">Fig. 9</a>
Airbag crash sensor, side-impact airbag (left/right)	1999 - 2001	Front seat crossmember under carpet (left/right)	
Airbag warning light	1999 - 2001	In instrument cluster	
Airbag, driver side	1999 - 2001	Steering wheel center pad	
Airbag, head protection (HPS), electrical connector (left/right)	1999 - 2001	At bottom of windshield pillar (A pillar) behind dashboard (left/right)	⇒ <a href="#">Fig. 42</a>
Airbag, passenger side	1999 - 2001	Right side dashboard	⇒ <a href="#">Fig. 41</a>
Airbag, side-impact (left/right front/rear)	1999 - 2001	Inside door (left/right, front/rear)	
Alarm control module (DWA)	1999 - 2001	Above main fuse box behind glove box	
Alarm indicator LED (DWA)	1999 - 2001	Attached to rear view mirror	
Alarm siren (DWA)	1999 - 2001	Right side rear of engine compartment near wipers	
Alarm siren battery (DWA)	1999 - 2001	Inside alarm siren	
All season traction (AST)		see ABS/ASC entries	
Alternator (generator)	1999 -2001	Left front of cylinder block	
Amplifier, radio	1999 - 2001	Left side trunk or cargo compartment behind trim panel	⇒ <a href="#">Fig. 54</a> , ⇒ <a href="#">Fig. 57</a>

Component	Year, model	Location	Refer to
Lumbar support air compressor	1999 - 2001	Under each seat equipped with support system	
Lumbar support control switch	1999 - 2001	Below seat base trim	
Lumbar support switch	1999 - 2001	Four-way toggle switch at base of seat, near seat control switches	
Main fuse panel		see Fuse panel, main	
Main relay panel		see Relay panel, main	
Main harness fuse		see Fuse for main harness F108 (200 amp)	
Mass air flow sensor	1999 - 2001	Left side engine compartment	⇒ <a href="#">Fig. 17</a>
Mixing actuators		see Air distribution motors	
MRS module		see Airbag control module	
Multi-function clock	1999 - 2001	In dash cluster below speedometer and tachometer	
Multiple restraint system (MRS) module		see Airbag control module	
Navigation computer	1999 - 2001	Left side of trunk	
Neutral safety switch		see Automatic transmission range switch	
OBD II connector (16-pin DLC)	1999 - 2001	In left footwell top trim, under left side of instrument cluster (see also Data link connector)	
Oil pressure switch	1999 - 2001	Left front of engine at oil filter housing	⇒ <a href="#">Fig. 26</a>
Oil temperature sensor	1999 - 2001	Left front of engine at oil filter housing	⇒ <a href="#">Fig. 26</a>
On-board computer	1999 - 2001	In instrument cluster	
On-board monitor	1999 - 2001	In center of dashboard	
Outside air temperature sensor	1999 - 2001	Under left side of front bumper	
Outside mirror control switch	1999 - 2001	On left front door arm rest	



⚡ Fig. 34 Underneath horn pad at steering wheel

1 - Airbag connector



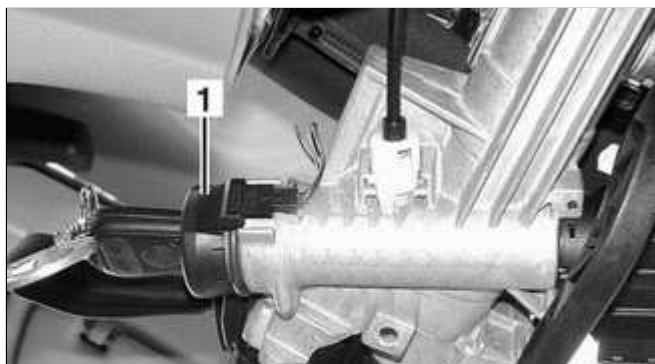
⚡ Fig. 35 Left side of steering column, below dashboard

1 - Steering angle sensor



⚡ Fig. 36 At ignition switch

1 - EWS (electronic immobilizer) ring antenna

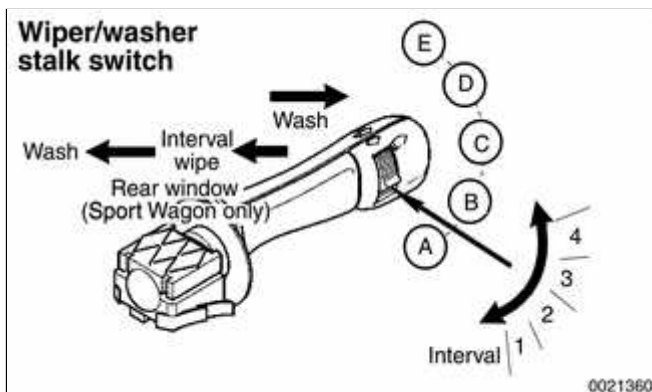


## Wiper and washer system

The wiper and washer functions in E46 vehicles are controlled by the ZKE V general module (GM V). Driver input to the system is via the multi-function stalk switch to the right of the steering column.

Operational faults in the wiper/washer system will set Diagnostic Trouble Codes (DTCs) which can be accessed through BMW scan tools DIS or MoDiC.

The components of the wiper/washer system are described below. Some functions or components are optional, as indicated.



Wiper/washer stalk switch. The system has four wiper settings for the windshield at the steering column stalk switch.

The settings are:

- ◆ **A:** Single wipe (hold stalk switch down)
- ◆ **B:** Off
- ◆ **C:** Interval (thumb wheel on stalk switch)
- ◆ **D:** Slow (automatically switches to interval when car is stopped.)
- ◆ **E:** Fast (automatically switches to slow speed when car is stopped.)

In "interval" setting, wiping intervals are dependent on road speed. See ⇒ [Table a. Wiper interval \(seconds\)](#).

## Wiper blade inserts, replacing



- ✦ To replace wiper inserts:
- ◆ Remove wiper blade as described earlier.
  - ◆ Unhook wiper blade insert from wiper arm guide. If necessary, guide slightly using needle nose pliers.
  - ◆ Pull old insert from wiper arm guides, noting installation position.
  - ◆ Remove metal support strips from old insert and install into slots in new insert, noting installation direction of cutouts in support strips.
  - ◆ Slide new insert through wiper blade guides. Lock insert in place at end guides.

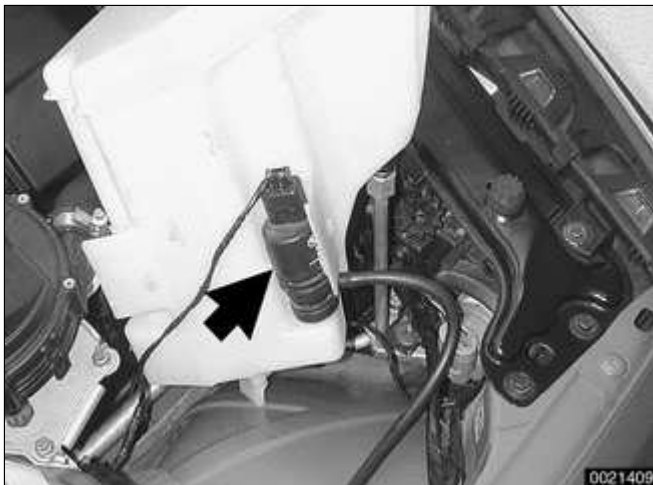
### **Note:**

*The notched cutouts in the retaining strips should engage the molded notches in the inserts.*

## Wiper arms, removing and installing

### **Note:**

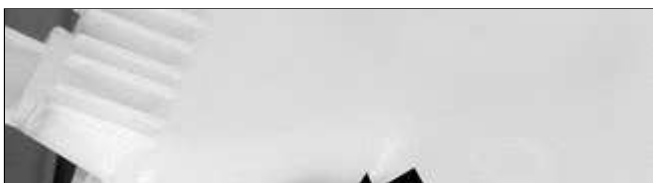
- ◆ *Wiper arm removal and installation on the Sport Wagon rear window is similar to the operation on the front wiper arms.*



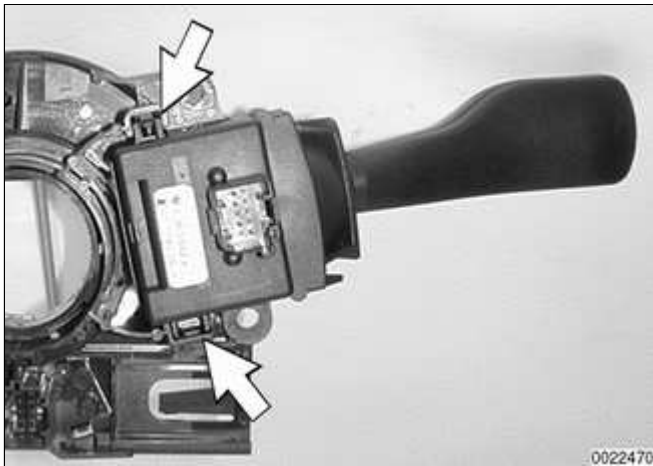
- ✦ To remove windshield washer pump (**arrow**) and headlight washer pump if equipped:
  - ◆ Disconnect electrical connection at pump.
  - ◆ Twist pump clockwise.
  - ◆ Pull pump out of reservoir.
- Installation is reverse of removal, noting the following:
  - ◆ Twist washer fluid level sensor clockwise to remove from base of reservoir.
  - ◆ Transfer reservoir cover and strainer to new container.
  - ◆ Coat fluid pump sealing ring with anti-friction agent.
  - ◆ On installation check that fluid hoses are not kinked.
  - ◆ Make sure reservoir heat shield is correctly engaged. Replace wire tie.
  - ◆ Refill reservoir.

### Front washer fluid level sensor, replacing

- ✦ Remove front washer fluid reservoir:
  - ◆ Twist washer fluid level sensor



described above, turn switch assembly face-down on work bench.

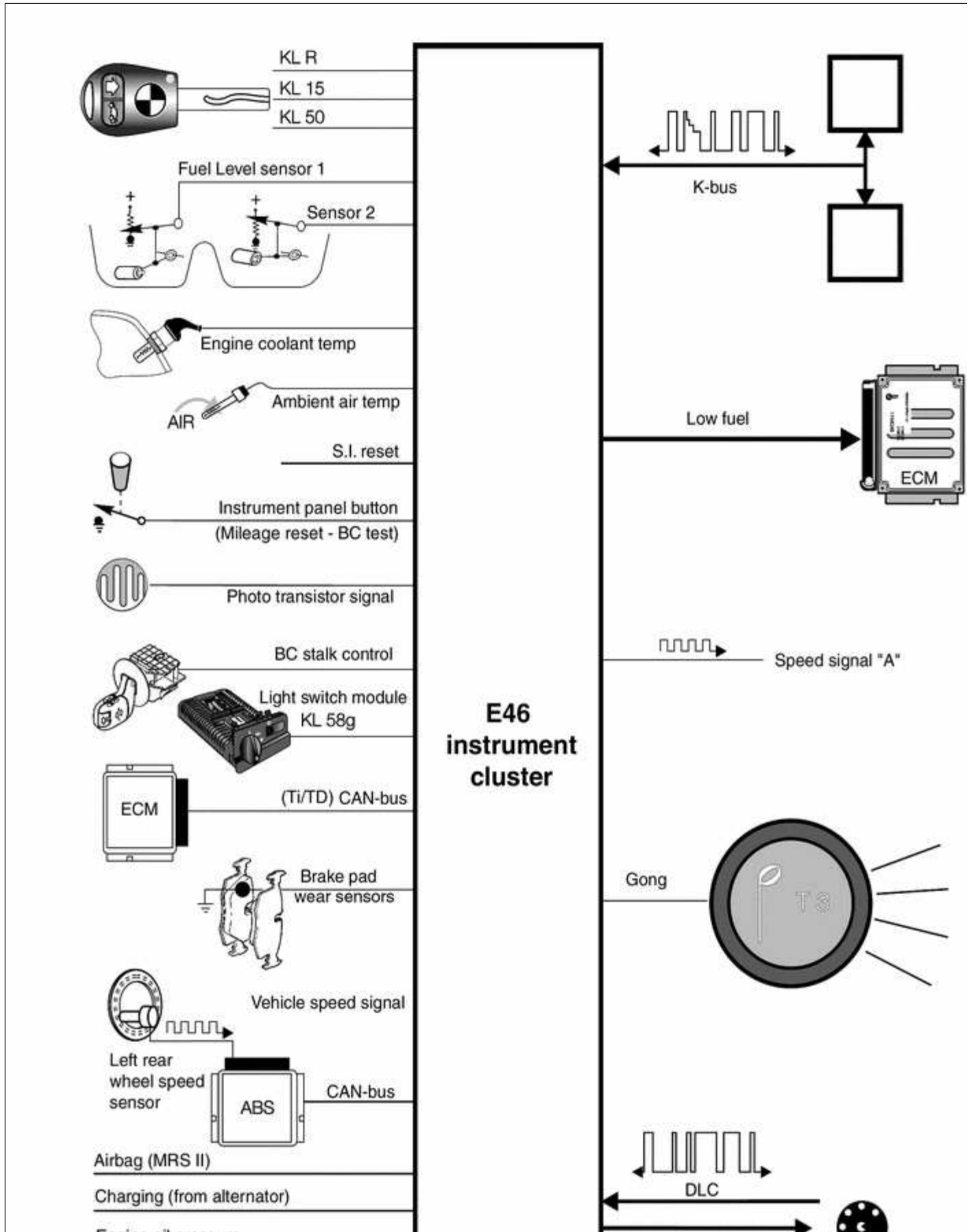


▲ Squeeze locking tabs (**arrows**) on sides of switch and slide switch out of assembly holder.

- Push in new switch until it positively snaps into switch housing.

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### E46 instrument cluster



## Light Switch

### Light switch assembly, removing and installing



- ✦ Pry gently at left dashboard trim to remove.

#### **CAUTION!**

**To avoid marring interior trim, work with a plastic prying tool.**



- ✦ Remove light switch mounting screws (**arrows**).
- Lift switch slightly and withdraw from dashboard.

#### **Note:**

- ◆ *If the vehicle is equipped with a left side glove compartment, remove the compartment for improved access to the back of the headlight switch and its electrical harness.*
- ◆ *Remove the left side footwell trim (above the pedals) for better access to the headlight switch electrical harness. See ⇒ [513 Interior Trim](#).*



- ✦ To release harness connector latch:

## Front Foglights

### Foglight aim, adjusting



- ⚡ Sedan or Sport Wagon: Use 4 mm Allen wrench to turn plastic adjuster (**arrow**) on outer edge of foglight.



- ⚡ Coupe or Convertible: Use adjuster (**arrow**) on inside upper edge of foglight.



- ⚡ 2001 models:
  - ◆ Using plastic pry tool, pry off foglight cover at slot (**arrow**).
  - ◆ Adjust using 6 mm Allen on outside upper corner of foglight.

activated, lights automatically turn off (soft off) after 8 seconds.

- ◆ After 16 minutes with door contact active (open door) and key off, lights are switched off (consumer cutoff function).

The component activation function of DIS also has the ability to switch the lights.

### Interior light, footwell light, or cargo compartment light (Sport Wagon), replacing bulb



- ◀ Pry interior light fixture gently to remove.
  - ◆ Detach electrical harness connector.
  - ◆ Remove bulb and replace.

#### **CAUTION!**

**When replacing bulbs, do not touch glass of bulb with fingers. Only touch bulb with clean cloth or bulb packaging.**

- Installation is reverse of removal. Bulb types and specifications for various interior lamps are listed below.

Interior light applications	
Footwell light bulb	Softlite 5W
Glove compartment light bulb	Softlite 5W
Passenger compartment bulb,	Softlite 5W

## IHKA personalization

Car Memory/Key Memory allows various functions and features of IHKA control to be tailored to the driver's wishes. The functions of IHKA that can be programmed by the driver include:

- ◆ Automatic activation of recirculation when the vehicle is started
- ◆ Blower speed adjustment (8-speed blower)
- ◆ Automatic opening of ventilation flaps with warm coolant
- ◆ Automatic closing of footwell flaps with A/C activation
- ◆ Automatic closing of defroster flaps with A/C activation
- ◆ Adjustments to set temperature
- ◆ Automatic activation of compressor control when the ignition is switched on
- ◆ Auto program for blower control when the ignition is switched on

These features are programmed using the coding/programming function of the DIS/MoDiC.

### **Note:**

See ⇒ [515 Central Locking and Anti-theft](#) for an explanation of Car Memory/Key Memory.

## Vents and Ducts

The IHKA air distribution system includes 5 air distribution motors (stepper motors), right and left footwell ducts, dashboard mounted defroster vents, and three sets of face level vents.

Removal of at least one of the stepper motors (right footwell vent) involves removal of the passenger side airbag in the dashboard.

### **WARNING!**

***Airbags are inflated by an explosive device. Handled improperly or without adequate safeguards, the system can be very dangerous. Special precautions must be observed prior to any work at or near the airbags. See ⇒ [721 Airbag System \(SRS\)](#).***

### **CAUTION!**

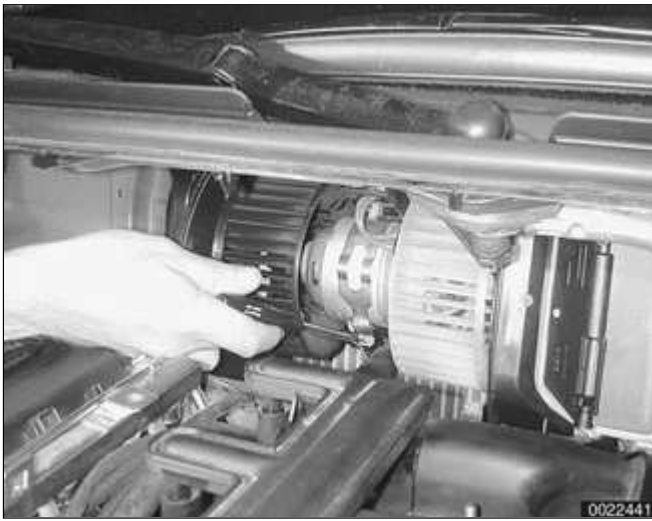
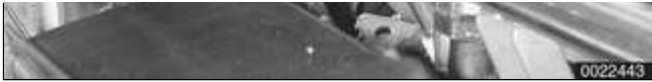
***When working on interior trim removal, work with plastic prying tools or wrap the tips of screwdrivers and pliers with tape.***

## Air distribution motors

The five air distribution motors are installed under the dashboard. They are made accessible by removing either the glove compartment and right footwell trim panel or the left footwell (pedal cluster) trim panel as described below.

- ⚡ Each motor can be removed after its electrical wiring harness connector has been removed.





- ✦ Pry off blower motor retaining strap.
  - Pull blower motor forward to remove.
  - Installation is reverse of removal:
    - ◆ Align slot in blower motor with mounting tab in blower motor housing.

## Blower motor resistor pack, replacing

### **Note:**

*The blower motor resistor pack is also referred to as the final stage unit.*

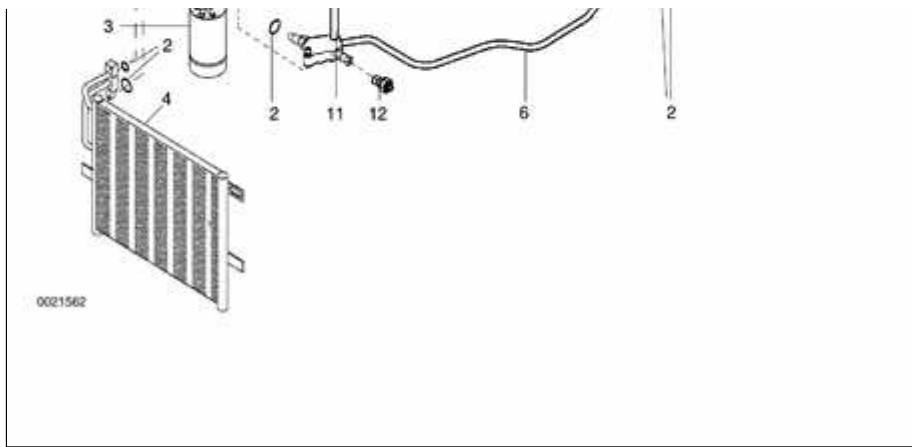
- Remove right footwell air duct as described earlier.



- ✦ Working under right side of dashboard at side of IHKA housing, unhook linkage, then remove air distribution motor (**arrow**).



- ✦ To remove blower resistor pack from IHKA housing:
  - ◆ Remove mounting screws



- 5 - Compressor
- 6 - Low pressure line
- 7 - Access port
- 8 - Double pipe
- 9 - Expansion valve
- 10 - Evaporator
- 11 - Access port
- 12 - Pressure sensor

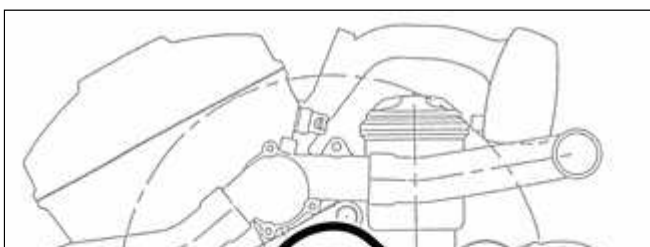
### A/C compressor, replacing

- Following manufacturer's instructions, connect an approved refrigerant recovery/recycling/recharging unit to A/C system and discharge system.

#### **WARNING!**

**Do not discharge/charge the A/C system without proper equipment and training. Damage to the vehicle and personal injury may result.**

- Remove splash shield from under engine.
- Mark A/C drive belt with direction of rotation.



- ◀ Release tension on A/C belt:
  - ◆ Use long-handled wrench to turn tensioner pulley release lug (A) clockwise (against spring tension).

## Troubleshooting

Although electronic radio and sound system troubleshooting is beyond the scope of this manual, there are number of self-tests that are possible with the standard BMW radio installed in E46 cars.

Radio test functions are activated by pressing the M button within 8 seconds of switching the radio on. Hold it pressed in for 8 seconds to start the tests.

The test functions include:

- ◆ Radio serial number
- ◆ Software version display
- ◆ Speed dependent volume control adjustment
- ◆ Station signal strength, including FM frequency set, signal strength and quality of signal received
- ◆ AM frequency set and signal strength

The test also checks antenna functions:

- ◆ Antenna signal strength (F number) indicates the quality of the signal received by the antenna. The scale ranges from 0 to 15, with the optimum value being 15. If the value falls below 10, radio stations can not be listened to in stereo.

## General

This section covers repairs to the seat belts.

Multiple Restraint System (MRS II) electronics integrate seat belt operations and airbag deployment. Airbag repair information is covered in ⇒ [721 Airbag System \(SRS\)](#).

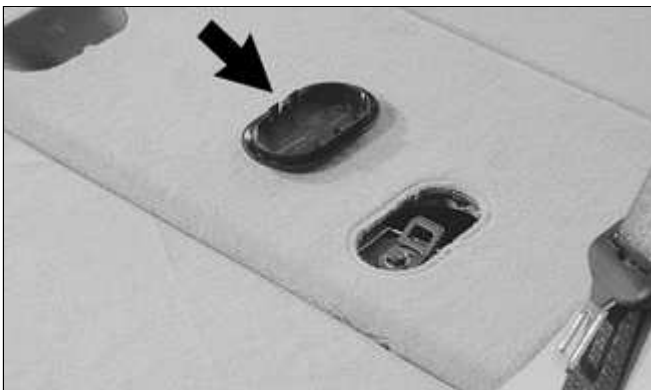
All E46 models are equipped with 3-point shoulder belts at four seating positions.

- ◆ Sport Wagon models are equipped with an additional 3-point shoulder belt in the center of the rear seat.
- ◆ Sedan and Coupe models are equipped with a lap belt in the center rear seat position.
- ◆ Convertible models are equipped with seat-integrated seat belt system (SGS) in the front seats.

## Child safety anchors

Sport Wagon models are equipped with three child safety harness anchors behind the rear seat in the cargo compartment floor.

- ▲ Remove plastic cover (**arrow**) to access safety anchor eye.



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